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ADVERTISEMENT.

The favorable reception given by the public to the *British Annual* of last year, has led to the publication of the present volume. In collecting the materials for the work, every attention has been bestowed in discovering accurate sources of information. But among such varied matter, the Editor is sensible that errors may still be included. He, therefore, trusts to the candour and indulgence of the reader, and will feel greatly indebted for the correction of any mistakes which may be detected. The Calendar has been prepared by Mr. Woolhouse, whose name is a sufficient guarantee of its accuracy. The materials for the Table of Chronology have been obtained from various sources, but more especially from *Montucla, Sprengel, Cassimir Broussais* and *Blair*. The extensive series of Tables of European Weights and Measures have been reduced from the valuable work of *Jäckel*, "*Neueste Europaische Münz, Mass und Gewichtskunde*," published in 1828 at Vienna. The Table of Medicinal Weights of Europe was extracted from the elaborate book of *Löhmann*, "*Tafeln der Medicinal und Apotheker Gewichte aller Länder und freien Städte in Europa*," which appears to have been hitherto wholly unknown in this country. The Tables of Coins have been greatly augmented by a reference to various authentic works, especially the French *Annuaire*, and a very useful little book, *Vere's Tables of Monies.* A large portion of the Annual has been devoted to national and foreign Universities. The information in this department has been collected with great difficulty, however imperfect it may appear to the reader. It was found impossible to introduce a complete account of more than one or two Universities in one volume. Queries of which a copy appears at the end of the present volume have been sent to the different Universities of Europe. Answers have been received from some, and are in the course of being sent by others. These will be presented to the readers of the Annual as quickly as possible, and will ultimately tend to the formation of Tables of Comparative Education of very great importance. The Editor takes this opportunity of stating, that he regrets that the observations in the Annual of last year in reference to Oxford and Cambridge should have given offence to the professors of these institutions. The statements were derived from what he believes to be the best authority, and ought not to have been construed into personal attacks, as it was expressly affirmed that the faults did not proceed from the professors, but from the system. The value of such seminaries to the country has been considered a sufficient reason for pointing out any abuses in their administration. If any mistatements should be detected and proved upon good authority, ample apology will be immediately expressed.

To Charles Tottie, Esq. the Swedish Consul, the Editor cannot allow this opportunity to pass without expressing his warmest thanks. That gentleman at once entered into the spirit of the enquiry, and procured the information relative to the Swedish Univerties in the hand writing of Baron Berzelius. The remaining contents of the British Annual speak for themselves. It is only necessary to add that two specimens of a new method of engraving have been inserted in the present volume, one of which is due to the liberality of the proprietor in Paris; and that the Editor will consider himself indebted to any individual who may point out any error in the present volume, or assist in furthering the enquiries respecting the education at universities and public schools by written answers to the queries inserted at the end of the Work.

20, Gower Street, Bedford Square.
25 November 1837.

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1838.

CALENDAR.

By W. S. B. WOOLHOUSE, Esq. F.R.A.S.

The Calendar contains all astronomical information which can possess any utility or interest with the public generally; it is arranged in as popular a form as the condensation in so small a space would admit; and its use will perhaps be best explained by a few references.

The times adopted are MEAN times, or the times shown by the ordinary public clocks when properly adjusted; *m* placed between the hours and minutes represents MORNING, and *a* represents AFTERNOON; also 0^h is placed for MIDNIGHT, and 12^h for NOON, by way of distinction.

1. MOON'S RISING, SETTING, AND SOUTHING.

Turn to page 6, February 19, and under the heading "☽ rises and sets" we find $3^h\ 56^m$, and by referring above in the same column, this time is found to be ("morn.") in the morning, and to be that of the moon's rising. In the next column, under "☽ south" we find $7^h\ 17^m$ in the morning; and this is the time when the moon appears directly south from the spectator, is most elevated and consequently most favourable for affording moon-light.

2. CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

The times here stated show when the moon passes by these two important planets; and for any case a reference to the risings and settings of the moon and planet will decide if the objects are above the horizon, and the probability of their being visible.

B

3. HIGH WATER.

The two columns under "High Water at London Bridge" show respectively the times of the morning and afternoon tides. Thus, on page 19, August 4, the morning tide is $0^h\ 10^m$ which is therefore 10^m after the preceding midnight; and the afternoon tide is $12^h\ 42^m$ or 42^m past noon.

The time of high water may easily be reduced to other places by means of a constant correction; thus:—

		h	m
For Aberdeen Bar	deduct	1	0
Belfast	deduct	4	30
Bristol	add	5	0
Dublin Bar	deduct	4	0
Dundee	add	0	10
Flamboro' Head	add	2	20
Hartlepool	add	1	40
Hull	add	4	0
Humber River	add	3	20
Leith Pier	add	0	10
Liverpool Dock	deduct	3	10
Nore Light	deduct	1	0
Plymouth Dock	add	3	25
Portsmouth Dock	deduct	2	50
Scarborough	add	2	20
Sunderland	add	0	50
Tynemouth Bar	add	0	40
Yarmouth Roads	deduct	6	0

4. PLANETS' RISING, SOUTHING, SETTING, &c.

The times of rising, southing and setting, of the planets are given for the 1st, 11th and 21st days of each month, under the three respective headings "Planet rises," "Planet South," "Planet sets" stated at the top of the page.

The times for the intermediate days may be easily deduced by inspection.

Take Jupiter at the right hand of page 11, and for the 11th of the month (April) we find that he rises at 2 a 37 or 37 minutes past 2 in the afternoon, is south at 9 a 29 and sets at 4 m 25 or 25m past 4 o'clock the preceding morning.

"Even.✱" signifies that the planet is an evening star, or visible longer during the evenings than the mornings.

5. MOON'S PHASES.

These are to be interpreted the same as the last.

6. The "SUN'S DECLINATION, SEMIDIAMETER, AND CHRONOMETER TIME AT SUN'S NOON," are useful to the Seaman for the determination of his latitude and the regulation of his watch or chronometer.

ARTICLES OF THE CALENDAR AND ECLIPSES.

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Solar cycle.	27
Julian period.	6551

March 25. A TOTAL ECLIPSE OF THE SUN, but invisible in this country.

April 10. A PARTIAL ECLIPSE OF THE MOON. Begins 28m before 1 o'clock in the morning; greatest obscuration at 1h 59m; end of the Eclipse 3h 25m.

September 18. AN ANNULAR ECLIPSE OF THE SUN, but invisible to this country.

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &C.	☉'s declination.		☉'s semi-diam.		☽ rises and sets.		☽ south.		☽'s age.
			°	′	′	″	h	m	h	m	d
1	M	Circumcision	23S	2	16	17	10 a	30	4 a	45	5
2	Tu		22	57	16	17	11	55	5	32	6
3	W		22	51	16	17	morn.		6	19	☽
4	Th		22	45	16	17	1	18	7	6	8
5	F		22	38	16	17	2	40	7	55	9
6	S	Epiphany, Tw. Day	22	32	16	17	4	2	8	46	10
7	G	1 S. after Epiphany	22	24	16	17	5	22	9	39	11
8	M	Plough Monday	22	16	16	17	6	36	10	34	12
9	Tu		22	8	16	17	7	40	11	29	13
10	W		21	59	16	17	rises		morn.		○
11	Th	Hilary Term begins	21	50	16	17	4 a	37	0	22	15
12	F		21	41	16	17	5	50	1	12	16
13	S	Cambridge Term begins	21	31	16	17	7	4	1	58	17
14	G	2 S. after Epiphany	21	20	16	17	8	15	2	41	18
15	M	Oxford Term begins	21	9	16	17	9	26	3	22	19
16	Tu		20	58	16	17	10	36	4	2	20
17	W		20	47	16	17	11	45	4	41	21
18	Th	St. Prisca	20	35	16	17	morn.		5	20	22
19	F		20	22	16	16	0	59	6	2	☾
20	S	Fabian	20	9	16	16	2	15	6	48	24
21	G	3 S. after Epiphany	19	56	16	16	3	36	7	38	25
22	M	Vincent	19	43	16	16	4	59	8	33	26
23	Tu		19	29	16	16	6	18	9	34	27
24	W		19	15	16	16	7	23	10	38	28
25	Th	Conversion of St. Paul	19	0	16	16	8	10	11	42	29
26	F		18	45	16	16	sets		12 a	44	●
27	S		18	30	16	16	6 a	35	1	42	1
28	G	4 S. after Epiphany	18	14	16	15	8	8	2	35	2
29	M	Venus most bright	17	58	16	15	9	36	3	26	3
30	Tu		17	42	16	15	11	2	4	14	4
31	W	Hilary Term ends	17S	25	16	15	morn		5	3	5

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h	m
Jupiter in conjunction	15 day	3 a	20
Venus ,,	28 ,,	6 a	7

Day of month.	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ☉'s noon.		
	h	m	h	m	h	m	s
1	5	24	5	46	12	3	51
2	6	13	6	38		4	19
3	7	2	7	25		4	47
4	7	48	8	12		5	14
5	8	40	9	15		5	41
6	9	54	10	36		6	8
7	11	16	11	51		6	34
8			12	23		7	0
9	0	53	1	19		7	25
10	1	42	2	4		7	49
11	2	24	2	43		8	13
12	3	1	3	19		8	37
13	3	36	3	53		8	59
14	4	9	4	26		9	22
15	4	44	5	2		9	43
16	5	20	5	37		10	4
17	5	54	6	10		10	24
18	6	27	6	45		10	43
19	7	3	7	22		11	2
20	7	42	8	8		11	20
21	8	41	9	19		11	37
22	10	0	10	43		11	54
23	11	23	12	0		12	10
24			12	33		12	25
25	1	2	1	29		12	39
26	1	56	2	22		12	52
27	2	46	3	10		13	5
28	3	34	3	57		13	17
29	4	20	4	43		13	28
30	5	4	5	25		13	38
31	5	45	6	4	12	13	47

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Even. ✳
	h m	h m	h m
1	10 m 23	3 a 18	8 a 13
11	9 52	3 11	8 30
21	9 17	2 57	8 37
♂	MARS.		
	h m	h m	h m
1	8 m 59	12 a 57	4 a 55
11	8 42	12 50	4 58
21	8 23	12 44	5 5
♃	JUPITER.		Morn. ✳
	h m	h m	h m
1	10 a 3	4 m 39	11 m 11
11	9 23	4 0	10 33
21	8 41	3 19	9 53
♄	SATURN.		
	h m	h m	h m
1	4 m 19	8 m 52	1 a 25
11	3 44	8 16	12 48
21	3 9	7 40	12 11
	☉ rises.	☉ east.	☉ sets.
	h m	h m	h m
1	8 m 8	4 m 45	4 a 0
11	8 5	4 54	4 12
21	7 56	5 5	4 28

☽'S PHASES.

		h m	
First Quarter	3 day	6 m 43	
Full Moon	10 „	7 a 20	
		h m	
Last Quarter	19 day	0 m 35	
New Moon	26 „	1 m 52	

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &C.	☉'s declination.		☉'s semidiam.		☽ rises and sets.		☽ south.		☽'s age.
			°	′	′	″	h	m	h	m	d
1	Th		17 S	8	16	15	0m	27	5a	52	☽
2	F	Purification	16	51	16	15	1	50	6	43	7
3	S		16	34	16	15	3	12	7	36	8
4	G	5 S. after Epiphany	16	16	16	14	4	28	8	30	9
5	M	Agatha	15	58	16	14	5	36	9	24	10
6	Tu		15	39	16	14	6	28	10	17	11
7	W		15	21	16	14	7	7	11	8	12
8	Th		15	2	16	14	7	34	11	55	13
9	F		14	43	16	14	rises		morn.		○
10	S		14	24	16	13	6 a	3	0	39	15
11	G	Septuagesima Sund.	14	4	16	13	7	14	1	21	16
12	M		13	44	16	13	8	24	2	0	17
13	Tu		13	24	16	13	9	34	2	39	18
14	W	Valentine	13	4	16	13	10	46	3	18	19
15	Th		12	43	16	12	11	59	3	59	20
16	F		12	23	16	12	morn.		4	42	21
17	S		12	2	16	12	1	16	5	29	☾
18	G	Sexagesima Sunday	11	41	16	12	2	37	6	20	23
19	M		11	19	16	11	3	56	7	17	24
20	Tu		10	58	16	11	5	6	8	18	25
21	W		10	36	16	11	6	0	9	21	26
22	Th		10	15	16	11	6	38	10	23	27
23	F	Camb. Term. div. mid.	9	53	16	11	7	5	11	23	28
24	S		9	31	16	10	sets		12 a	19	●
25	G	Shrove Sunday	9	8	16	10	7 a	3	1	12	1
26	M		8	46	16	10	8	34	2	3	2
27	Tu	Shrove Tuesday	8	24	16	10	10	3	2	53	3
28	W	Ash Wednesday	8 S	1	16	9	11	31	3	44	4

CONJUNCTIONS OF VENUS AN JUPITER WITH THE MOON.

		h	m
Jupiter in conjunction	11 day	5 a	44
Venus ,,	25 ,,	2 m	19

Day of month.	High Water at London Bridge. Morn.	High Water at London Bridge. After.	Chr. Time at ⊙'s noon.
	h m	h m	h m s
1	6 24	6 44	12 13 55
2	7 6	7 30	14 3
3	7 58	8 31	14 10
4	9 10	9 55	14 15
5	10 43	11 28	14 20
6		12 8	14 25
7	0 41	1 8	14 28
8	1 30	1 50	14 31
9	2 9	2 28	14 32
10	2 46	3 3	14 33
11	3 19	3 34	14 34
12	3 49	4 3	14 33
13	4 17	4 32	14 32
14	4 47	5 1	14 30
15	5 14	5 28	14 27
16	5 42	5 59	14 24
17	6 19	6 40	14 19
18	7 2	7 27	14 14
19	7 56	8 35	14 9
20	9 20	10 8	14 3
21	10 55	11 40	13 56
22		12 17	13 48
23	0 48	1 18	13 40
24	1 46	2 11	13 32
25	2 33	2 54	13 22
26	3 16	3 37	13 12
27	3 58	4 18	13 2
28	4 37	4 56	12 12 51

Day of Month.	Planet rises.	Planet south.	Planet sets.
♀ VENUS.			Even. ✱
	h m	h m	h m
1	8 m 31	2 a 33	8 a 35
11	7 42	1 58	8 14
21	6 48	1 9	7 30
♂ MARS.			
	h m	h m	h m
1	7 m 59	12 a 35	5 a 11
11	7 37	12 27	5 17
21	7 13	12 18	5 23
♃ JUPITER.			Morn. ✱
	h m	h m	h m
1	7 a 54	2 m 33	9 m 8
11	7 9	1 50	8 27
21	6 22	1 6	7 46
♄ SATURN.			
	h m	h m	h m
1	2 m 30	7 m 0	11 m 30
11	1 53	6 23	10 53
21	1 16	5 45	10 14
	⊙ rises.	⊙ east.	⊙ sets.
	h m	h m	h m
1	7 m 41	5 m 17	4 a 48
11	7 25	5 29	5 5
21	7 5	5 40	5 23

☽'s PHASES.

		h m			h m
First Quarter	1 day	5 a 34	Last Quarter	17 day	5 a 39
Full Moon	9 „	1 a 52	New Moon	24 „	12 a 8

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semi-diam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	Th	St. David	7 S 38	16 9	morn.	4 a 36	5
2	F	Chad.	7 15	16 9	0 57	5 30	6
3	S		6 52	16 9	2 18	6 24	☽
4	G	1st Sunday in Lent	6 29	16 8	3 29	7 19	8
5	M		6 6	16 8	4 27	8 13	9
6	Tu		5 43	16 8	5 9	9 4	10
7	W	Perpetua	5 20	16 8	5 40	9 53	11
8	Th		4 56	16 7	6 2	10 37	12
9	F		4 33	16 7	6 17	11 20	13
10	S		4 10	16 7	6 29	12 0	14
11	G	2nd Sunday in Lent	3 46	16 7	rises	morn.	○
12	M		3 23	16 6	7 a 23	0 39	16
13	Tu		2 59	16 6	8 35	1 18	17
14	W		2 35	16 6	9 48	1 58	18
15	Th	[in Leonis	2 12	16 6	11 4	2 40	19
16	F	Jupiter approaching a *	1 48	16 5	morn.	3 25	20
17	S	St. Patrick	1 24	16 5	0 23	4 14	21
18	G	3rd Sunday in Lent	1 1	16 5	1 42	5 8	22
19	M		0 37	16 4	2 54	6 6	☾
20	Tu		0 S 13	16 4	3 53	7 6	24
21	W	Benedict. Spring com.	0 N 11	16 4	4 35	8 6	25
22	Th		0 34	16 4	5 5	9 5	26
23	F		0 58	16 3	5 26	10 2	27
24	S		1 22	16 3	5 42	10 55	28
25	G	Lady Day 4 S. in Lent	1 45	16 3	sets	11 47	●
26	M		2 9	16 3	7 a 28	12 a 38	1
27	Tu		2 32	16 2	8 58	1 29	2
28	W		2 56	16 2	10 29	2 22	3
29	Th		3 19	16 2	11 57	3 17	4
30	F		3 42	16 1	morn.	4 14	5
31	S		4 N 6	16 1	1 16	5 11	6

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h m
Jupiter in conjunction	10 day	4 a 52
Venus „	23 „	6 a 31

Day of month.	High Water at London Bridge. Morn.	High Water at London Bridge. After.	Chr. Time at ⊙'s noon.
	h m	h m	h m s
1	5 13	5 32	12 12 39
2	5 52	6 18	12 27
3	6 35	6 58	12 14
4	7 26	8 1	12 1
5	8 42	9 29	11 48
6	10 18	11 4	11 34
7	11 44		11 19
8	0 17	12 44	11 4
9	1 8	1 31	10 49
10	1 51	2 8	10 33
11	2 24	2 40	10 17
12	2 55	3 9	10 1
13	3 23	3 37	9 44
14	3 50	4 4	9 28
15	4 17	4 31	9 10
16	4 45	5 0	8 53
17	5 17	5 34	8 36
18	5 53	6 14	8 18
19	6 37	7 4	8 0
20	7 36	8 20	7 42
21	9 13	10 2	7 24
22	10 47	11 27	7 6
23		12 4	6 47
24	0 34	1 0	6 29
25	1 25	1 49	6 10
26	2 11	2 32	5 52
27	2 52	3 12	5 34
28	3 32	3 51	5 15
29	4 11	4 30	4 57
30	4 49	5 9	4 38
31	5 30	5 52	12 4 20

Day of month.	Planet rises.	Planet south.	Planet sets.
♀ VENUS. { Even. ✱ till the 2nd			
	h m	h m	h m
1	6 m 4	12 a 22	6 a 40
11	5 15	11 m 21	5 27
21	4 39	10 30	4 21
♂ MARS.			
	h m	h m	h m
1	6 m 52	12 a 10	5 a 28
11	6 27	12 a 0	5 33
21	5 59	11 m 49	5 39
♃ JUPITER. { Morn. ✱ till the 4th			
	h m	h m	h m
1	5 a 45	0 m 31	7 m 13
11	4 59	11 a 43	6 31
21	4 12	10 59	5 50
♄ SATURN.			
	h m	h m	h m
1	0 m 45	5 m 14	9 m 43
11	0 m 5	4 35	9 5
21	11 a 21	3 55	8 25
	⊙ rises.	⊙ east.	⊙ sets.
	h m	h m	h m
1	6 m 49	5 m 49	5 a 37
11	6 27	5 58	5 55
21	6 4	6 8	6 12

☽'s PHASES.

		h m			h m
First Quarter	3 day	6 m 35	Last Quarter	19 day	6 m 31
Full Moon	11 „	8 m 39	New Moon	25 „	9 a 45

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semidiam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	G	5th Sunday in Lent	4N 29	16 1	2m21	6 a 6	☽
2	M		4 52	16 1	3 9	7 0	8
3	Tu		5 15	16 0	3 44	7 49	9
4	W	St. Ambrose	5 38	16 0	4 7	8 35	10
5	Th		6 1	16 0	4 25	9 18	11
6	F	Cambridge Term ends	6 24	16 0	4 38	9 59	12
7	S	Oxford Term ends	6 46	15 59	4 50	10 38	13
8	G	Palm Sunday	7 9	15 59	4 58	11 17	14
9	M	Moon eclipsed & vis.	7 31	15 59	5 7	11 57	15
10	Tu	Venus most bright	7 53	15 58	rises	morn.	○
11	W		8 15	15 58	8 a 52	0 39	17
12	Th	Maunday Thursday	8 37	15 58	10 11	1 23	18
13	F	Good Friday	8 59	15 58	11 31	2 11	19
14	S		9 21	15 57	morn.	3 4	20
15	G	Easter Day	9 42	15 57	0 46	4 0	21
16	M	Easter Monday	10 4	15 57	1 46	4 59	22
17	Tu		10 25	15 57	2 35	5 58	☾
18	W		10 46	15 56	3 7	6 56	24
19	Th	Alphege	11 7	15 56	3 30	7 51	25
20	F		11 28	15 56	3 47	8 43	26
21	S		11 48	15 55	4 1	9 34	27
22	G	Low Sunday	12 8	15 55	4 13	10 24	28
23	M	St. George	12 29	15 55	4 26	11 14	29
24	Tu	[T. beg.	12 48	15 55	sets	12 a 6	●
25	W	St. Mark. Camb. & Oxf.	13 8	15 54	9 a 25	1 1	1
26	Th		13 28	15 54	10 50	1 58	2
27	F		13 47	15 54	morn.	2 56	3
28	S		14 6	15 54	0 4	3 54	4
29	G	2 Sunday aft. Easter	14 25	15 54	1 1	4 50	5
30	M		14N 43	15 53	1 43	5 42	6

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

				h m
Jupiter	in conjunction	6	day	4 a 55
Venus	„	21	„	0 m 29

Day of month	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ☉'s noon.		
	h	m	h	m	h	m	s
1	6	14	6	38	12	4	1
2	7	4	7	36		3	43
3	8	18	9	6		3	25
4	9	51	10	33		3	7
5	11	12	11	48		2	49
6			12	19		2	32
7	0	44	1	3		2	14
8	1	21	1	38		1	57
9	1	54	2	8		1	40
10	2	22	2	36		1	23
11	2	49	3	2		1	6
12	3	16	3	30		0	50
13	3	45	4	1		0	34
14	4	19	4	37		0	19
15	4	55	5	15	12	0	3
16	5	37	6	1	11	59	49
17	6	27	6	57		59	34
18	7	35	8	17		59	20
19	9	2	9	49		59	6
20	10	33	11	10		58	53
21	11	41				58	40
22	0	10	12	37		58	28
23	1	0	1	22		58	16
24	1	44	2	5		58	4
25	2	26	2	47		57	53
26	3	7	3	26		57	43
27	3	46	4	7		57	33
28	4	28	4	49		57	23
29	5	11	5	33		57	14
30	5	56	6	19	11	57	6

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Morn. ✳
	h m	h m	h m
1	4 m 11	9 m 51	3 a 31
11	3 50	9 29	3 8
21	3 31	9 15	2 59
♂	MARS.		
	h m	h m	h m
1	5 m 29	11 m 37	5 a 45
11	5 3	11 26	5 49
21	4 37	11 15	5 53
♃	JUPITER.		Even. ✳
	h m	h m	h m
1	3 a 21	10 a 11	5 m 5
11	2 37	9 29	4 25
21	1 54	8 47	3 44
♄	SATURN.		
	h m	h m	h m
1	10 a 36	3 m 10	7 m 40
11	9 54	2 29	7 0
21	9 12	1 48	6 20
	☉ rises.	☉ east.	☉ sets.
	h m	h m	h m
1	5 m 39	6 m 18	6 a 30
11	5 17	6 27	6 47
21	4 55	6 37	7 4

☽'S PHASES.

		h m			h m
First Quarter	1 day	9 a 33	Last Quarter	17 day	3 a 30
Full Moon	10 „	2 m 6	New Moon	24 „	7 m 1

Day of month	Day of week	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semi-diam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	Tu		15N 2	15 53	2m11	6a30	☽
2	W		15 20	15 53	2 31	7 15	8
3	Th	Invention of the Cross	15 38	15 53	2 46	7 56	9
4	F		15 55	15 52	2 56	8 36	10
5	S		16 12	15 52	3 7	9 15	11
6	G	3 Sunday aft. Easter	16 29	15 52	3 17	9 54	12
7	M		16 46	15 52	3 26	10 36	13
8	Tu		17 3	15 52	3 37	11 19	14
9	W		17 19	15 51	rises	morn.	○
10	Th	Easter Term ends	17 35	15 51	9a16	0 7	16
11	F		17 50	15 51	10 35	0 59	17
12	S		18 6	15 51	11 42	1 54	18
13	G	4 Sunday aft. Easter	18 21	15 50	morn.	2 53	19
14	M		18 35	15 50	0 34	3 53	20
15	Tu		18 50	15 50	1 10	4 51	21
16	W		19 4	15 50	1 36	5 46	☾
17	Th		19 18	15 50	1 53	6 38	23
18	F		19 31	15 49	2 8	7 28	24
19	S	Dunstan	19 44	15 49	2 20	8 16	25
20	G	Rogation Sunday	19 57	15 49	2 33	9 5	26
21	M		20 9	15 49	2 47	9 55	27
22	Tu		20 21	15 49	3 2	10 47	28
23	W		20 33	15 49	sets	11 42	●
24	Th	Ascension Day	20 45	15 48	9a42	12a40	1
25	F		20 56	15 48	10 48	1 39	2
26	S		21 6	15 48	11 37	2 37	3
27	G	Sunday after Ascen.	21 17	15 48	morn.	3 32	4
28	M		21 26	15 48	0 11	4 22	5
29	Tu		21 36	15 48	0 34	5 9	6
30	W		21 45	15 48	0 51	5 52	7
31	Th	Camb. Term divides n.	21N54	15 47	1 3	6 32	☽

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

Jupiter in conjunction	3 day	9 a 21
Venus ,,	20 ,,	6 m 45
Jupiter ,,	31 ,,	7 m 12

Day of month.	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ⊙'s noon.		
	h	m	h	m	h	m	s
1	6	44	7	13	11	56	58
2	7	46	8	25		56	50
3	9	7	9	48		56	43
4	10	24	10	56		56	37
5	11	26	11	52		56	31
6			12	15		56	26
7	0	36	12	55		56	21
8	1	12	1	27		56	17
9	1	42	1	58		56	13
10	2	14	2	31		56	10
11	2	48	3	5		56	7
12	3	23	3	42		56	5
13	4	2	4	23		56	4
14	4	45	5	7		56	3
15	5	31	5	57		56	3
16	6	25	6	56		56	4
17	7	31	8	9		56	5
18	8	50	9	30		56	6
19	10	6	10	40		56	8
20	11	12	11	40		56	11
21			12	6		56	14
22	0	31	12	56		56	18
23	1	20	1	43		56	23
24	2	6	2	28		56	28
25	2	50	3	11		56	33
26	3	32	3	53		56	39
27	4	13	4	33		56	45
28	4	53	5	14		56	52
29	5	35	5	58		57	0
30	6	23	6	49		57	7
31	7	16	7	43	11	57	16

Day of month.	Planet rises.	Planet south.	Planet sets.
♀ VENUS.			Morn. ✳
	h m	h m	h m
1	3 m 15	9 m 9	3 a 3
11	2 54	9 2	3 10
21	2 36	9 0	3 24
♂ MARS.			
	h m	h m	h m
1	4 m 9	11 m 3	5 a 57
11	3 45	10 53	6 1
21	3 20	10 42	6 4
♃ JUPITER.			Even. ✳
	h m	h m	h m
1	1 a 14	8 a 7	3 m 4
11	12 a 34	7 27	2 24
21	11 m 57	6 49	1 45
♄ SATURN.			
	h m	h m	h m
1	8 a 29	1 m 6	5 m 39
11	7 45	0 m 24	4 58
21	7 2	10 a 37	4 16
	⊙ rises.	⊙ east.	⊙ sets.
	h m	h m	h m
1	4 m 35	6 m 46	7 a 21
11	4 17	6 55	7 36
21	4 3	7 4	7 51

☽'s PHASES.

			h	m				h	m
First Quarter	1	day	2 a	5	New Moon	23	day	4 a	23
Full Moon	9	„	4 a	58	First Quarter	31	„	7 m	35
Last Quarter	16	„	9 a	42					

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semi-diam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	F	Nicomede	22 N 2	15 47	1 m 15	7 a 11	9
2	S	Oxford Term ends	22 11	15 47	1 24	7 50	10
3	G	WHIT-SUNDAY	22 18	15 47	1 33	8 31	11
4	M	WHIT-MONDAY	22 25	15 47	1 44	9 13	12
5	Tu		22 32	15 47	1 56	9 59	13
6	W	Oxford Term begins	22 39	15 47	2 11	10 50	14
7	Th		22 45	15 47	2 34	11 45	15
8	F		22 51	15 46	rises.	morn.	○
9	S		22 56	15 46	10 a 29	0 44	17
10	G	TRINITY SUNDAY	23 1	15 46	11 10	1 45	18
11	M	St. Barnabas	23 5	15 46	11 39	2 45	19
12	Tu		23 9	15 46	11 59	3 42	20
13	W		23 13	15 46	morn.	4 35	21
14	Th	Trinity Term ends	23 16	15 46	0 15	5 26	22
15	F		23 19	15 46	0 28	6 14	☾
16	S		23 22	15 46	0 40	7. 1	24
17	G	1 SUND. AFT. TRINITY	23 24	15 46	0 53	7 49	25
18	M		23 25	15 46	1 8	8 39	26
19	Tu		23 27	15 45	1 26	9 32	27
20	W		23 27	15 45	1 51	10 28	28
21	Th	Summer commences	23 28	15 45	2 27	11 26	29
22	F		23 28	15 45	sets.	12 a 24	●
23	S		23 27	15 45	10 a 8	1 21	1
24	G	Midsummer day	23 26	15 45	10 36	2 13	2
25	M	Ju. close to ✳ in Leonis	23 25	15 45	10 54	3 2	3
26	Tu		23 23	15 45	11 9	3 46	4
27	W		23 21	15 45	11 21	4 28	5
28	Th		23 19	15 45	11 31	5 7	6
29	F	St. Peter	23 16	15 45	11 40	5 46	7
30	S		23 N 13	15 45	11 50	6 26	☽

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h m
Venus in conjunction	18 day	8 a 25
Jupiter ,,	27 ,,	9 a 27

Day of month.	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ☉'s noon.		
	h	m	h	m	h	m	s
1	8	11	8	41	11	57	24
2	9	12	9	44		57	33
3	10	14	10	43		57	43
4	11	11	11	37		57	52
5			12	1		58	2
6	0	23	12	44		58	13
7	1	5	1	26		58	23
8	1	47	2	9		58	34
9	2	30	2	51		58	46
10	3	12	3	33		58	57
11	3	54	4	16		59	9
12	4	39	5	3		59	21
13	5	29	5	56		59	33
14	6	24	6	52		59	46
15	7	21	7	50	11	59	58
16	8	19	8	49	12	0	11
17	9	21	9	54		0	24
18	10	27	11	1		0	37
19	11	36				0	50
20	0	8	12	36		1	3
21	1	4	1	30		1	16
22	1	54	2	17		1	29
23	2	39	3	0		1	42
24	3	20	3	40		1	55
25	3	59	4	18		2	8
26	4	37	4	56		2	21
27	5	15	5	34		2	34
28	5	54	6	15		2	46
29	6	36	6	57		2	58
30	7	18	7	39	12	3	10

Day of month.	Planet rises.	Planet south.	Planet sets.
♀ VENUS. Morn. ✳			
	h m	h m	h m
1	2 m 17	9 m 0	3 a 43
11	2 0	9 2	4 4
21	1 44	9 5	4 26
♂ MARS.			
	h m	h m	h m
1	2 m 54	10 m 30	6 a 6
11	2 31	10 20	6 9
21	2 11	10 10	6 9
♃ JUPITER. Even. ✳			
	h m	h m	h m
1	11 m 18	6 a 9	1 m 4
11	10 45	5 33	0 m 25
21	10 12	4 57	11 a 42
♄ SATURN.			
	h m	h m	h m
1	6 a 14	10 a 50	3 m 31
11	5 31	10 8	2 50
21	4 49	9 27	2 9
	☉ rises.	☉ east.	☉ sets.
	h m	h m	h m
1	3 m 51	7 m 12	8 a 5
11	3 45	7 18	8 14
21	3 44	7 22	8 18

☽'s PHASES.

			h m
Full Moon	8	day	4 m 51
Last Quarter	15	„	2 m 31
New Moon	22	day	2 m 34
First Quarter	30	„	1 m 12

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.		☉'s semi-diam.		☽ rises and sets.		☽ south.		☽'s age.
			°	'	'	"	h	m	h	m	d
1	G	3 Sun. aft. Trinity	23N	9	15	45	morn.		7 a	6	9
2	M		23	5	15	45	0	1	7	50	10
3	Tu	Oxford Act. Camb.Com.	23	0	15	45	0	14	8	39	11
4	W		22	55	15	45	0	34	9	32	12
5	Th		22	50	15	45	1	2	10	29	13
6	F	Cambridge Term ends	22	44	15	45	1	44	11	30	14
7	S	Oxford Term ends	22	38	15	45	rises		morn.		○
8	G	4 Sun. aft. Trinity	22	32	15	45	9 a	41	0	32	16
9	M		22	25	15	45	10	4	1	32	17
10	Tu		22	17	15	45	10	21	2	29	18
11	W		22	10	15	45	10	35	3	21	19
12	Th		22	2	15	45	10	47	4	11	20
13	F		21	53	15	45	11	0	4	59	21
14	S		21	44	15	45	11	14	5	47	☾
15	G	5 Sun. aft. Trinity	21	35	15	45	11	31	6	36	23
16	M		21	26	15	46	11	54	7	28	24
17	Tu		21	16	15	46	morn.		8	22	25
18	W		21	5	15	46	0	25	9	18	26
19	Th		20	55	15	46	1	8	10	15	27
20	F	Margaret	20	44	15	46	2	7	11	12	28
21	S		20	33	15	46	sets.		12 a	5	●
22	G	6 Sund. aft. Trinity	20	21	15	46	8 a	59	12	55	1
23	M		20	9	15	46	9	15	1	41	2
24	Tu		19	56	15	46	9	28	2	24	3
25	W	St. James	19	44	15	46	9	38	3	4	4
26	Th	St. Anne	19	31	15	46	9	47	3	43	5
27	F		19	17	15	47	9	57	4	22	6
28	S		19	4	15	47	10	6	5	2	7
29	G	7 Sund. aft. Trinity	18	50	15	47	10	19	5	44	☽
30	M		18	35	15	47	10	36	6	29	9
31	Tu		18N	21	15	47	10	59	7	19	10

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h m
Venus in conjunction	18 day	12 a 27
Jupiter	25 „	2 a 23

Day of month.	High Water at London Bridge. Morn. h	m	After. h	m	Chr. Time at ☉'s noon. h	m	s
1	8	0	8	23	12	3	22
2	9	48	9	17		3	34
3	9	50	10	26		3	45
4	11	2	11	36		3	56
5			12	6		4	6
6	0	34	1	2		4	17
7	1	29	1	54		4	26
8	2	18	2	41		4	36
9	3	3	3	25		4	45
10	3	47	4	9		4	54
11	4	32	4	56		5	2
12	5	20	5	44		5	10
13	6	8	6	32		5	18
14	6	54	7	15		5	25
15	7	37	8	2		5	32
16	8	32	9	8		5	38
17	9	48	10	31		5	43
18	11	13	11	52		5	49
19			12	25		5	53
20	0	56	1	25		5	57
21	1	50	2	11		6	1
22	2	30	2	49		6	4
23	3	8	3	26		6	6
24	3	43	4	0		6	8
25	4	17	4	34		6	9
26	4	51	5	8		6	10
27	5	25	5	41		6	10
28	5	58	6	14		6	10
29	6	30	6	47		6	8
30	7	4	7	23		6	7
31	7	46	8	15	12	6	4

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Morn. ✳
	h m	h m	h m
1	1 m 33	9 m 11	4 a 49
11	1 25	9 18	5 11
21	1 24	9 28	5 32
♂	MARS.		
	h m	h m	h m
1	1 m 54	10 m 1	6 a 8
11	1 37	9 51	6 5
21	1 22	9 41	6 0
♃	JUPITER.		Even. ✳
	h m	h m	h m
1	9 m 40	4 a 23	11 a 6
11	9 9	3 49	10 29
21	8 40	3 16	9 52
♄	SATURN.		
	h m	h m	h m
1	4 a 8	8 a 46	1 m 28
11	3 27	8 5	0 47
21	2 47	7 25	0 7
	☉ rises.	☉ east.	☉ sets.
	h m	h m	h m
1	3 m 49	7 m 23	8 a 18
11	3 57	7 21	8 12
21	4 9	7 15	8 2

☽'s PHASES.

		h m			h m
Full Moon	7 day	2 a 19	New Moon	21 day	2 a 22
Last Quarter	14 „	7 m 20	First Quarter	29 „	5 a 55

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semidiam.	☽ rises and sets.	☉ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	W	Lammas Day	18N 6	15 47	11 a 32	8 a 13	11
2	Th		17 51	15 47	morn.	9 13	12
3	F		17 35	15 47	0 23	10 14	13
4	S		17 19	15 48	1 34	11 16	14
5	*G*	8 Sund. aft. Trinity	17 3	15 48	rises	morn.	○
6	M	Transfiguration	16 47	15 48	8 25	0 15	16
7	Tu	Name of Jesus	16 30	15 48	8 41	1 11	17
8	W		16 14	15 48	8 54	2 3	18
9	Th		15 56	15 48	9 7	2 53	19
10	F	St. Lawrence	15 39	15 48	9 19	3 43	20
11	S		15 21	15 49	9 36	4 33	21
12	*G*	9 Sund. aft. Trinity	15 4	15 49	9 57	5 24	☾
13	M	Queen Adelaide born	14 45	15 49	10 25	6 18	23
14	Tu		14 27	15 49	11 4	7 13	24
15	W	Assumption	14 9	15 49	11 57	8 10	25
16	Th		13 50	15 49	morn.	9 7	26
17	F		13 31	15 50	1 4	10 1	27
18	S		13 11	15 50	2 18	10 51	28
19	*G*	10 Sund. aft. Trinity	12 52	15 50	3 34	11 38	29
20	M		12 32	15 50	sets	12 a 21	●
21	Tu	King William IV. born	12 12	15 50	7 a 46	1 2	1
22	W		11 52	15 51	7 55	1 41	2
23	Th		11 32	15 51	8 5	2 20	3
24	F	St. Bartholomew	11 12	15 51	8 14	2 59	4
25	S		10 51	15 51	8 25	3 40	5
26	*A*	11 Sund. aft. Trinity	10 30	15 51	8 40	4 23	6
27	M		10 9	15 52	8 58	5 10	7
28	Tu	St. Augustine	9 48	15 52	9 26	6 2	☽
29	W	St. John Bapt. beheaded	9 27	15 52	10 8	6 57	9
30	Th		9 5	15 52	11 8	7 56	10
31	F		8N44	15 53	morn.	8 57	11

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h m
Venus in conjunction	17 day	9 m 27
Jupiter „	22 „	8 m 36

Day of month.	High Water at London Bridge. Morn.	After.	Chr. Time at ☉'s noon.
	h m	h m	h m s
1	8 50	9 31	12 6 1
2	10 13	10 56	5 57
3	11 36		5 53
4	0 10	12 42	5 48
5	1 11	1 39	5 43
6	2 5	2 29	5 37
7	2 52	3 14	5 30
8	3 36	3 57	5 23
9	4 18	4 39	5 15
10	4 59	5 18	5 7
11	5 37	5 57	4 58
12	6 19	6 42	4 48
13	7 6	7 33	4 38
14	8 2	8 40	4 28
15	9 27	10 17	4 16
16	11 6	11 49	4 5
17		12 23	3 53
18	0 51	1 15	3 40
19	1 37	1 58	3 27
20	2 17	2 36	3 13
21	2 54	3 10	2 59
22	3 25	3 39	2 45
23	3 53	4 6	2 30
24	4 20	4 33	2 14
25	4 47	5 0	1 58
26	5 14	5 28	1 42
27	5 44	6 2	1 25
28	6 22	6 43	1 8
29	7 8	7 38	0 51
30	8 16	9 1	0 33
31	9 49	10 38	12 0 15

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Morn. ✳
	h m	h m	h m
1	1 m 33	9 m 41	5 a 49
11	1 48	9 53	5 58
21	2 7	10 4	6 1
♂	MARS.		
	h m	h m	h m
1	1 m 10	9 m 30	5 a 50
11	1 1	9 20	5 39
21	0 53	9 8	5 23
♃	JUPITER.		Even. ✳
	h m	h m	h m
1	8 m 8	2 a 40	9 a 12
11	7 39	2 8	8 37
21	7 11	1 36	8 1
♄	SATURN.		
	h m	h m	h m
1	2 a 4	6 a 42	11 a 20
11	1 25	6 3	10 41
21	12 48	5 25	10 2
	☉ rises.	☉ east.	☉ sets.
	h m	h m	h m
1	4 m 25	7 m 6	7 a 46
11	4 39	6 55	7 30
21	4 55	6 43	7 10

☽'s PHASES.

		h m			h m
Full Moon	5 day	10 a 26	New Moon	20 day	4 m 26
Last Quarter	12 ,,	1 a 28	First Quarter	28 ,,	8 m 55

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &C.	☉'s declination.	☉'s semidiam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	S	Giles	8 N 22	15 53	0 m 27	9 a 57	12
2	G	12 SUND. AFT. TRINITY	8 0	15 53	1 59	10 54	13
3	M		7 38	15 53	3 33	11 48	14
4	Tu		7 16	15 54	rises	morn.	○
5	W	OLD BARTHOLOMEW	6 54	15 54	7 a 13	0 41	16
6	Th		6 32	15 54	7 26	1 32	17
7	F	Enurchus	6 9	15 54	7 41	2 23	18
8	S	WM. AND ADEL. CR.	5 47	15 55	7 59	3 16	19
9	G	13 SUND. AFT. TRINITY	5 24	15 55	8 25	4 10	20
10	M		5 1	15 55	9 2	5 7	☾
11	Tu		4 39	15 55	9 52	6 5	22
12	W		4 16	15 55	10 55	7 2	23
13	Th		3 53	15 56	morn.	7 57	24
14	F	Holy Cross.	3 30	15 56	0 7	8 49	25
15	S		3 7	15 56	1 22	9 36	26
16	G	14 SUN. AFT. TRINITY	2 43	15 57	2 38	10 20	27
17	M		2 20	15 57	3 50	11 2	28
18	Tu	Sun Eclipsed, not vis.	1 57	15 57	sets	11 41	●
19	W		1 34	15 57	6 a 13	12 a 20	1
20	Th		1 10	15 58	6 23	12 59	2
21	F	St. Matthew	0 47	15 58	6 35	1 39	3
22	S		0 24	15 58	6 47	2 21	4
23	G	15 SUN. AFT. TRINITY	0 N 0	15 58	7 3	3 6	5
24	M	Autumn commenced	0 S 23	15 59	7 27	3 55	6
25	Tu		0 47	15 59	8 2	4 48	7
26	W	St. Cyprian	1 10	15 59	8 54	5 45	☽
27	Th		1 34	15 59	10 3	6 43	9
28	F		1 57	16 0	11 26	7 41	10
29	S	MICHAELMAS DAY	2 20	16 0	morn.	8 38	11
30	G	16 SUN. AFT. TRINITY	2 S 44	16 0	0 58	9 32	12

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h m
Venus in conjunction	16 day	3 a 52
Jupiter ,,	19 ,,	3 m 18

Day of month.	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ⊙'s noon.		
	h	m	h	m	h	m	s
1	11	22	11	57	11	59	56
2			12	28		59	37
3	0	56	1	23		59	18
4	1	47	2	11		58	59
5	2	34	2	56		58	39
6	3	16	3	35		58	19
7	3	53	4	12		57	59
8	4	31	4	50		57	39
9	5	9	5	30		57	18
10	5	53	6	16		56	58
11	6	41	7	9		56	37
12	7	43	8	25		56	16
13	9	13	10	3		55	55
14	10	52	11	33		55	35
15			12	4		55	14
16	0	32	12	55		54	53
17	1	17	1	38		54	32
18	1	57	2	15		54	11
19	2	31	2	45		53	50
20	2	58	3	10		53	29
21	3	22	3	33		53	8
22	3	45	3	56		52	47
23	4	8	4	22		52	26
24	4	38	4	55		52	5
25	5	14	5	34		51	45
26	5	55	6	18		51	25
27	6	44	7	15		51	4
28	7	56	8	43		50	44
29	9	32	10	17		50	25
30	10	59	11	36	11	50	5

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Morn. ✳
	h m	h m	h m
1	2 m 37	10 m 16	5 a 55
11	3 6	10 25	5 44
21	3 36	10 33	5 30
♂	MARS.		
	h m	h m	h m
1	0 m 45	8 m 55	5 a 5
11	0 41	8 43	4 45
21	0 35	8 29	4 23
♃	JUPITER.		Even. ✳ till the 22nd.
	h m	h m	h m
1	6 m 41	1 a 1	7 a 21
11	6 14	12 a 30	6 46
21	5 47	11 m 58	6 9
♄	SATURN.		
	h m	h m	h m
1	12 a 8	4 a 44	9 a 20
11	11 m 32	4 7	8 42
21	10 58	3 31	8 4
	⊙ rises.	⊙ east.	⊙ sets.
	h m	h m	h m
1	5 m 12	6 m 27	6 a 46
11	5 29	6 12	6 24
21	5 45	5 56	6 1

☽'s PHASES.

		h m			h m
Full Moon	4 day	6 m 18	New Moon	18 day	8 a 45
Last Quarter	10 „	10 a 9	First Quarter	26 „	9 a 53

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semidiam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	M		3 S 7	16 1	2m 29	10 a 25	13
2	Tu		3 30	16 1	4 2	11 16	14
3	W		3 54	16 1	rises	morn.	○
4	Th		4 17	16 1	5 a 45	0 8	16
5	F		4 40	16 2	6 2	1 1	17
6	S	Faith.	5 3	16 2	6 24	1 56	18
7	G	17 Sund. aft. Trinity	5 26	16 2	6 57	2 54	19
8	M		5 49	16 3	7 43	3 54	20
9	Tu	St. Denys.	6 12	16 3	8 43	4 54	21
10	W	Camb. & Ox. Terms beg.	6 35	16 3	9 54	5 51	☾
11	Th	Old Michaelmas Day.	6 58	16 3	11 11	6 44	23
12	F		7 20	16 4	morn.	7 34	24
13	S		7 43	16 4	0 26	8 19	25
14	G	18 Sun. aft. Trinity	8 5	16 4	1 39	9 1	26
15	M		8 28	16 4	2 51	9 41	27
16	Tu		8 50	16 5	4 1	10 20	28
17	W	Etheldreda.	9 12	16 5	5 10	10 58	29
18	Th	St. Luke.	9 34	16 5	sets	11 38	●
19	F		9 56	16 6	4 a 55	12 a 20	1
20	S		10 18	16 6	5 11	1 4	2
21	G	19 Sund. aft. Trinity	10 39	16 6	5 32	1 52	3
22	M		11 1	16 6	6 3	2 44	4
23	Tu		11 22	16 7	6 48	3 39	5
24	W		11 43	16 7	7 50	4 35	6
25	Th	Crispin.	12 4	16 7	9 7	5 32	7
26	F		12 24	16 7	10 32	6 28	☽
27	S		12 45	16 8	morn.	7 21	9
28	G	20 Sund. aft. Trinity	13 5	16 8	0 2	8 12	10
29	M		13 25	16 8	1 30	9 2	11
30	Tu		13 45	16 8	3 0	9 52	12
31	W		14 S 5	16 9	4 30	10 44	13

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

			h m
♀ ☌ ♃	13	day	3 a 49
Jupiter in conjunction	16	,,	10 a 6
Venus ,,	17	,,	6 m 6

Day of month.	High Water at London Bridge. Morn.	After.	Chr. Time at ⊙'s noon.
	h m	h m	h m s
1		12 7	11 49 46
2	0 35	1 1	49 27
3	1 26	1 49	49 8
4	2 9	2 28	48 50
5	2 45	3 4	48 31
6	3 23	3 43	48 14
7	4 4	4 26	47 57
8	4 48	5 11	47 40
9	5 34	5 57	47 23
10	6 20	6 46	47 7
11	7 20	8 3	46 52
12	8 48	9 33	46 37
13	10 17	10 59	46 22
14	11 35		46 8
15	0 3	12 27	45 55
16	0 50	1 10	45 42
17	1 27	1 42	45 30
18	1 56	2 10	45 18
19	2 23	2 35	45 7
20	2 48	3 0	44 57
21	3 13	3 27	44 47
22	3 43	4 0	44 38
23	4 17	4 35	44 30
24	4 54	5 15	44 22
25	5 38	6 3	44 15
26	6 31	7 4	44 8
27	7 43	8 26	44 3
28	9 12	9 55	43 58
29	10 35	11 10	43 53
30	11 41		43 50
31	0 7	12 31	11 43 47

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Morn. ⚹
	h m	h m	h m
1	4 m 6	10 m 40	5 a 14
11	4 38	10 47	4 56
21	5 9	10 53	4 37
♂	MARS.		
	h m	h m	h m
1	0 m 28	8 m 14	4 a 0
11	0 25	8 0	3 35
21	0 17	7 43	3 9
♃	JUPITER.		Morn. ⚹
	h m	h m	h m
1	5 m 20	11 m 27	5 a 34
11	4 53	10 55	4 57
21	4 26	10 24	4 22
♄	SATURN.		
	h m	h m	h m
1	10 m 23	2 a 55	7 a 27
11	9 50	2 20	6 50
21	9 15	1 44	6 13
	⊙ rises.	⊙ east.	⊙ sets.
	h m	h m	h m
1	6 m 1	5 m 40	5 a 38
11	6 18	5 25	5 15
21	6 35	5 11	4 54

☽'s PHASES.

		h m			h m
Full Moon	3 day	2 a 46	New Moon	18 day	2 a 25
Last Quarter	10 „	10 m 25	First Quarter	26 „	8 m 58

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &C.	⊙'s declination.	⊙'s semi-diam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	Th	All Saints	14S 24	16 9	6 m 1	11 a 38	14
2	F	Michaelmas T. beg.	14 43	16 9	rises.	morn.	○
3	S		15 2	16 9	4 a 52	0 36	16
4	G	21 Sund. aft. Trinity	15 21	16 10	5 33	1 36	17
5	M	Gunpowder Plot.	15 39	16 10	6 28	2 38	18
6	Tu		15 57	16 10	7 37	3 38	19
7	W		16 15	16 10	8 53	4 35	20
8	Th		16 33	16 11	10 11	5 27	21
9	F	Lord Mayor's Day	16 50	16 11	11 26	6 15	☾
10	S		17 7	16 11	morn.	6 58	23
11	G	22 Sund. aft. Trinity	17 24	16 11	0 39	7 39	24
12	M	Camb. Term div. mid.	17 41	16 11	1 49	8 18	25
13	Tu	Britius	17 57	16 12	2 58	8 57	26
14	W		18 13	16 12	4 8	9 36	27
15	Th	Machutus	18 28	16 12	5 20	10 17	28
16	F		18 44	16 12	6 35	11 1	29
17	S		18 58	16 13	sets.	11 48	●
18	G	23 Sund. aft. Trinity	19 13	16 13	4 a 6	12 a 40	1
19	M		19 27	16 13	4 46	1 34	2
20	Tu		19 41	16 13	5 44	2 31	3
21	W		19 55	16 13	6 57	3 28	4
22	Th	St. Cecilia	20 8	16 13	8 19	4 23	5
23	F	St. Clement	20 20	16 14	9 46	5 16	6
24	S		20 33	16 14	11 12	6 6	☽
25	G	24 Sund. aft. Trinity	20 45	16 14	morn.	6 55	8
26	M	Michaelmas Term ends	20 56	16 14	0 37	7 43	9
27	Tu		21 8	16 14	2 4	8 32	10
28	W		21 18	16 15	3 31	9 23	11
29	Th		21 29	16 15	5 1	10 18	12
30	F	St. Andrew	21S 39	16 15	6 34	11 16	13

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

			h m
Jupiter	in conjunction	13 day	4 a 40
Venus	„	16 „	6 a 24

Day of month.	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ☉'s noon.		
	h	m	h	m	h	m	s
1	0	54	1	16	11	43	45
2	1	37	1	59		43	44
3	2	20	2	41		43	44
4	3	3	3	25		43	44
5	4	47	4	9		43	46
6	4	31	4	53		43	48
7	5	16	5	40		43	51
8	6	4	6	29		43	55
9	7	57	7	32		43	59
10	8	10	8	49		44	5
11	9	29	10	10		44	11
12	10	46	11	13		44	19
13	11	36	11	59		44	27
14			12	20		44	36
15	0	38	12	55		44	46
16	1	12	1	28		44	57
17	1	44	2	0		45	8
18	2	16	2	33		45	21
19	2	50	3	8		45	34
20	3	26	3	45		45	48
21	4	5	4	25		46	3
22	4	46	5	8		46	19
23	5	32	5	59		46	35
24	6	27	6	58		46	52
25	7	32	8	8		47	10
26	8	45	9	21		47	29
27	9	56	10	28		47	48
28	10	58	11	27		48	8
29	11	55				48	29
30	0	22	12	49	11	48	51

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		Morn. ✳
	h m	h m	h m
1	5 m 44	11 m 1	4 a 18
11	6 18	11 10	4 2
21	6 50	11 20	3 50
♂	MARS.		
	h m	h m	h m
1	0 m 8	7 m 23	2 a 38
11	11 a 57	7 4	2 9
21	11 46	6 44	1 40
♃	JUPITER.		Morn. ✳
	h m	h m	h m
1	3 m 54	9 m 48	3 a 42
11	3 26	9 16	3 6
21	2 57	8 44	2 31
♄	SATURN.		
	h m	h m	h m
1	8 m 39	1 a 6	5 a 33
11	8 6	12 a 32	4 58
21	7 33	11 m 57	4 21
	☉ rises	☉ south	☉ sets.
	h m	h m	h m
1	6 m 54	4 m 57	4 a 32
11	7 12	4 46	4 15
21	7 29	4 39	4 2

☽'s PHASES.

		h m			h m
Full Moon	2 day	0 m 25	New Moon	17 day	8 m 2
Last Quarter	9 „	2 m 49	First Quarter	24 „	6 a 3

Day of month.	Day of week.	SUNDAYS, HOLIDAYS, &c.	☉'s declination.	☉'s semi-diam.	☽ rises and sets.	☽ south.	☽'s age.
			° ′	′ ″	h m	h m	d
1	S		21S 48	16 15	rises	morn.	O
2	G	ADVENT SUNDAY	21 58	16 15	4 a 10	0 18	15
3	M		22 6	16 15	5 15	1 20	16
4	Tu		22 15	16 15	6 30	2 20	17
5	W		22 23	16 16	7 49	3 16	18
6	Th	St. Nicholas	22 30	16 16	9 7	4 6	19
7	F		22 37	16 16	10 23	4 53	20
8	S	Conception	22 44	16 16	11 34	5 35	☾
9	G	2 SUNDAY IN ADVENT	22 50	16 16	morn.	6 15	22
10	M		22 56	16 16	0 44	6 54	23
11	Tu		23 1	16 16	1 53	7 33	24
12	W		23 6	16 16	3 5	8 13	25
13	Th	St. Lucy	23 10	16 16	4 17	8 55	26
14	F		23 14	16 17	5 34	9 41	27
15	S		23 17	16 17	6 52	10 32	28
16	G	3 SUNDAY IN ADVENT	23 20	16 17	8 6	11 26	29
17	M	Oxford Term ends	23 22	16 17	sets	12 a 23	●
18	Tu		23 24	16 17	4 a 45	1 21	1
19	W		23 26	16 17	6 7	2 18	2
20	Th		23 27	16 17	7 32	3 13	3
21	F	St. Thomas	23 28	16 17	9 0	4 4	4
22	S	Winter commences	23 28	16 17	10 25	4 53	5
23	G	4 SUNDAY IN ADVENT	23 27	16 17	11 49	5 40	6
24	M		23 27	16 17	morn.	6 27	☽
25	Tu	CHRISTMAS DAY	23 25	16 17	1 14	7 16	8
26	W	St. Stephen	23 23	16 17	2 40	8 8	9
27	Th	St. John	23 21	16 17	4 9	9 3	10
28	F	Innocents	23 18	16 17	5 38	10 1	11
29	S		23 15	16 17	7 1	11 2	12
30	G	1 SUND. AFT. CHRIST.	23 12	16 17	8 12	morn.	13
31	M	Silvester	23 S 8	16 17	9 4	0 3	O

CONJUNCTIONS OF VENUS AND JUPITER WITH THE MOON.

		h m
Jupiter in conjunction	11 day	10 m 14
Venus ,,	16 ,,	midnight

Day of month.	High Water at London Bridge. Morn.		High Water at London Bridge. After.		Chr. Time at ⊙'s noon.
	h	m	h	m	h m s
1	1	15	1	40	11 49 13
2	2	5	2	30	49 35
3	2	54	3	17	49 59
4	3	38	3	58	50 23
5	4	18	4	38	50 47
6	4	59	5	21	51 13
7	5	44	6	8	51 38
8	6	33	6	58	52 5
9	7	24	7	51	52 31
10	8	19	8	48	52 58
11	9	19	9	49	53 26
12	10	17	10	46	53 54
13	11	14	11	41	54 22
14			12	7	54 51
15	0	31	12	53	55 20
16	1	14	1	35	55 49
17	1	55	2	15	56 19
18	2	35	2	56	56 49
19	3	17	3	38	57 18
20	3	59	4	20	57 48
21	4	42	5	5	58 18
22	5	29	5	53	58 48
23	6	18	6	44	59 19
24	7	9	7	35	11 59 49
25	8	2	8	30	12 0 18
26	9	2	9	37	0 48
27	10	15	10	54	1 18
28	11	30			1 47
29	0	2	12	33	2 17
30	1	4	1	33	2 46
31	1	57	2	20	12 3 15

Day of month.	Planet rises.	Planet south.	Planet sets.
♀	VENUS.		{ Morn. ✱ till the 17th
	h m	h m	h m
1	7 m 21	11 m 32	3 a 43
11	7 50	11 m 47	3 44
21	8 11	12 a 1	3 51
♂	MARS.		
	h m	h m	h m
1	11 a 34	6 m 23	1 a 10
11	11 19	6 0	12 39
21	11 1	5 36	12 8
♃	JUPITER.		Morn. ✱
	h m	h m	h m
1	2 m 28	8 m 11	1 a 54
11	1 57	7 37	1 17
21	1 25	7 2	12 39
♄	SATURN.		
	h m	h m	h m
1	7 m 0	11 m 23	3 a 46
11	6 27	10 48	3 9
21	5 54	10 14	2 34
	⊙ rises.	⊙ east.	⊙ sets.
	h m	h m	h m
1	7 m 45	4 m 35	3 a 53
11	7 58	4 34	3 49
21	8 6	4 37	3 51

☽'s PHASES.

		h m			h m
Full Moon	1 day	11 m 34	First Quarter	24 day	3 m 7
Last Quarter	8 ,,	10 a 56	Full Moon	31 ,,	0 m 35
New Moon	17 ,,	0 m 23			

CONTRIBUTIONS

TO

A TABLE

OF THE

CHRONOLOGY OF SCIENCE.

In consequence of the gradual nature of the development which the sciences have undergone, it is impossible to trace their origin back to any precise year or century. The ancients were so strongly influenced by this consideration, and with the importance of the sciences, that they did not hesitate to ascribe their source to divinity itself. Modern chronologists have, however, displayed great perseverance in their researches upon this subject, so important in the history of the human mind, and their labours have been attended with some degree of success.

Astronomy, comprising the study of the motions of the heavenly bodies, is connected with such palpable and amazing phenomena that we cannot doubt of its having first attracted the attention of mankind. According to Josephus, Seth divided the stars into constellations and gave names to the heavenly bodies. But this tradition, like the fable of Endymion, who is said to have passed many years in the daily and nightly observations of the stars on Mount Latmos, the invention of the sphere by Museus and Linus, and the theory of the universe by Orpheus is not considered genuine by most historians. The Babylonians and Egyptians were undoubtedly the first people who studied astronomy as a science. In Chaldea the Temple of Jupiter Belus, raised by Semiramis, of which remnants existed in the time of Pliny, served as an observatory to the Chaldeans; while the Egyptians had their colleges of priests at Diospolis, Heliopolis and Memphis with the famous golden circle of Osymandyas. The Chaldeans boast of their Zoroaster, King of Bactria, who lived five hundred years before the siege of Troy, as the founder of the science of Astronomy; the Egyptians on the other hand, assert that Thot or Mercury Trismegistus originated *Astronomy, Arithmetic* and *Geometry.* The Chinese knew only the elements of this science when the Europeans first visited them.

Arithmetic, according to Strabo, originated with the Phenicians, and Cedrenus asserts that Phenix, son of Agenor, wrote the first treatise on this important branch of mathematics in the Phenician language. The Egyptians, however, claim the discovery; according to Socrates and Plato, Theut or Thot the minister of Sesostris, invented numbers and geometry. Josephus on the other hand, states that Abraham taught the Egyptians arithmetic.

Geometry, which literally signifies the measure of the earth or of land, is considered by Herodotus to have originated in Egypt in the time of Sesostris; and when we consider the enterprizing character of that monarch in erecting buildings and forming canals, the opinion may perhaps deserve considerable credit.

Mechanics, Hydrostatics and *Hydraulics* made early no small progress as the monuments in Egypt distinctly prove. In the same country we may readily infer that the use of the inclined plane, the screw or inclined plane rolled round a cylinder, and the wedge occurred at a very remote period.

Optics. The first traces of this science appear in the writings of Aristotle. Mechanics, as a science, were first treated of in his *Mechanical Questions.*

Medicine. The serpent, the symbol of medicine, was worshipped by the Phenicians, Egyptians, Hebrews, Greeks and other ancient nations, yet the origin of medicine is usually attributed to the time of Osiris, who introduced Agriculture and many improvements into Egypt. His symbol was the sun: his wife Isis, represented by the moon, was considered the divinity of medicine; she brought back to life her son Orus. Mercury Trismegistus or Thot, is said to have written a work, the six last chapters of which treated of anatomy, diseases, especially those of women, affections of the eyes, surgical instruments and remedies. But this is probably a modern work. After the discovery of the papyrus, this knowledge was collected into a book which was called *Embre.* It contained the rules of the science of medicine to which the physicians were obliged punctually to adhere.

Such is a short sketch of our knowledge of the origin of the sciences previous to the introduction of any chronology. The other sciences date their commencement in modern times.

4004 B. C.—According to the Mosaic History, Adam and Eve were clothed with "coats of skins."

3875 B. C.—TUBAL CAIN born; "an instructor of every artificer in brass (copper)* and iron," gold, silver, copper, iron, and perhaps tin as they exist in a native state were known from the earliest periods.

Idem.—JUBAL born, "the father of all such as handle the harp and organ."

3000 B. C.—The fabulous anatomical works of Hermes and Athotis, said to have been written.

2349 B. C.—The flood of Noah, according to the Mosaic History. Traditions of a partial inundation still exist among the nations of the East which is quite in consonance with the scripture account.

2347 B. C.—Noah planted a vineyard and made wine.

1822 B. C.—Memnon, the Egyptian, invents the letters.

1800 B. C.—First case of difficult labour recorded in the case of REBEKAH, when delivered of Esau and Jacob. The second case mentioned of twins is that of *Thamar*. Phineas the daughter of the High Priest Heli, was assisted at her delivery by women. Midwives were termed *Majalledeth;* the most distinguished in early times were Phuha and Sephora;—the woman was placed in a chair.

* This word translated brass in our version signifies a serpent. Copper exists native, but brass is an artificial preparation of zinc and copper.

1707 B. C.—The commencement of a great famine in Egypt in the time of Joseph.

1672 B. C.—Jacob embalmed by the "physicians" of Egypt at the command of Joseph.

1635 B. C.—Joseph, son of Jacob, "embalmed and put in a coffin in Egypt."

1593 B. C.—Moses prescribes Hygienic Laws—orders certain kinds of food. India received similar laws of a religious character, ordering sobriety, vegetable food and ablutions; the Egyptian priests ordered baths, severe regimen, and monthly dietetic vomiting.

1431 B. C.—The knowledge of iron, according to Hesiod, brought over from Phrygia to Greece by the Dactyli who settled in Crete during the reign of Minos I.

1398 B. C—Melampus a physician and divine cured of folly and unclean diseases, the daughters of King Proetus by black hellebore, purification, and exercise.

1325 B. C.—The great Egyptian canicular year, or year of Thot or Sothis, began on Saturday July 20th and consisted of 1460 years—the Dog Star or Sirius having risen that morning at Heliopolis precisely at four o'clock.

1294 B. C.—Minos in Crete, Iphitus in Elis and (884) Lycurgus in Sparta introduced games and fights, athletic exercises, gymnasia and public baths.

1284 B. C.—Orpheus the poet lived.

Idem.—Linus the poet.

1270 B. C.—Chiron the centaur, celebrated for his treatment of wounds and ulcers, and as being the teacher of Esculapius flourished.

1263 B. C.—Esculapius son of Apollo, disciple of Chiron, treated diseases by external medicines and prayers (ἐπαοιδῇ) to the gods; temples were built for him in healthy places; cures were effected in the temples by young men, mystical ceremonies, baths, frictions, gymnastics, bleeding, mild medicines, purgatives. Votive tablets were suspended in the temples representing the diseased parts, and indicating the effectual medicines. According to Heraclitus, Esculapius died from inflammation of the lungs—Hygeia and Panacea the sisters of Esculapius, are obviously allegories.

1184 B. C.—Podalyrus and Machaon sons of Esculapius, renowned at the Siege of Troy. The former practised bleeding from the arm. According to some, Podalyrus was a physician and Machaon a surgeon; —Machaon cured Philoctetes of a wound by a magic formula.

1080 B. C.—Lycaon built Lycosura. Phoroneus built Argos. Aegialius built Sicyon; these were the oldest towns in Peloponesus; previously the inhabitants lived in detached houses scattered over the fields.

1048 B. C.—The Edomites conquered and dispersed by David; they fly to Egypt, Persian Gulf, Mediterranean, and carry with them their arts and sciences especially navigation, astronomy, and letters.

1047 B. C.—The Edomites or Phœnicians (as they called themselves by translating Erythraea (Red Sea) into that of Phœnicia) began to make voyages in the Mediterranean

1045 B. C.—The Phœnicians under Cadmus and others pass into Asia Minor, Crete, Greece and Libya, and introduce Letters, Poetry, Music, the Octaeteris, Metals, and other fabrications, and other arts and sciences. Deucalion's flood took place about this time.

1035 B. C.—The Idæi Dactyli who accompanied the Phœnicians discover iron in Mount Ida in Greece, and work it into armour and iron tools; they introduce Music and Poetry.

1034 B. C.—Ammon King of Egypt first built long and tall ships with sails; previously they used small round vessels which kept close in shore. The Egyptians, however, began now to observe the stars. Hence the origin of Astronomy and Navigation may be dated from this period. Hitherto the luni-solar year had been in use; but this year being of an uncertain length they found the length of the solar year by observing the heliacal rising and setting of the stars, and made it consist of five days more than the twelve calendar months of the old luni-solar year.

1030 B. C.—Ceres, a woman of Sicily, comes into Attica in search of her daughter who was stolen, and teaches the Greeks to sow corn, for which she was deified, after death.

1028 B. C.—Œnotrus son of Lycaon led some Greeks into Italy and there taught them to build houses.

1007 B. C.—Temples begin to be built in Greece —Hyagnis the Phrygian invents the pipe.

989 B. C.—Dædalus and his nephew Talus invent the saw, the turning-lath, the wimble, the chop-axe and other instruments of carpenters and joiners. Dædalus also invented statues with their feet asunder as if they walked.

979 B. C.—Thoas is sent from Crete to Lemnos; reigns there in the city Hephoistia, and works in copper and iron.

943 B. C.—Evander and his mother Carmenta carry letters into Italy.

939 B. C.—Chiron, who was born in the golden age, forms the constellations for the use of the Argonauts, and places the solstitial and equinoctial points in the fifteenth degrees or middles of the constellations of Cancer, Chelæ, Capricorn, and Aries. Meton in the year of Nabonassar 316, observed the summer solstice in the eighth degree of Cancer, and therefore the solstice had then gone back seven degrees; it retrogrades one degree in about seventy-two years, and seven degrees in about 504 years. The Argonautic expedition therefore took place about 936 B. C. according to Newton.

927 B. C.—Hercules and Æsculapius deified.

916 B. C.—Hesiod the poet flourished.

912 B. C.—Memphis, and a bridge over the Nile built by Menes.

907 B. C.—Homer wrote his poems.

887 B. C.—Amenophis established the year of 365 days; a circle was set up in his temples divided into 365 parts, every part having the date of the year and the heliacal rising and setting of the stars noted upon it.

884 B. C.—Sulphuret of antimony first mentioned (2 Kings ix. 30.) When Jehu came to Jezreel she painted her face—or literally "put her eyes in stibium" (sulphuret of antimony.) This refers to painting the eye-brows with the black powder of sulphuret of antimony which is still practised by the Hindoos on the Concan coast of India at the present day. The juice of the *hennah* plant is also employed for the same purpose. It is remarkable (Thomson's History of Chemistry vol. I. 75) that the term *alcohol* now given to spirits of wine was originally applied to the powder of sulphuret of antimony.

838 B. C.—Cheops built the largest Egyptian pyramid.

825 B. C.—King Cephren built another great pyramid.

786 B. C.—Trireme ships invented by the Corinthians.

760 B. C.—The reduction of tin alluded to by Isaiah (chap. i. 25). The literal translation of the last clause of this verse is, "I will purify your scoria, and take away all your tin." Tin occurs in the state of oxide in Cornwall, Spain, Gallicia, Hungary and Malacca. The Hebrew word, from which the original term is derived, signifies to *divide* or *division*.

747 B. C.—The Egyptians carry their Astrology and Astronomy to Babylon, and found the era of Nabonassar in Egyptian years.

720 B. C.—The oldest astronomical observations on record made at Babylon. Ptolomy afterwards employed them to determine the periods of the moon's mean motion.

715 B. C.—Law of Numa passed which ordered that the uterus of every woman who died pregnant should be opened, and the child extracted.

712 B. C.—Charcoal and the use of the bellows mentioned by Isaiah (chap. 54, 16) "Behold I have created the smith that bloweth the coals in the fire." The word coal should obviously be charcoal, as no coal exists in the neighbourhood of Syria.

686 B. C.—Archilochus the poet and inventor of Jambic verse flourished.

684 B. C.—Tyrtæus the poet flourished.

680 B. C.—Thales flourished. He was born 640 years before the christian era ; he visited Egypt at an early age and conversed with the priests. According to Diogenes Laertes he measured the pyramids or rather the obelisks by means of their shadows in presence

of King Amasis who was astonished at the sagacity of the Grecian philosopher. Hence it would appear that the knowledge of this method of ascertaining altitudes was then unknown in Egypt. On his return to Greece he communicated his knowledge to his countrymen, and instituted the Ionic sect. Previous to his time, tradition states that a certain Euphorbus of Phrygia had given a description (apparently geometrical) of the triangle. The compass and the rule took their origin from fabulous times; the square and level are said to have been invented by Theodorus of Samos one of the architects of the temple of Ephesus. Thales directed his attention to the properties of triangles and the circle; he discovered that all triangles which have the diameter for their base, and whose opposite angle reaches the circumference, have this angle a right angle. He predicted that this discovery would be the prelude to a great many others, and made a sacrifice to the Muses. His pupils were Ameristus the geometrican and Anaximander. According to Apuleus, Thales was acquainted with the sphere, that is the division of the heavens into different circles, the obliquity of the ecliptic and the cause of the phases of the moon. He measured also the diameter of the sun, and found it to be the 720th part of the orbit, in which he deviated very little from the truth. But the greatest feature in the character of Thales was his calculating with accuracy an eclipse of the sun, which shows that he must have either been acquainted with a great many elements of which history makes no mention, or that he had derived from the Egyptians some artificial method of calculation. It is certain that Thales was acquainted with the obliquity of the ecliptic although the discovery has been attributed to Pythagoras, Œnopidis and Anaximander. But according to Diogenes Laertes, he wrote a work on solstices and equinoxes; he was acquainted with the spherical figure of the earth and the causes of the eclipse of the moon.

676 B. C.—Terpander the poet flourished.

673 B. C.—Thaletus of Gortinius the musician flourished.

670 B. C.—Alcman of Sardis the lyric poet flourished.

655 B. C.—The Ionians had access to Egypt and learned Philosophy, Astronomy and Geometry.

620 B. C.—Arion the musician lived.

607 B. C.—Alcæus the poet flourished.

600 B. C.—Sappho the lyric poetess flourished.

Public education and hygiene instituted in Persia.

596 B. C.—Phidon introduced weights and measures, and the coining of silver money.

588 B. C.—Silver, iron, tin, lead, ivory, ebony, emeralds, coral, agate, honey, oil, resin, white wool, precious stones and gold mentioned by Ezekiel (chap. xxvii) as the articles of commerce from Tarsus to Tyre. The original hebrew word, translated tin in our version, is derived from a root signifying *division;* this may perhaps apply to the granular state of the ore of this metal. The word translated *lead* is derived from the root signifying *earth* ; this is not easily understood, because the common ore of lead is the sulphuret or galena which possesses all the aspects of a metal, and has no resemblance whatever to earth. It would appear, therefore, that we cannot arrive at any definite opinion with regard to the true nature of this metal.

585 B. C.—Xenophanes flourished. According to him nothing has been created: all is eternal, invariable; God is the world; the world is God. He distinguished empirical from rational principles.

Idem.—Æsop the mythologist lived.

Idem.—In the sixth year of the Lydian war, on the 28th May of this year, the eclipse of the sun, predicted by Thales, occurred just att he moment when Cyaxarus, King of the Medes, was on the point of giving battle to Aliathus, King of Lydia, and put an end to the war. According to the calculations of Riccioli this was the year in which the eclipse occurred; but Mr. Baily refers it to the year 610.

562 B. C.—Susarion and Dolon the inventors of comedy flourished.

560 B. C.—Anaximander pupil of Thales flourished. He was born about the year 620 B. C. and died in the year 545 B. C. He directed the Ionic school after the death of Thales, and confirmed the theories of his master. He taught that the world was round, and that the moon derived its light from the sun. Some have supposed that he conceived the earth to move round the centre of the universe. But according to Montucla the sentence from which this deduction has been drawn will bear another interpretation; for, according to Aristotle it was an ancient question, how the earth could sustain itself in the centre of the universe without falling. Now Anaximander explained this by saying, "that it was prevented from falling by its uniform position round the centre of the universe, a position which caused it to remain there, having nothing to displace it." He considered that the sun was an

inflamed mass as large at least as the earth. Anaximander, according to Diogenes, invented the sphere; he also constructed the first gnomon at Lacedemon. It consisted of a needle elevated perpendicularly, and which showed, by the shadow of its summit, the course of the sun, differing from that used in the present day by which the light of the sun is made to pass through a circular hole of which the centre in considered the summit of its height. Anaximander employed his instrument to observe the solstices. Geographical charts and sun-dials were first used by Anaximander. According to Strabo and Diogenes he made a map of Greece and of the countries and seas which the people of that country were in the habit of frequenting. Such was the origin of *geography* in Greece on which Hecateus, the countryman of Anaximander, wrote the first treatise on record, but which has not come down to our times. Sesostris, long anterior, had made a map of the countries which he had conquered. Pliny says that Anaximenes was the first inventor of sun dials, but he probably made an error from the similarity of the names.

556 B. C.—Stesechorus the poet flourished.

549 B. C.—Theognis the poet flourished.

544 B. C.—Darius, the Mede, recoins the Lydian money into Darics.

536 B. C.—Thespis the inventor of tragedy flourished.

524 B. C.—Damocedes cured Darius of a dislocation of the foot which neither the physicians of Persia nor of Egypt could cure.

506 B. C.—Heraclitus of Ephesus lived. He was of opinion that the divine mind was disseminated throughout the universe, and that it reaches the body

principally by the lungs; he considered fire the principle of every thing, the intelligent divinity; the soul as an exhalation of fire; every thing is in motion, changing, and uncertain.

505 B. C.—Parmenides of Elea the philosopher lived.

500 B. C.—Alcmeon of Crotona died. He conceived that the head of the fœtus is first formed, and that the fœtus is nourished from without. He discovered the eustachian tubes.

497 B. C.—Pythagoras died. He was born at Samos about the year 540 B. C. He was first a pupil of Thales and then of Pherecydes of Syros, to whom the discovery of the heliotrope or instrument for measuring and determining the changes of the sun has been usually ascribed. Pythagoras travelled into Egypt, conversed with the priests, and examined the columns of Sothis or Thot, upon which were engraven the principles of geometry; he is then said to have penetrated to the Ganges where he saw the Brahmins or Gymnosophists of India; there it is supposed he obtained his doctrine of metempsychosis. On his return to his native country he became a prey to tyranny, and went to Italy where he founded his celebrated school; he made several great and important discoveries. He discovered that the square of the hypothenuse of a right angled triangle is equal to the squares of the two sides; he was so delighted with this discovery which constitutes the xlviii proposition of the first book of Euclid, that he made a sacrifice of a hecatomb to the Muses. The application which he gave to geometry originated several new theories, such as the incommensurability of certain lines; of the diagonal of the square compared

to the side, the theory of regular bodies which includes so many geometrical principles. Montucla conceives that Pythagoras had some idea of the revolution of the earth round the sun. Comets were considered by the Pythagoreans as stars which were as old as the universe, which revolve round the sun, and which only show themselves when they have arrived at a certain part of their orbit. The Pythagoreans thought the fixed stars were so many suns dispersed through the immensity of space, around which, planets similar to those of our sun revolve; they considered that these suns, like our planets, revolved round their own axis; they believed that all the planets were inhabited by animals not inferior in beauty and size to those of our earth. Pythagoras first reduced music to numbers, by ascertaining that the sound of a hammer on an anvil derived its quality from the weight of the hammer —he drew many important deductions from this fact. According to Pythagoras, number is the principal thing in science; the divinity is the sun—the vital power of nature of which the soul is an emanation. He considered that physiology ought to be founded on the laws of numbers; the brain is the seat of thought; he recommended vegetable diet, temperance, exercise of mind and body, and religious chanting.

486 B. C.—Æschylus the tragic poet died.

470 B. C.—Iccus of Tarentum recommended moderation in enjoyment. Sobriety became with him a proverb; he corrected the regimen of the Athletæ.

479 B. C.—Confucius the Chinese philosopher died.

460 B. C.—Temple of Æsculapius built at Rome.

440 B. C.—Herodicus (Prodicus) of Selymbria flourish-

ed, a sophist, gymnastist and physician, instituted medical gymnastics for improving health and curing diseases.

Idem.—Leucippus flourished. According to him the soul is a being of fire. Democritus afterwards developed his views stating that the soul which consists of fire is known obscurely by its sensible part; clearly by its rational part. He believed in fatalism.

Idem.—Melissus lived. He conceived that reason and experience were opposed to each other.

435 B. C.—Pindar the lyric poet died.

432 B. C.—Phidias the statuary died.

431 B. C.—Cratinus the comic poet lived.

430 B. C.—Zeno of Elis lived—found experience to be contradictory to itself.

430 B. C.—Hippocrates, the celebrated physician of Cos, flourished. He was born 446 years before Christ, and died 365 years before Christ, aged 95 years. He first distinguished himself by curing Perdiccas, King of Macedonia of a consumption occasioned by his unfortunate love for his mother-in-law, Phila. He visited Athens, and freed it from a great plague, by lighting fires in every town, and burning aromatics to purify the air. He is said to have practised medicine at Athens. The works of Hippocrates, were written on tablets of wax, as paper was unknown in his time. His work, *On the Nature of Man,* was authentic, according to Galen; he considered the animal body to consist not of one element, but of several: fire, air, earth and water, blood, phlegm, bile and black bile. Diseases proceed from the absence or superabundance of the four latter humours. The principle of life, according to him, was not fire as

Pythagoras thought, but integrant, the essence of which is superior to that of fire. "Man enjoys perfect health when the animal heat is intimately combined with the other elementary qualities." His writings show, that with the exception of osteology with which he was well acquainted, he was completely ignorant of anatomy, or had but a very superficial idea of the organization of man, the basis of scientific medicine. It is said he presented a skeleton to the Temple of Apollo, at Delphi. He has described the different forms of the bones of the head, in numerous individuals, with an account of the varieties in the direction of the sutures, diploe, and the vascular structure. He was ignorant of any difference between arteries and veins; he called all the blood vessels φλὲψ and ἀςτηςίη with him signified the trachea. He divided the blood vessels into four pairs: the first pair goes from the head on the two external sides of the vertebral column, and is distributed to the haunches and loins, and passes to the legs and feet; the second, (formed of the jugular veins) passes out near the ears, descends along the neck to the genital organs and soles of the feet; the third pair comes from the temples, and goes to the lungs; the fourth pair goes from the forehead and eyes, to the neck, clavicles, arms and fingers. It would appear, therefore, that he had never examined a dead body. He was totally ignorant of the uses of the nerves, and of the structure of the viscera. He considered the brain to be a white body, spongy, glandular, serving to attract the humours from all parts of the body. He states that the frothy matter passed in diarrhæa, comes from the head; and in his book on *Air, Water, and Localities*, he affirms that dysenteries in a moist winter, derive their origin from the same cause. He thought that the diaphagm and heart were the seats of passion and sensation. The dissolution of the body into its constituent parts, he considered the cause of death. His theory of generation is not worth noticing. He explained inflammation by ascribing it to a determination of blood into parts, where it had no access before. He ascribed the formation of calculi, to the accumulation of sandy particles. He fixed three principal periods of disease: crudeness, coction, and crisis. The crisis was marked by the state of the urine, especially in reference to sediment and cloudiness, by the stools, saliva and crust on the tongue. He derived no signs from the pulse, but appears to have been ignorant of its existence. He talks, however, of the beating of the vessels of the neck, violent, spasmodic, and perceptible to the eye. He established some good rules with regard to regimen and diet. He practised bleeding in acute diseases near the diseased part. He employed emetics; his purgatives were all of a violent or drastic kind: white hellebore, euphorbia peplus, thapsia asclepium, the flowers and seeds of carthamus tinctorius, daphne laureola; he used also alum, some preparations of copper, lead. He taught the art of bandaging, applied poultices to wounds, the trepan in cases of wounds of the head; he treated fractures by extension and counter extension, and bandages; he used complicated apparatus for reducing dislocations. It would appear, from the preceding sketch of the opinions of Hippocrates that he was comparatively ignorant as a physician, and could never have advanced medicine as a science, as he had no knowledge of anatomy and chemistry, which constitute physiology, the basis of medicine. Some modern physicians have assumed that a minute knowledge of anatomy is not necessary for the practise of medicine. This great error has undoubtedly originated from the absurd veneration for the writings of the Greeks and Latins.

428 B. C.—Anaxagoras of Clazomene died aged 72. He was a disciple of Thales; he believed in a superior intelligence, the unity of God (?); he believed in the eternity of the corpuscles of matter which by their accumulation constituted the ancient chaos. These corpuscles enjoyed some of them similar, others dissimilar properties; the divinity, the eternal and immaterial spirit, so re-united them that those of the same kind became united; this constituted his celebrated doctrine of *homéoméries*. According to Aristotle he first broached the doctrine of the immortality of the soul which he considered etherial or igneous. He appears to have dissected animals. He conceived that the bile, by penetrating into the lungs, the vessels and the pleura produced acute diseases. He considered the sun as a terrestrial mass in a state of inflammation; ascribed the permanence of the stars in their motions to their circular movement. Hence he appears to have had the first idea of the centrifugal force.

420 B. C.—Thessalus, Draco and Polybus established the first Dogmatic school which was also termed Hippocratic, as they followed the principles of the physician of Cos. Thessalus is said to have written a work on diseases. They introduced the physiology of Plato into medicine.

Idem.—Hippocrates of Cos the mathematician. We are indebted to him for the discovery of the quadration of the lunes or the spaces included between the arcs of two unequal circles; he was originally a merchant. He is said by Simplicius to have been expelled from a Pythagorean school because he charged money for teaching geometry. He first drew attention to the duplication of the cube, which requires the finding of two mean proportionals between the side of the given cube and the double of the same, the first of which two mean proportionals is the side of the double cube. It is often termed the Delian problem, from the circumstance that Hippocrates stated that a plague which raged at Athens would cease, when the altar of Apollo, which was a cube, should be doubled.

Idem.—Bryson and Antiphon flourished, and broached some ideas with regard to the quadrature of the circle which was termed by Aristotle paralogism.

Idem.—Meton and Euctemon flourished. They proposed their *enneadecateridis*, or cycle of nineteen years. This consisted of a period of nineteen lunar years, twelve of which were common or constituted of twelve lunations and the other seven of thirteen, which made in all 230 lunations; the intercalary years were the 3rd, 6th, 8th, 11th, 14th, 17th and 19th. This cycle was established in the year 433 before Christ, and is termed the Metonic cycle. Several imperfections in it were endeavoured to be corrected a century afterwards by Calippus.

Idem.—Empedocles, the Pythagorean flourished. He is said to have written poems upon the sphere, and other parts of physics. He considered light to be a body emanating continually from luminous bodies. He threw himself into Mount Etna, in order to be considered immortal.

Idem.—He believed in four elements, fire, air, water and earth. Fire is the principle of life; the changes in the body consist of the juxta position of the elements; the soul is a combination of the latter; its seat is in the blood; thought depends on organization.

Idem.—Timeus of Locris flourished. He wrote dialogues on the formation of the universe.

415 B. C.—Aristarchus, the tragic poet lived.

Idem.—Eupolis, the comic poet lived.

Idem.—Archytas and Philolaus lived. To them we are indebted for the method of finding two mean proportionals between two given lines, with a view to the duplication of the cube. He invented also the screw, crane and various hydraulic machines, and a winged pigeon or automaton. He was one of the first persons, who employed analysis, which was communicated to him by Plato.

Idem.—Herodotus, the father of history, flourished.

407 B. C.—Euripides, the tragic poet died, aged 78.

406 B. C.—Sophocles, the tragic poet died, aged 91.

Idem.—Plato, the comic poet, lived.

Idem.—Acron, the empirical physician lived.

404 B. C.—Democritus of Abdera, made researches on the brain, and wrote a book on the anatomy of the cameleon. He considered the embryo to be nourished by the cotyledons of the uterus. He appears to have been one of the principal promoters of the elementary doctrine of the contact of circles and spheres, and irrational lines and solids. He broached several ideas respecting perspective and optics. He wrote some works on astronomy, and proposed a new arrangement of the Greek calendar. He published *Ephemerides,* and a *Uranography,* or description of the constellations in the heavens. He considered that a vacuum was necessary for

motion, that all heavy bodies will fall into a vacuum with the same rapidity; that lightness is nothing but a less weight, and that light consists of an emanation of corpuscles from a luminous body. He taught that the milky way consisted of a number of small stars, each of which escapes the eye; but all united, occasion a greater brightness in the heavens.

Idem.—Œnopis of Chios lived. He combated the vulgar fallacy that figures, whose boundaries are equal, have equal capacities.

400 B. C.—Socrates, the philosopher flourished.

Idem.—Plato flourished. He invented geometrical analysis. This consists in taking for granted the thing to be proved, and then ascertaining how it may be proved. The second discovery of Plato, or of his school was, that of the conic sections. The figure of a cone must have been familiar to every person, at an early period, but no one had attempted to investigate the properties of such a figure, until the time of Plato. He ascertained that a cone may be cut in five different ways, giving origin to the parabola, hyperbola, and ellipse. The third discovery of the Platonic school, was that of geometrical loci or a series of points, each of which equally resolves a problem, capable from its nature of an infinity of solutions. These were divided into classes: *plane loci,* or simple lines, straight or circular; *solid,* included conic sections, while the curves of a higher order were termed *hypersolid* or simply linear. During the time of Plato, the problem of the duplication of the cube came into great notice. The pupils of Plato were: Archytas, Laodamas, Theactetus, Amyclas, Neoclis, Leon, Eudoxus, Theudius, Atheneus, Philosophus, Hermotimus, the two

Philips, Cratistus, Menechmus, and Dinostrates. Eudoxus particularly cultivated comic sections; Menechmus enlarged this branch of mathematics; his most remarkable solutions, are the two solutions of the problem of two mean proportionals. Dinostrates discovered the quadratrix.

Plato admitted three primitive beings: the creator, the form by which he created every thing, and the matter of which it is composed. From all eternity there has existed a matter destitute of properties and form, and composed only of elementary atoms, which wander through space without being confined to any regular movements. The elements were composed of matter, which was deposited in the form of different triangles over each other; those of the earth were rectangular, and those of the other elements irregular, because they may be reciprocally converted. The elementary figure of fire is a pyramid; that of air, is a dodecahedron; that of water, an icosahedron; and that of the earth, a hexahedron composed of rectangular triangles. This was quite in consonance with the doctrine of Plato, that knowledge comes to us by reason, and not by sense and in obedience to the dogma suspended over the door of his school. "Let no one enter here, who is ignorant of geometry." He conceived that the spinal marrow was first formed of small triangles similar to those of which fire consists. God sowed the soul in that portion of the marrow called brain; life consists of spirit and fire; and the heat of the blood is the source of this fire; the fire attenuates and dissolves the food; the red blood is the principal source of nutrition; nutrition takes place by the attraction of similar particles; the sense of taste is communicated by small veins, leading from the tongue to the heart, which is the seat of desire; sleep is the repose of the sensitive soul. Plato was unacquainted with the uses of the nerves, but considered them tendons. He particularly recommended exercise; he explained all the functions by the play of the physical elements of the body; all the passions exist in the liver; the spleen serves as an emunctory to the liver; on each side of the spinal marrow there are two principal vessels destined to carry away the superfluous humours of the head; the lungs throw out the most subtle parts of the body, the air and fire; the defect in the proportion between the physical elements of the body, is the proximate cause of all diseases; inflammation of the bile occasions most of the acute and inflammatory diseases; superabundance of fire causes continued fever, that of air quotidians, and that of water tertians.

ENGLISH IMPERIAL WEIGHTS AND MEASURES.

A cubic inch of distilled water at 62° F. weighs in vacuo 252.72 grs.; a cubic foot will therefore weigh 62.3862 lbs. avoird. In air a cubic inch weighs 252.458 grs. and a cubic foot 62.3206 ibs. An ounce of water =1.73298 cubic inches.

Imperial gallon=277.296 cubic inches or 10 lbs.

Standard avoirdupois pound=7.000 grains troy.

" . troy.pound=5.860 grains troy.

" gallon=10 lbs. avoird.=277.276 cubic inch

Standard quart=2.5 lbs. avoirdupois.
„ pint=1.25 lbs. avoird.=20 ounces distilled water.
„ peck=2 gallons.
„ bushel=8 gallons=80 lbs. avoird. of water.
„ 3 bushels=1 sack.
„ 12 sacks=1 chaldron.

From the experiments made by order of the government to determine the length of the pendulum vibrating seconds at London in a vacuum and reduced to the level of the sea, it was found that the distance from the axis of suspension to the centre of oscillation of such a pendulum is 39.1393 inches of the brass standard of 3 feet, made by Bird in 1760 and in the possession of the House of Commons, the distance between the centres of the gold pins at 62° being a yard, and that the length of a platinum metre at the temperature 32° F. supposed to be the 10,000,000th part of the quadrant of the meridian corresponds with 39.3708 inches ; its ratio to the imperial measure of 3 feet is as 1.09363 to 1, the logarithm .0388717.

Perch=16½ feet square.

Rood=1210 square yards.

Acre=4840 square yards=160 square perches, poles or roods.

The five standards are as follows in imperial measure:

General Lambton's scale used in India. . . .	35 99934
Sir George Schuckburgh's scale (identical with the imperial).	35.99998
General Roy's scale	36.00088
Royal Society standard	36.00135
Ramsden's bar	36.00249

SPECIFIC GRAVITY OF WATER AT DIFFERENT TEMPERATURES.

Water at 62° being unity

70°	0.99913	56°	1.00050	44°	1.00107
68°	0.99936	54°	1.00064	42°	1.00111
66°	0.99958	52°	1.00076	40°	1.00113
64°	0.99980	50°	1.00087	38°	1.00113
62°	1.00000	48°	1.00095		
58°	1.00035	46°	1.00102		

The difference of temperature between 62° and 39° where water attains its greatest density will vary the bulk of a gallon of water rather less than the third of a cubic inch, and assuming from the mean of numerous estimates the expansion of brass 0.00001044 for each degree of Fahrenheit, the difference of temperature from 62° to 39° will vary the contents of a brass gallon measure just one fifth of a cubic inch. The specific gravity of clear water from the Thames, exceeds that of distilled water in the proportion of 1.0006 to 1° making a difference of about one sixth of a cubic inch on a gallon. Rain water does not differ from distilled water so as to require any allowance for common purposes.

The weights and measures at present employed in Great Britain, were fixed by an act of parliament passed in the year 1824. In order to give stability to the system, certain constant quantities required to be selected, which might, by being at any time ready for reference, prevent the standard from being liable to alteration.

I.—MEASURES OF LENGTH.

Inches.	Feet.	Yards.	Poles or perches.	Furlongs.	Miles.
1	0.083	0.027	0.0505	0.00012626	0.00001578282
12	1	0.333	0.6060	0.001515	0.000189393
36	3	1	0.1818	0.004545	0.000568181
192	16.5	5.5	1	0.025	0.003125
7920	660	220	40	1	0.125
63360	5280	1760	320	8	1

II.—MEASURES OF SUPERFICIES.

Square inches.	Square feet.	Square yards	Square poles.	Roods.	Acres.
1	0.00694	0.0007715	0.0000255076	0.0000006377	0.0000001594
144	1	0.11	0.0036730945	0.0000918274	0.0000229568
1296	9	1	0.0330578512	0.0008264463	0.0002066116
39204	272.25	30.25	1	0.025	0.00625
1568160	10890	1210	40	1	0.25
6272640	43560	4840	160	4	1

III.—MEASURES OF CAPACITY.

Cubic inches.	Gills.	Pints.	Quarts.	Gallons.	Pecks.	Bushels.	Quarters.
8.6648076103	1	0.25	0.125	0.03125	0.015625	0.00390625	0.00048828125
34.6592304412	4	1	0.5	0.125	0.0625	0.015625	0.001953125
69.3184609825	8	2	1	0.25	0.125	0.03125	0.00390625
277.2738435700	32	8	4	1	0.5	0.125	0.015625
554.5476871400	64	16	8	2	1	0.25	0.03125
2218.1907485601	256	64	32	8	4	1	0.125
17751.2598848179	2048	512	256	64	32	8	1

1.—TROY WEIGHT.

Grains.	Pennyweights.	Oz.	lbs.
1	0.0416	0.00208.3	0.0001736.1
24	1	0.05	0.00416.
480	20	1	0.083.
5760	240	12	1

2.—APOTHECARIES' WEIGHT.

Grains.	℈	ʒ	℥	lb.
1	0.05	0.016	0.002083	0.00017361
20	1	0.33	0.0416	0.003472
60	3	1	0.125	0.010416
480	24	8	1	0.083
5760	288	96	12	1

3.—AVOIRDUPOIS WEIGHT.

Grains.	Dr.	Oz.	lb.	Qrs.	Cwt.	Tons.
27.34375	1	0.0625	0.00390625	0.0001395089	0.0000348772	0.00000174386
437.5	16	1	0.0625	0.002231428	0.000557857	0.0000278928
7000	256	16	1	0.35714285	0.0892857842	0.0044642857
196000	7168	448	28	1	0.25	0.0125
784000	28672	1792	112	4	1	0.05
15680000	473440	35840	2240	80	20	1

ENGLISH AND CONTINENTAL MEASURES.

LONG MEASURE.

The English Imperial yard is equal to

443.295936	Old Paris lines.
1.173487	Vienna ell.
1.097608	Bavarian ell.
1.456756	Danish ell.
0.761986	French ell.
1.595836	Hamburg ell.
1.617487	Leipzig ell.
0.914383	Lombardy metro.
0.914383	Netherland ell.
1.371015	Prussian ell.
1.285169	Russian arschin.
1.540055	Swedish ell.

The English Foot is equivalent to

135.114160	Old Paris lines.
0 964227	Vienna foot.
1,044320	Bavarian foot.
0.971170	Danish foot.
0.304794	French metre.
1.063891	Hamburg foot.
1.078325	Leipzig foot.
0.304794	Lombardy metro.
3.047944	Netherland palm.
0.971136	Prussian foot.
1.000845	Russian foot.
1.026804	Swedish foot.

DRY MEASURE.

The Imperial Quarter is equal to

14654.368	Paris old cubic inches.
4.726706	Vienna metzen.
1.307307	Bavarian scheffel.
2.089600	Danish tonne.
0.290689	French kilolitre.
2.758728	Hamburg scheffel.
2.705754	Leipzig scheffel.
2.906891	Lombardy soma.
2.906891	Netherland mudde.
5.288968	Prussian scheffel.
1.494115	Russian tschetwert.
1.984063	Swedish tonne.

LIQUID MEASURE

Imperial Standard Gallon is equal to

228.9745	Old Paris cubic inches
0.078289	Vienna eimer
0.070812	Bavarian schänk-eimer
0.030333	Danish ahm.
0.004542	French kilolitre.
0.031366	Hamburg ahm.
0.059876	Leipzig eimer.
0.045420	Lombardy soma.
0.045420	Netherland vat
0.066112	Prussian eimer.
0.357772	Russian wedro
0.028910	Swedish ahm.
0.036138	„ tonne.

WEIGHTS.

Imperial Standard Troy Pound is equal to

0.666417	Vienna pound.
0.666432	Bavarian pound.
0.747409	Danish pound.
0.822857	English avoird. pound.
0.373202	French kilogramme.
0.770502	Hamburg pound.
0.798382	Leipzig pound.
0.373202	Lombardy libbra.
0.373202	Netherland pound.
0.797932	Prussian pound.
0.912487	Russian pound.
0.881153	Swedish pound.

Imperial Standard Avoirdupois Pound equivalent to

0.809882	Vienna pound.
0.809900	Bavarian pound.
0.908310	Danish pound.
1.215277	English troy pound.
0.453544	French kilogramme.
0.936374	Hamburg pound.
0.970255	Leipzig pound.
0.453544	Lombardy libbra.
0.453544	Netherland pound.
0.969709	Prussian pound.
1.108926	Russian pound.
1.070846	Swedish vict. pound.

VALUE OF AN ENGLISH POUND STERLING.

Vienna.

9 florins, 31 kr. 3.24 pf.

France.

24 francs, 74.688 centimes.

Hanover.

5 reichsthaler, 25 mark groschen, 6.812 pfennig.

States of the Church.

4 scudi, 6 paoli, 2 bajocchi.

Modena.

24 lire, 74.688 centes. Italiani, or 64 lire, 9 soldi, 8.695 denari di Modena.

Naples.

5 ducati, 82 grani, 5.217 cavalli.

Netherlands.

11 gulden, 58.868 cents.

North America.

4 dollars, 44⅘ cents.

Norway.

4 species-thaler, 2 ort. 0.924 schilling.

Oldenburg.

7 reichsthaler, 44 grot. 4.687 schwar.

Parma.

100 lire, 4 soldi, 5.99 denari.

Poland.

41 gulden, 9.226 groschen.

Portugal.

4112.725 rees. or 4 millerees 112.725 rees.

Prussia.

6 thaler, 20 silver groschen, 1.601 pfennig.

Russia.

6 rubel, 19.613 copecs of silver.

Saxony.

6 thalers, 8 groschen, 5.791 pfennig.

Sardinia.

13 lire, 3 soldi, 1.03 denari.

Sweden.

4 reichsthaler, 16 skilling, 9.378 rundstücke.

Switzerland.

16.922 Swiss pounds.

Sicily.

5 ducati, 82 barocchi, 5.216 piccoli.

Spain.

92 reales, 23 maravedis, 2.456 dineros.

Tuscany.

29 lire, 9 soldi, 2 542 denari.

Turkey.

36 piastres, 8.585 paras.

EUROPEAN WEIGHTS.

GERMAN, GEWICHT SYSTEM—FRENCH, POIDS.

Aarau.

	English pounds.
Pound...........................	1.276492 troy
,, ...	1.050370 avoir.

Alessandria.

	English pounds.
Libbra	0.988761 troy
„	0.813609 avoir.

Alicant.

Libbra major	1.389325 troy
„ „	1.143216 avoir.
Libbra minor	0.926216 troy
„ „	0.762144 avoir.
Libbra castellana	1.234955 troy
„ „	1.016192 avoir.

Altenburg.

Pound	1.249969 troy
„	1.028546 avoir.

Altona.

Pound	1.297854 troy
„	1.067949 avoir.

Ancona.

Pound	0.886302 troy
„	0.729300 avoir.

Appenzel.

Pound	1.566036 troy
„	1.288624 avoir.

Barcelona.

•Pound	1.095907 troy
„	0.901775 avoir.

Basle.

Pound	1.311639 troy
„	1.079291 avoir.

Berlin.	English pounds.
Pound........................	1.253238 troy
„	1.031236 avoir.
Berne.	
Pound........................	1.393695 troy
„	1.146812 avoir.
Bilboa.	
Pound........................	1.312460 troy
„	1.079967 avoir.
Bologna.	
Libbra........................	0.970340 troy
„	0.798451 avoir.
Botzen.	
Pound........................	1.342331 troy
„	1.104547 avoir.
Brunswick.	
Pound........................	1.252217 troy
„	1.030395 avoir.
Bremen.	
Pound........................	1.335737 troy
„	1.099121 avoir.
Bukarest.	
Pound........................	3.453839 troy
„	2.844016 avoir.
Cadiz.	
Occa........................	1.234955 troy
„	1.016192 avoir.

Cagliari.

	English pounds.
Lira	1.074117 troy
"	0.883845 avoir.
Candia.	
Rottel	1.504548 troy
"	1.238028 avoir.
Carlsruhe.	
Pound	1.339756 troy
"	1.102428 avoir.
Cassel.	
Pound	1.297008 troy
"	1.067252 avoir.
Coburg.	
Pound	1.365764 troy
"	1.123828 avoir.
Cologne.	
56304 Mark	0.639599 troy
" "	0.526299 avoir.
Constantinople.	
Rottel	1.709135 troy
"	1.406374 avoir.
Cantar	200.538620 troy
"	165.014636 avoir.
Copenhagen.	
Pound	1.337954 troy
"	1.100945 avoir.
Corunna.	
Pound	1.539620 troy
"	1.266880 avoir.

Cracow.

	English pounds.
Pound	1.087362 troy
"	.894743 avoir.
Stone	34.795592 troy
"	28.631801 avoir.

Darmstadt.

Pound	1.339756 troy
"	1.102628 avoir.

Dieppe.

Weight for herrings (16664 *inhab.*)	40.192708 troy
" " "	33.072857 avoir.

Ferrara.

Lira	0.908929 troy
"	0.747919 avoir.

Florence.

Pound	0.909735 troy
"	0.748582 avoir.

Frankfort.

Heavy pound	1.353987 troy
" "	1.114138 avoir.
Light pound	1.253691 troy
" "	1.031609 avoir.

Freyburg.

Pound	1.416488 troy
"	1.165567 avoir.

Fulda.

Pound	1.367463 troy
"	1.125226 avoir.

Geneva.

	English pounds.
Great pound....................	1.475715 troy
„	1.204303 avoir.
Small pound	1.229762 troy
„	1.011919 avoir.

Genoa.

Peso grosso libbra..................	0.934694 troy
„ „	0.769120 avoir.
Libbra for gold and silver.........	0.849727 troy
„ „ „	0.699204 avoir.
Libbra for silk..................	0.919228 troy
„ „	0.756394 avoir.

Glarus.

Krämer pound	1.412591 troy
„ „	1.162360 avoir.
Silk pound....................	1.255650 troy
„ „	1.033220 avoir.

Gotha.

Pound.........................	1.249967 troy
„	1.028546 avoir.

Hague.

Pound.........................	2.679513 troy
„	2.204857 avoir.

Hamburg.

Pound.........................	1.297854 troy
„	1.067949 avoir.

Hanau.

Pound.........................	1.252417 troy
„	1.030560 avoid.

Hanover.

	English pounds.
Pound..................	1.311896 troy
„	1.079503 avoir.

Hildesheim.

Pound..................	1.250872 troy
„	1.029289 avoir.

Lausanne.

Pound..................	1.362106 troy
„	1.120819 avoir.
Mark..................	0.655819 troy
„	0.539645 avoir

La Valetta.

Lira..................	0.848420 troy
„	0.698128 avoir.

Leipzig.

Pound..................	1.252533 troy
„	1.030655 avoir.

Lemberg.

Pound..................	1.125419 troy
„	0.926059 avoir.

Lisbon.

Libbra..................	1.229805 troy
„	1.011954 avoir.

Lübeck.

Pound..................	1.295078 troy
„	1.065664 avoir.

Lucca.

	English pounds.
Pound..	0.997247 troy
,,	0.820592 avoir.

Lucerne.

Pound	1.337774 troy
,,	1.100797 avoir.

Lünenberg.

Pound	1.310657 troy
,,	1.078483 avoir.

Madrid.

Libbra	1.234896 troy
,,	1.016143 avoir.

Mahon.

Rottel	1.125989 troy
,,	0.926528 avoir.

Meiningin (4500 inhabitants.)

Pound	1.365711 troy
,,	1.123785 avoir.

Messina.

Cassico	29.251650 troy
,,	24.069929 avoir.
Rotolo grosso	2.340132 troy
,,	1.925594 avoir.
Rotolo sottile	2.127440 troy
,,	1.750579 avoir.
Libbra	0.851027 troy
,,	0.700273 avoir.

Milan.

	English pounds.
Libbra metrica..................	2.679513 troy
" "	2.204857 avoir.
Libbra peso grosso.............	2.018253 troy
" "	1.660733 avoir.
Libbra peso sottile...........	0.862821 troy
" "	0.709979 avoir.

Modena.

Commercial pound............	0.911409 troy
"	0.749960 avoir.

Munich.

Pound.........................	1.500527 troy
"	1.234720 avoir.

Naples.

Rotolo........................	2.387457 troy
"	1.964536 avoir.
Libbra........................	0.860123 troy
"	0.707759 avoir.

Neufchâtel.

Pound.........................	1.393648 troy
"	1.146774 avoir.

Nice.

Pound.........................	0.830772 troy
"	0.683607 avoir.

Osnaburg.

Pound.........................	1.323535 troy
"	1.089080 avoir.

Oviedo.

Libbra major..................	1.852362 troy
"	1.524229 avoir.

Palma.

	English pounds.
Rotolo	1.125991 troy
„	0.926529 avoir.

Paris.

Kilogramme	2.679513 troy
„	2.204857 avoir.

Parma.

Lira	0.874675 troy
„	0.719732 avoir.

Patras.

Commercial pound	1.070658 troy
„	0.880999 avoir.
Silk pound	1.338323 troy
„	1.101248 avoir.

Petersburg.

Pound	1.095905 troy
„	0.901773 avoir.
Pud	43.836204 troy
„	36.070933 avoir.

Pisa.

Pound	0.909807 troy
„	0.748641 avoir.

Prague.

Pound	1.378219 troy
„	1.134077 avoir.

Ragusa.

Pound	0.973290 troy
„	0.800879 avoir.

Rome.

	English pounds.
Lira	0.908963 troy
„	0.747947 avoir.

Rostock (15303 inhabitants.)

Pound	1.362662 troy
„	1.121284 avoir.

St. Gall.

Heavy pound	1.566033 troy
„	1.288622 avoir.
Light pound	1.246027 troy.
„	1.025302 avoir.

Schafhausen.

Heavy pound	1.540648 troy
„	1.267733 avoir.
Light pound	1.232539 troy
„	1.014203 avoir.

Soleure.

Pound	1.390469 troy
„	1.144157 avoir.

Stockholm.

Victualien pfund	1.134876 troy
„	0.933840 avoir.
Mark of staple towns	0.911257 troy
„ „	0.749834 avoir.
Mark of the mines	1.007060 troy
„ „	0.828666 avoir.
Mark of country towns	0.959148 troy
„ „	0.789241 avoir.

Trent (10704 inhabitants.)

	English pounds.
Pound	1.508302 troy
„	1.241117 avoir.

Valentia.

Pound	0.956058 troy
„	0.786699 avoir.

Venice.

Libbra grossa	1.278124 troy
„	1.051713 avoir.
Libbra sottile	0.807149 troy
„	0.664168 avoir.

Vienna.

Commercial pound	1.500559 troy
„	1.234746 avoir.
Gold and silver pound	1.535039 troy
„ „	1.263118 avoir.

Warsaw.

Funt	1.086553 troy
„	0,894078 avoir.

Wiesbaden.

Pound	1.261210 troy
„	1.037796 avoir.

Zürich.

Heavy pound	1.412591 troy
„	1.162360 avoir.
Light pound for silk	1,255650 troy
„ „	1.033220 avoir.

EUROPEAN MEASURES OF LENGTH.

Aarau (Switzerland 3500 *inhabitants.)*

	English imp. meas.
Elle..............................	0.656235 yard

Alessandria (Sardinia 35000.)

Raso..............................	0.659689 yard
Common foot......................	1.123494 feet
Foot (*Limprandische*).............	1.605300

Alicant (Spain 17400.)

Vara..............................	0.823180 yard

Altenburg (Saxony 10160.)

Elle..............................	0.943646 feet

Altona (Holstein 23400.)

Elle..............................	0.626630 yard
Foot..............................	0.939945 feet

Ancona (States of the Church 17358.)

Braccio...........................	0.702615 yard
Foot..............................	1.281878 feet

Appenzell (Switzerland 3000.)

Linen elle........................	0.876789 yard
Woollen elle......................	0.673751
Foot..............................	1.032460 feet

Barcelona (Spain 130000.)

Varra.............................	0.864697 yard
Canna.............................	5.188184 feet

Basle (Switzerland 16215)

Large elle........................	1.289280 yard
Small elle........................	0.595052
Foot..............................	0.978364 feet

Berlin (*Prussia* 220000.)

	English imp. mea.
Ell.	0.729386 yard
Foot..	1.029721 feet

Berne (*Switzerland* 17552.)

Ell	0.593325 yard
Foot	0.962369 feet

Bilboa (*Spain* 15000.)

Vara........................	0.930561 yard

Bologna (*States of the Church* 65287.)

Braccio........................	0.705568 yard
Foot........................	1.244773 foot

Botzen (*Tyrol* 6863.)

Ell	0.864454 yard
Braccio	0.601219
Foot	1.096214 foot

Bremen (378001.)

Ell	0.632557 yard
Foot	0.948836 foot

Brunswick (*Germany* 37360.)

Ell........................	0.624158 yard
Foot........................	0.936237 foot

Bukarest (*Wallachia* 60000.)

Silk ell, or *halibiu*	0.766944 yard
Linen ell, or *Endese*	0.724336

Cadiz (*Spain* 70000.)

Vara	0 927357 yard
Foot, or pies........................	0.927362 foot

H

Cagliari (*Sardinia* 35000.)

	English imp. mea.
Ell, or raso	0 600721 yard
Palmo	0.772032 foot

Canea (*Candia* 9000)

Ell, or *pick*	0.696941 yard

Carlsruhe (*Germany* 17396.)

Ell	0.656235 yard
Foot	0.984352 foot

Cassel (25801.)

Ell	0.623811 yard
Foot	0.943911 foot

Clausenburg (20000)

Ell	0.681728 yard

Coburg (8154)

Ell	0.641185 yard

Constantinople (597800)

Ell, or small pik	0.708532 yard
Large pik	0.731717
Kanevas pik	0 905407
Endrezeh	0.701875

Copenhagen (101000.)

Ell, or aln	0.686456 yard
Foot	1.029677 foot

Corunna (11000)

Elle, or vara	0.925629 yard

Coethen (5560.)

Ell	0.695461 yard

Cracow (24756 *inhab.*)

	English imp. mea.
Ell, or Lokiec	.674738 yard
Foot, or Stopa	1.169381 foot

Darmstadt (19982).

Ell	0.656179 yard
Foot	0.820224 foot

Dresden (28151.)

Ell	0.619564 yard

Ferrara (23600.)

Silk braccio	0.697681 yard
Woollen do	0.738387
Foot	1.316664 foot

Florence (79300.)

Braccio, or ell	0.649814 yard

Frankfort (48900.)

Ell	0.598523 yard
Brabant ell	0.767025
Frankfort foot	0.933743 foot
For French goods	1.292674

Freyburg (6000.)

Stab	1.169751 yard
Foot	0.962149 foot

Fulda (9153.)

Ell	0.618733 yard
Foot	0.928500 foot

	English imp. meas.
Geneva (31370 *inhab.*)	
Small ell	1.250788 yard
Large ditto	1.299723
Foot.	1.600868
Genoa (80240.)	
Palmo	0.273222 yard
Canna	8.196670 foot
Gera (*Russia* 7373)	
Ell	0.610841 yard
Glarus (4150.)	
Ell	8.656235 yard
Foot	0.984352 foot
Gotha (12760.)	
Ell	0.943645 foot
Hague (43980.)	
Ell	1.093633 yard
Palm	0.328089 foot
Hamburg (110000.)	
Hamburg ell	0.626630 yard
Brabant ditto	0.756148
Hamburg foot	0.939945 foot
Rheinland ditto	1.029720
Hanau (9634.)	
Ell	0.594717 yard
Brabant ell	0.759746
Hanau foot	0.935712 foot
Hanover (22702.)	
Ell	0.638659 yard
Foot	0.957989 foot

Hildesheim (*Hanover* 12630 *inhab.*)

	English imp. meas.
Ell	0.612806 yard
Foot	0.919219 foot

Lausanne (10900.)

Ell	1.176782 yard
Foot	0.962149 foot

La Valletta (30000.)

Ell, or Canne	2.275236 yard

Lugano (8000.)

Braccio lungo	0.742420 yard
„ piccolo	0.575644

Leipzig (42000.)

Ell	0.618242 yard
Brabant ell	0.749795
Foot	0.927363 foot

Lemberg (53595.)

Ell	0.649542 yard
Foot	0.974313 foot

Lemgo (3450.)

Ell	0.629045 yard
Foot	0.943565 foot

Lisbon (240000.)

Vasa	1.195275 yard
Foot	0.717165 foot

Lubeck (32600.)

Ell	0.631070 yard
Foot	0.954748 foot

Lucca (29370 *inhab.*)

	English imp. meas.
Braccio	0.650806 yard
Foot	1.935428 foot

Lucerne (6055.)

Ell	0.688306 yard
Foot	1.032460 foot

Madrid (168000.)

Vara	0.927357 yard
Pies	0.927362 foot

Mahon (2080.)

Canna	1.876437 yard
Palma	0.703664 foot

Milan (129800)

Metro	1.093633 yard
Ell	0.650642

Messina (44658.)

Canna	2.311174 yard
Foot	0.794141 foot

Modena (20,000.)

Braccio	0.708772 yard
Foot	1.698560 foot

Munich (70000.)

Ell	0.911007 yard
Foot	0.957560 foot

Naples (351754.)

Canna	2.306865 yard
Palmo	0.864943 foot

Neufchatel (5600 *inhab.*)

	English imp. meas.
Ell	1.232524 yard
Foot	0.984335 foot
Nice (21000.)	
Raso	0.599310 yard
Palmo	0.869438 foot
Oldenburg (5836.)	
Ell	0.635265 yard
Foot	0.972507 foot
Osnaburg (10927.)	
Ell	0.657962 yard
Foot	0.916262 foot
Oviedo (7500.)	
Vara	0.955980 yard
Palma (29600.)	
Canna	1.875697 yard
Paris (894000.)	
Aune	1.312359 yard
Metre	3.280899 foot
Pied	1.065765
Toise	6.394592
Parma (30180.)	
Silk braccio	0.650066 yard
Linen do.	0.704091
Braccio di legno	1.778739 foot
Patras (3000.)	
Woollen pick	0.749729 yard
Silk do.	0.694719

Petersburg (570000 *inhab.*)

	English imp. meas.
Arschin	0.778107 yard
Foot	0.992155 foot
Saschen	7.002966

Pisa (20000.)

Brasse	0.638272 yard
Passeto	3.829636 feet
Canna	9.574090

Prague (104675.)

Ell	0.649578 yard
Foot	0.972453 feet

Ragusa (15400.)

Ell	0.561253 yard

Rome (128300.)

Canna	2.188961 yard
Wood canna	7.327137 foot

St. Gall (8900.)

Woollen ell	0.688548 yard
Linen do	0.803820
Stab	1.289428 foot
Woollen ell	0.662402 yard
Linen do	0.799324
Foot	1.032460 foot

Schaffhausen (6830.)

Ell	0.651367 yard

Soleure (4500.)

Ell	0.595792 yard

	English imp. meas.
Stockholm (72137 *inhab.*)	
Ell	0.649327 yard
Foot	0.973894 foot
Trieste (40530.)	
Woollen ell	0.740114 yard
Silk do.	0.702122
Valencia (106000.)	
Vara	1.004581 yard
Palmo	0.753436 foot
Vienna (298102.)	
Ell	0.852160 yard
Foot	1.037099 foot
Venice (109927.)	
Silk braccio	0.698175 yard
Woollen do.	0.744743
Foot	1.140882 foot
Warsaw (128052.)	
Ell	0.629932 yard
Foot	0.944898 foot
Weimar (8957.)	
Ell	0.616762 yard
Foot	0.925143 foot
Wiesbaden (6300.)	
Ell	0.607510 yard
Foot	0.944386 foot
Zurich (10533.)	
Ell	0.656234 yard
Foot	0.984351 foot

EUROPEAN MEASURES OF CAPACITY.

(GERMAN: GETREIDE MASS.—FRENCH: MESURES DE CAPACITÉ.)

	English imp. meas.
Aarau.	
Viertel	0.076905 quar.
Saum	31.706587 gall.
Alessandria.	
Sacco	0.395446 quar.
Caro	124.205970 gall.
Alicant.	
Cahiz	0.847534 quar.
Tonnelada	237.581599 gall.
Altenburg.	
Malter	0.483746 quar.
Eimer	14.936090 gall.
Altona.	
Tonne	0.478560 quar.
Ahm	31.881508 gall.
Ancona.	
Rubbio	0.939250 quar.
Soma	15.091088 gall.
Appenzel.	
Mütt	0.314309 quar.
Eimer	9.223734 gall.
Barcelona.	
Salma	0.935418 quar.
Carga	24.042152 gall.

Basle.

	English imp. meas.
Sack........	0.444918 quar.
Saum.................	32.335478 gall.

Berlin.

Scheffel....................	0.189072 quar.
Oxhoft.....	15.125821 gall.

Berne.

Mütt.....	0.578390 quar.
Landfass......................	220.606767 gall.

Bilboa.

Fanega	0.206970 quar.
Cantara.....	3.467635 gall.

Bologna.

Corba....	0.253851 quar.
Liquid do	16.246433 gall.

Bordeaux (93000 *inhabitants.*)

Hogshead	50.211174 gall.

Botzen.

Kornstar........................	0.105189 quar.
Yhren.........................	9.782748 gall.

Brunswick.

Wispel.......	1.067944 quar.
Fuder.......	4.856202 gall.

Bremen.

Last...	0.244680 quar.
Ahm.......	31.436464 gall.

Buckarest.	English imp. meas.
Dimerli............................	0.084625 quar.
Viadra............................	3.115380 gall.
Cadiz.	
Cahiz............................	0.196598 quar.
Cagliari.	
Restiere............................	0.505859 quar.
Candia.	
Carga............................	0.524075 quar.
Old tun............................	19.670312 gall.
Carlsruhe.	
Zuber............................	0.516015 quar.
Ohm............................	33.024964 gall.
Cassel.	
Vientel............................	0.551712 quar.
Ohm............................	35.085129 gall.
Clausenburg.	
Kübel............................	0.338502 quar.
Eimer, or Ur............................	2.492304 gall.
Coburg.	
Simra............................	0.301889 quar.
Constantinople.	
Fortin............................	0.483135 quar.
Alma............................	1.109303 gall.
Copenhagen.	
Last............................	0.478560 quar.
Fass, or Stuck............................	32.966553 gall.
Bier tonne............................	28.928985

Corunna.

	English imp. meas.
Fanega	0.218637 quar.
Moyo	29.474897 gall.

Cöthen.

Scheffel	0.182982 quar.

Cracow.

Last	0.413153 quar.
Beczka	30.060989 gall.

Darmstadt.

Malter	0.440332 quar.
Ohm	35.226629 gall.

Dresden.

Eimer	12.986658 gall.

Ferrara.

Moggio	2.079925 quar.
Mastello	18.028208 gall.

Ferrol.

Fanega	0.244842

Florence.

Sacco	0.244432 quar.
Barillo	9.171252 gall.

Frankfort.

Malter	0.394689 quar.
Ohm	31.575741 gall.
Wein Stück	254.184719 quar.

Freiburg.

Sack	0.054932 quar.
Fass	8.603578 gall.

Fulda.

Malter	0.604237 quar.
Ohm	32.175298 gall.

Geneva.

	English imp. meas.
Coupe, or Sack..	0.267158 quar.
Char or Fuder.....	120.747726 gall.

Genoa.

Mina	0.401562 quar.
Mezzarola.....................	32.685028 gall.
Barillo for oil....................	14.237502

Glarus.

Mütt	0.282509 quar.
Do rough	0.286494
Malter..........................	1.150245
Eimer	23.504800 gall.

Gotha.

Malter........................ .	0.602823 quar.
Eimer	14.936090 gall.

Hague.

Mudde	0.344010 quar.
Vat	22.016643 gall.

Hamburg.

Scheffel	0.362485 quar.
Ahm	31.881508 gall.

Hanau.

Malter.......	0.420455 quar.
Ohm	33.725638 gall.
Small do......................	28.335243

Hanover.

Last......	0.641992 quar.
Fuder	34.239620 gall.

Hildesheim.

Fuder	0.178370 quar.

Lausanne.

	English imp. meas.
Viertel	0.047221 quar.
Muid	0.544854
Char	102.386947 gall.

La Valetta.

Salma	0.916382 quar.

Leipzig.

Winspel	0.369582 quar.
Fuder	16.700986 gall.

Lemberg.

Korzec	0.423127 quar.

Lemgo.

Malter	0.124718 quar.
Ohm	34.290281 quar.

Lisbon.

Moyo	0.185882 quar.
Tonnelada	191.672459 gall.

Lubeck.

Last	0.114914 quar.
Haben scheffel	0.136341
Fuder	31.881279 gall.

Lucca.

Stajo	0.084304 quar.

Lucerne.

Malter	0.478219 quar.
Saum	38.047904 gall.

Lugano.

Star	0.068034 quar.

Lunenburg.

Winspel	4.279952 quar.

Madrid.

	English imp. meas.
Cahiz	0.196598 quar.
Cantaro or arroba major	3.467635 gall.
Arroba minor	2.707606

Mahon.

Quartera	0.248185 quar.
Carga	22.255753 gall.

Milan.

Some	0.344010 quar.
Moggio	0.503060
Liquid some	22.016643 gall.

Malaga (42100 *inhabitants.*)

Fanega	0.208538 quar.
Arroba	78.017421 gall.

Marseilles.

Millerolle for oil and wine	13.145568 gall.
Ditto of oil manufacturers	14.09051
Escandeau for oil	3.286392

Messina.

Salma grossa	1.184639 quar.
Salma generales	0.952216
Wine Salma	19.286139 gall.

Modena.

Stajo	0.241634 quar.

Munich.

Scheffel	0.764931 quar.
Schänkeimer	14.121807 gall.
Bier eimer	15.063261

Naples.

Tomolo	0.190010 quar.
Barile	9.604016 gall.

Neufchatel.

	English imp. meas.
Muid	56.982595 gall.

Nice.

Sacco	0.397538 quar.

Odenburg (11969 *inhabitants.*)

Ung ako	15.414632 galls.

Oldenburg.

Tonne	0.613127 quar.
Last	8.402682 gall.

Osnaburg.

Last	0.098741 quar.
Ahm	30.081075 gall.
Fuder	29.006751

Oviedo.

Fanega	0.262108 quar.
Cantaro	4.044017 gall.

Palma.

Quartera	0.248185 quar.
Carga	22.255753 gall.

Paris.

Kilolitre	3.440100 quar. 220.166434 gall.

Parma.

Staro, or Stago	0.176876 quar.

Patras.

Staro	0.282511 quar.
Bachel	0.102972

Petersburg.

Tschetwert	0.669292 quar.
Wedro	2.795071 gall.

Pisa.

	English imp. meas.
Stajo	0.083810 quar.
Barile da vino	10.036075 gall.
Barile da olio	7.359923

Prague.

Strich	0.322000 quar.

Pressburg (35135 *inhabitants.*)

Wine eimer	0.183507 quar.
Eimer	11.744481 gall.

Rome.

Rubbio	0.919325 quar.
Rubbio (haber maas)	0.846921
Botta	90.183835 gall.
Wine barilo	10.020426
Oil ditto	11.693127

Rostock.

Korn	0.133785 quar.
Ahm	31.881279 gall.

Santander (19100 *inhabitants.*)

Fanega	0.189431 quar.

St. Gall.

Mütt	0.261791 quar.
Eimer	11.250258 gall.

Schaffhausen.

Malter	1.402121 quar.
Streaked Malter	0.621982
Eimer trüben sinn	9.840309 gall.
Eimer lautern sinn	9.261467

Soleure.

Doppelmass	0.091119 quar.
Saum	35.083964 gall.

Stockholm.

	English imp. meas.
Tonne..............................	0.504016 quar.
Tonne roggen........	0.567066
Tonne mallz............ ,....	0.598524
Tonne sallz...........	0.535539
Ahm.........	34.589291 gall.
Oil tonne.........................	27,671398

Stuttgart.

Scheffel...........................	0.609675
Eimer..............................	64.712818 gall.

Temeswar.

Small cseber....	9.175376 gall.
Large ditto.......................	18.350752

Tokay.

Weinfass..........................	32.297315 gall.
Small ditto..........	16.148662

Trieste.

Staro..........	0.254872 quar.
Orne..	14 455758 gall.

Valentia.

Cahiz.............................	0.687648 quar.
Wine carga...................	37.536175 gall.

Venice.

Stajo..............................	0.291927 quar.
Biconzia..........	34.920377 gall.

Vienna.

Metzen........	0 211563 quar.
Wine eimer..	12.773061 gall.

Warsaw.

	English imp. meas.
Corzec	0.440332 quar.
Beczka	22.016643 gall.

Weimar.

Scheffel	0.264767 quar.
Eimer	16.138207 gall.

Wiesbaden.

Malter	0.376305 quar.
Ohm	29.848791 gall.

Zug (2000 *inhabitants.*)

Mütt	0.308886 quar.
Malter	1.241484

Zürich

Mütt	0.214270 quar.
Eimer	24.108224 gall.

RUSSIAN WEIGHTS AND MEASURES.

The Russian commission for weights and measures have finished their labours, the result of which was published by an imperial order, 11th October 1836. From this it appears, that an English cubic inch of distilled water weighs in vacuo 368.261 doli, at the temperature of 62°, of which 9216 go to form the coined pound of 1747. A Russian coined pound of distilled water at 62° therefore is equal to 25.019 (more correctly 25.018935) English cubic inches. The Russian measures at 62° F. are as follow.

A Stoof 3lb of distilled water =		75.056805	Eng. cubic in.
A Wedro 30lb	”	750.56805	”
A Garnez 8lb	”	200.15148	”
A Tschetwerik 64lb	”	1601.21185	”
A Tschetwert 512lb	”	12809.69480	”

The *Archin* and *Saschen* remain respectively equal to 24 and 84 English cubic inches.

When reduced to their weight in air, Paucher has calculated the following :—

	Specific Gravity.	Eng. cubic inch distilled water.
Counterpoise of cast iron	7.142	367.9721 doli.
English troy pound............	8.	367.9653 ”
Common pound of Petersburg and Constantinople	8.33	367.9631 ”
Brass pound of Petersburg......	8.351	367.9629 ”
Pound of the Petersburg commission	8.50	367.9620 ”
Pound of Platinum	20.666	367.9307 ”

MEDICINAL WEIGHTS OF EUROPE AND NORTH AMERICA.

In most of the countries of Europe the weights used by apothecaries are divided into pounds, ounces, drachms, scruples and grains. Athough the terms are the same in most instances the value of the weights differs considerably in each country. This will be best exhibited in a tabular form.

England.	Bavaria.	Bologna.	Sardinia.	Germany.
1grain	1.04gr.	1.38gr.	1.46gr.	1.04gr.
5 ,,	5.18 ,,	6.88 ,,	7.29 ,,	5.21 ,,
10 ,,	10.37 ,,	13.75 ,,	14.57 ,,	10.43 ,,
19 ,,	19.70 ,,	1sc. 2.13 ,,	1sc. 3.68 ,,	19.82 ,,
1scruple	1sc. 0.73 ,,	1 ,, 3.50 ,,	1 ,, 5.14 ,,	1sc. 0.86 ,,
1drachm	1dr. 0 ,, 2.20 ,,	1dr. 0 ,, 10.51 ,,	1dr. 0 ,, 15.42 ,,	1dr. 0 ,, 2.58 ,,
1ounce	1oz. 0 ,, 0 ,, 17.60 ,,	1oz. 1 ,, 0 ,, 12.08 ,,	1oz. 1 ,, 2 ,, 3.37 ,,	1oz. 0 ,, 1 ,, 0.60 ,,
12oz. or 1lb.	12 ,, 3 ,, 1 ,, 11.23 ,,	13 ,, 6 ,, 0 ,, 0.93 ,,	14 ,, 4 ,, 1 ,, 16.40 ,,	12 ,, 4 ,, 0 ,, 7.22 ,,

England.	France.	Lubeck.	Modena.	Netherlands.
1grain	0.0648gram.	1 34gr.	1 32gr.	1gr.
3 ,,	0.1944 ,,	3.03 ,,	3.95 ,,	2.99 ,,
19 ,,	1.2310 ,,	19.21 ,,	1sc. 0.99 ,,	18.91 ,,
1scruple	1.2958 ,,	1sc. 0.22 ,,	1 ,, 2.31 ,,	19.90 ,,
1drachm	3 8875 ,,	1dr. 0 ,, 0.66 ,,	1dr. 0 ,, 6.92 ,,	2sc. 19.71 ,,
1ounce	31.1002 ,,	1oz. 0 ,, 0 ,, 5.30 ,,	1oz. 0 ,, 2 ,, 7.40 ,,	7dr. 2 ,, 17.70 ,,
1pound	373.2020 ,,	12 ,, 1 ,, 0 ,, 3.60 ,,	13 ,, 1 ,, 0 ,, 16.80 ,,	11oz. 7 ,, 1 ,, 12.38 ,,

England.	Austria.	Poland.	Portugal.
1grain	0.89gr.	1.04gr.	1.80gr.
1scruple	17.77 ,,	1sc. 0·82 ,,	0ou. 1sc. 2.02 ,,
1drachm	2sc. 13.31 ,,	1dr. 0 ,, 2.46 ,,	1 ,, 0 ,, 6.07 ,,
1ounce	7dr. 0 ,, 6.51 ,,	1oz. 0 ,, 0 ,, 19.67 ,,	1oz. 0 ,, 2 ,, 0.55 ,,
1pound	10oz. 5 ,, 0 ,, 18.09 ,,	12 ,, 3 ,, 2 ,, 16.04 ,,	13 ,, 0 ,, 0 ,, 6.62 ,,

England.	Prussia.	Rome.	Sweden.
1grain	1.06gr.	1.32 ,,	1.05gr.
1scruple	1 ,, 1.28 ,,	1sc. 2.42 ,,	1sc. 0.95 ,,
1drachm	1dr. 0 ,, 3.83 ,,	1dr. 0 ,, 7.25 ,,	1dr. 0 ,, 2.86 ,,
1ounce	1oz. 0 ,, 1 ,, 10.68 ,,	1oz. 0 ,, 2 ,, 9.98 ,,	1oz. 0 ,, 1 ,, 2.87 ,,
1pound	12 ,, 6 ,, 0 ,, 8.12 ,,	13 ,, 1 ,, 1 ,, 23.72 ,,	12 ,, 4 ,, 1 ,, 14.48 ,,

England.	Sicily.	Spain.	Tuscany.
1grain	1.45gr.	0ob 0car 1.30gr	1.32gr.
1scruple	1sc. 9.09 ,,	1sc 0 ,, 0 ,, 1.96 ,,	1sc. 2.38 ,,
1drachm	1dr. 1 ,, 7.26 ,,	1dr 0 ,, 0 ,, 1 ,, 1.87 ,,	1dr. 0 ,, 7.14 ,,
1ounce	1oz. 1 ,, 1 ,, 18.09 ,,	1oz 0 ,, 1 ,, 1 ,, 2 ,, 2.96 ,,	1oz. 0 ,, 2 ,, 9.10 ,,
1pound	13 ,, 9 ,, 1 ,, 17.11 ,,	12 ,, 7 ,, 2 ,, 0 ,, 2 ,, 3.46 ,,	13 ,, 1 ,, 1 ,, 13.21 ,,

England.	Turin.	Turkey.	Venice.
1grain	1.35gr.	0kill 1.29gr.	1.24gr.
1scruple	1sc. 2.98 ,,	6 ,, 1.82 ,,	1sc. 4.78 ,,
1drachm	1dr. 0 ,, 8.94 ,,	1dr. 3 ,, 1.47 ,,	1dr. 0 ,, 14.34 ,,
1ounce	1oz. 0 ,, 2 ,, 23.56 ,,	9 ,, 10 ,, 3.73 ,,	1oz. 1 ,, 2 ,, 14.69 ,,
1pound	13 ,, 3 ,, 2 ,, 18,71 ,,	116 ,, 3 ,, 0.78 ,,	14 ,, 6 ,, 2 ,, 16.23 ,,

TABLES

OF THE

COINS OF DIFFERENT COUNTRIES.

N.B.—IN THE FOLLOWING TABLES THE FRANC IS CONSIDERED EQUIVALENT TO 9·53 PENCE ENGLISH.

ALGIERS.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, Sequin Soultany....		8.71	0	6	11
Silver, Zoudi boudjou.. ..		3.72	0	2	11½

AUSTRIA AND BOHEMIA.

Gold, Mark of Cologne = 20 guldens..		50.55	2	0	0
Ducat of the Emperor	53,9	11.86	0	9	5
Ducat of Hungary. ..	53,9	11.90	0	9	5½
Half sovereign..... .	85,94	17.58	0	13	11½
Quarter sovereign. ..	42,97	8.79	0	6	11¾
Silver, crown or rix dollar of the convention of 1753..............	433,25	5.19,50	0	4	1½
Half rix dollar or florin or gulden..........	216,625	2.59,75	0	2	0¾
Twenty kreutzers. ..	103,16	.86,50	0	0	8¼
Ten kreutzers.......	60,18	.43,25	0	0	4⅛

BADEN.

Gold, piece of 2 florins. ..	104,98	21.04	0	16	8½
1 florin....	52,49	10.52	0	8	4¼
Silver, piece of 2 florins..	392,91	4.18	0	3	3¾
1 florin....	196,45	2.09	0	1	7¾½

BATAVIA.

	weight in grs. troy	value in fr. cts.	English value £	s	d
30 doits = 1 schilling		0.53	0	0	5
4 schillings = 1 florin		2.11	0	1	8
4 cash = 1 mace. ..		.75	0	0	7
6 mace = 1 pataca..		4.53	0	3	7

BAVARIA.

Gold, Ducat..	53,87	11.85	0	9	5
Carolin	150,34	25.66	1	0	4½
Maximilian.........	100,29	17.18	0	13	7¾
Silver, crown...........	453,51	5.66	0	4	5¾
Rix dollar of 1800. ..	424,74	5.10	0	4	0½
Kopfstuck..........	102,55	0.86	0	0	6¾.
Florin or gulden			0	1	8½

BELGIUM.

Gold, double sovereign. ..	170,558	34.88,5	1	7	8½
Sovereign..........	85,279	17.36,0	0	13	9⅛
Silver, ducaton..........	514,13	6.33,5	0	4	11
Half ducaton........	257,065	3.16,2	0	2	5½
Crown of Brabant. ..	455,90	5.61,8	0	4	5½
Half crown.........	227,95	2.80,9	0	2	2¾
Double esculin......	152,52	1.23,5	0	0	11¾

BENCOOLEN.

12 Satellees or 4 succos = 1 dollar...............		6.32	0	5	0

BENGAL.

12 pice 1 anna, 16 annas or 1 rupee currency......		2.11	0	1	8
16 annas or 1 sicca rupee.		2.47	0	1	11
16 sicca rupees or 1 gold mohur..............		41.39	1	12	9

K

BOMBAY.

	weight in grs. troy	value in fr. cts.	English value £ s d
Rupee..................		·2.32	0 1 10
Gold mohur or 15 rupees.		36.65	1 9 0

CAPE OF GOOD HOPE.

6 stivers = 1 skillin; 8 skillins = 1 rix dollar ..		1.90	0 1 6

CEYLON, JAVA AND MALACCA.

24 doits or 6 stivers = 1 skillin....		0.26	0 0 2½
8 skillins or 12 fanams = 1 rixdollar or rupee....		2.21	0 1 9

CHINA.

10 cash=1 kandareen, or 10 ditto=1 mace..		0.85	0 0 8
10 mace=100 kandareens or 1000 cash=1 tale. ..		8.48	0 6 9
1 dollar=72 kandareens or 2½ current rupees......		6.11	0 4 10

DENMARK AND HOLSTEIN.

Gold, current ducat since 1767....	48,52	9.47	0 7 6¼
Species since 1791 to 1802..	54,32	11.86	0 9 5
Christian since 1773.	103,97	20.95	0 16 7½
Silver, rix dollar of 96 schellings since 1776	449,66	5.66	0 4 5¾
Rix dollar or piece of 6 marks..........	41,37	4.96	0 3 11¼
Danish mark of 16 schellings 1776. ..		0.94	0 0 9

ENGLAND.

	weight in grs. troy	value in fr. cts.	English value £ s d
Gold, guinea of 21 shillings	129,4382	26.47	
Half guinea.........	64,719	13.23,50	
Sovereign since 1818 of 20 shillings.. ..	123,274	25.20,80	
Half sovereign..	61,637	12.60,40	
Silver, crown of 5 shillings	464,295	6.16	
Old shilling....	92,859	1.23,80	
Crown since 1818. ..	436,3636	5.80,72	
Shilling since 1818 ..	87,2727	1.16,14	

EGYPT.

Gold, Sequin....	40,13	6.71	0	5	4¼
Karat...					
Silver, Grouch or piastre of 40 paras............	44,77	0.30	0	0	2¾

FRANCE.

Piece of 40 francs.......	199,09	40	1	11	9¼
,, 20 francs.......	99,545	20	0	15	10½½
,, 5 francs........			0	3	11½
100 cents or 1 franc.... ..		1	0	0	9½¼
25 sous or 126 cents.		1.26			

GREECE.

Silver, Phenix(Capod'Istria)	69.100	6.90	0	0	8½
5 drachmas (Otho) ..	34.457	4.48	0	3	6½
1 decalepta or 10 lepta		0.10	0	0	1
1 pendalepta or 5 ,,		.5	0	0	0½

HAMBURG.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Ducat *ad legem imperii.* ..	53,89	11.86	0	9	5
New city ducat..........	53,85	11.76	0	9	4
Mark banco (imaginary) ..		1.88	0	1	5¾
Mark or 16 schellings according to the convention of Lubeck........	141,48	1.53	0	1	2½
Rix dollar or crown.	451,31	5.78	0	4	7

HESSE DARMSTADT.

Gold, Ducat (ad legem Imperii)...........	53,88	11.85	0	9	5
Carolin	150,39	25.87	1	0	6½
10 new florins..	104,19				
Silver, Kopfstuck........					
Florins of Mayence..					
New crown (kronenthaler..	455,42	5.71	0	4	6½
Piece of 6 kreutzers..	37,51	0.18	0	0	1¾
„ 3 „ ..	21,39	0.09	0	0	0¾½
„ 1 „ ..	9,17	0.03	0	0	0¼

HANOVER.

Gold, Ducat of George I. 1724............	53,29	11.89	0	9	5¼
Ducat ad *leg imper.* ..	53,89	11.85	0	9	4¾
4 Florins of George II	200,57	34.95	1	7	9
Silver, Crown or florin of George II.......	201.71	2.90	0	2	3½
Crown of Hanover or rixthaler..	450.99	5.70	0	4	6¼

HOLLAND.

	weight in grs. troy	value in fr cts.	English vaue £	s	d
Gold, ducat	54,21	11.93	0	9	5¾
Ryder..........	154,19	31.65	1	5	1½
20 florins 1808......	210,86	43.14	1	14	3¼
10 florins 1808......	105,43				
10 florins of William 1818..	103,88	20.85,99	0	16	6¾
Silver, florin of 100 cents.	166,20	2.13,62	0	1	8¼
Piece of 25 cents....	65,30	0.53,40	0	0	5
Copper, 1 cent..	59,35				
Silver, escalin or piece of 6 sous...........	76,81	0.64	0	0	6
Ducaton or ryder....	502,81	6.85	0	5	5¼
Ducat or rix dollar..	435,81	5.48	0	4	4¼

JAMAICA.

12 pence currency..		0.76	0	0	7¼
20 shillings „		15.38	0	12	2½

JAPAN.

(BY APPROXIMATION).

Gold, old kobang of 100 mace..		51.24	2	0	8¼
Half kobang of 50 mace..		25.62	1	0	4⅛
New kobang of 100 mace...		32 69	1	5	11½
Half ditto of 50 mace.		16.34,50	0	12	11¾
Silver, tigo-gin or piece of 40 mace..........		14.40	0	11	5¼
Half ditto or piece of 20 mace..........		7.20	0	5	8½
Quarter ditto or piece of 10 mace.		3.60	0	2	10¼
Eighth of ditto or piece of 5 mace...		1.80	0	1	5⅛

(LOMBARDY VENETIAN).

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, sovereign since 1823	174,94	35.13	1	7	10¾
Half ditto or 20 pounds of Austria........	87,47	17.56	0	13	11¼⅛
Silver, crown of 6 pounds of Austria........	401,17	5 20	0	4	1½
Half crown or 1 florin.	200,58	2.60	0	2	0¾
Pound of Austria....	66,86	0.86,6	0	0	8¼

MADRAS.

12 pice=1 anna; 16 annas =1 rupee...........		2.32	0	1	10
36 pice or 3 annas.......		.42	0	4	0
80 cash or 8 doodies=1 faram................		.21	0	3	2
45 farams=1 pagoda.....		9.48	0	7	6

MALTA.

Gold, Double Louis.......	255.83	48.12	1	18	2½
Silver, Crown or oz. of 30 tarins............	458.24	5.49	0	4	4¼
Scudo..............		2.11	0	1	8

MAURITIUS.

dollar=100 cents 10 livres or 5 francs......		5.27	0	4	2
1 livre=2 sols..........		0.25	0		2¼

MOCHA.

80 cavears=1 dollar or piastre............		4.42	0	3	6
100 Spanish dollars=121 piastres...............					

MOGUL.

(BY APPROXIMATION).

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, mogul rupee.......		38.72	1	10	9
Half ditto...		19.36	0	15	4½
Quarter ditto.......		9.68	0	7	8¼
Pagoda (cross)......		9.46	0	7	6⅛
,, (star).		9.35	0	7	5
Ducat of the Dutch company.		11.62	0	9	2¾
Half ditto..		5.81	0	4	7¼⅛
Silver, mogul rupee.....		2 42	0	1	11
Rupee of Madras....		2.40	0	1	10¾
,, Arcot.....		2.36	0	1	10½
,, Pondicherry		2.42	0	1	11
Double fanon of India		0.63	0	0	6
Fanon..............		0.31,50	0	0	3
Piece of the Dutch company.........		2.40	0	1	10¾

NAPLES.

Gold, new oz. of 3 ducats since 1818.......	58,45	12.99	0	10	3¾
Quintuple of 15 ducats since 1818........	292,26	64.95	2	11	6¾⅛
Decuple of 30 ducats since 1818........	584,52	192.90	5	3	1¾⅛
Silver, 12 carlins of 120 grs. since 1804.....	425,04	5.10	0	4	0½
Ducat of 10 carlins of 100 grs. 1784.....	354,22	4.25	0	3	4½
2 carlins 1804.	70,84	0.85	0	0	8
1 carlin 1804.......	35,42	0.42,5	0	0	4
Ducat of 10 carlins 1818..	354,19	4.25	0	3	4½

PARMA.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, sequin.............	53,538	11.95	0	9	5¾
Pistole of 1784......	115,75	23.01	0	18	3¼
,, 1786 to 1791	11,024	21.91,50	0	17	4¾
40 lire of Marie Louise 1815.............	199,19	40	1	11	9¼
20 ditto 1815...	95,595	20	0	15	10½⅛
Silver, ducat 1784 to 1796	396,86	5.18	0	4	1¼
Piece of 3 livres 1790.	56,68	0.68	0	0	6½
,, 1 livre 10 sols 1790...	28,34	0.34	0	0	3¼
5 lire of Marie Louise 1815..	385,95	5.	0	3	11½

PERSIA.

(BY APPROXIMATION.)

			£	s	d
Gold, rupee............		36.75	1	9	2¼
Half rupee..........		18.37,50	0	14	7⅛
Silver, double rupee of 5 abassis...........		4.90	0	3	10½
Rupee of 1½ abassis.		2.246	0	1	11¼
Abassi..		0.97	0	0	9¼
Mamoudi..		0 48.50	0	0	4½
Larin............		1.03	0	0	9¾⅛

PORTUGAL.

			£	s	d
1000 reas or 1 milrea.. ..		6.11	0	4	10½
100 ,, 1 testoon....		0.61	0	0	5¾
20 ,, 1 vintem....		0.12	0	0	1¼
8 dobras or 12,800 reas or 1 joe..		91.	3	12	0

PRUSSIA.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, ducat..............	53,89	11.77	0	9	4⅛
Frederick....	103,26	20.80	0	16	6¼
Half Frederick......	51,63	10.40	0	8	3⅛
Silver, rix dollar or dollar of 30 silver groschen 1823..	34 3,39	3.71,11	0	2	11¼
Piece of 5 silver groschen....	57,30	0.61,85	0	0	5¾
Silver groschen	33,84	0.10	0	0	1

RAGUSA.

Gold, neant....					
Silver, talaro or ragusine..	453,87	3.90	0	3	1
Half talaro..	226,935	1.95	0	1	7½
Ducat..	210,97	1.37	0	1	3
12 grossettes	63,91	0.41	0	0	3¾
6 grossettes....	31,955	0.20,50	0	0	1¾½¼

RUSSIA.

Gold, ducat from 1755 to 1763............	53.95	11.79	0	9	4¼
Ducat of 1763..	53.60	11.59	0	9	2½
Imperial of 10 roubles 1755 to 1763......	256,03	52.38	2	1	7
Half imperial of 5 roubles 1755 to 1763..	128,015	26.19	1	0	9½
Imperial of 10 roubles 1763.............	47,44	41.29	0	12	9½
Half imperial of 5 roubles 1763.........	100,81	20.64,50	0	16	4¾
Silver, rouble of 100 copecks 1750 to 1762	399,37	4.61	0	3	7¾
Ditto of 1763 to 1807	370,68	4.0	0	3	2⅛
Paper rouble........		1.5	0	0	10

SARDINIA.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, carlin, 1768....... ..	247,87	49.33	1	19	$2\frac{1}{8}$
Half carlin..........	123,935	24.66,50	0	19	$7\frac{1}{16}$
Pistole.	140,76	28.45	1	2	$7\frac{3}{4}\frac{1}{2}$
Half pistole.........	70,38	14.22,50	0	11	$3\frac{1}{2}$
Silver, crown, 1768, or scudo.	36,42	4.70	0	3	$8\frac{3}{4}$
Half crown.	18,21	2.35	0	1	$10\frac{1}{4}\frac{1}{2}$
Quarter of a crown or a pound.	91,04	1,17,50	0	0	$11\frac{1}{8}$
New crown 5 pounds.	385,95	5.0	0	3	$11\frac{1}{2}$
Soldo..............		10	0	0	1

SAVOY AND PIEDMONT.

Gold, sequin..	53,53	11.95	0	9	$5\frac{3}{4}$
Double new pistole of 24 livres.	148,51	30	1	3	$9\frac{3}{4}$
Half new pistole of 12 livres............	74,255	15	0	11	$10\frac{3}{4}$
Carlin since 1755....	742,56	150.	5	19	$1\frac{1}{2}$
Half ditto...	371,28	75	2	19	$6\frac{3}{4}$
New pistole of 20 liv. 1816..	99,59	20	0	15	$10\frac{1}{2}$
Silver, crown of 6 livres 1755...	542,14	7.07	0	5	$7\frac{1}{4}$
Half ditto...	271,07	3.53,50	0	2	$9\frac{1}{2}\frac{1}{4}$
Quarter ditto or 30 sous.	135,535	176,75	0	1	$4\frac{3}{4}$
Half ditto or 15 sous.	67,767	0.88,37	0	0	$8\frac{1}{4}\frac{1}{2}$
New crown of 5 livres 1816..	385,95	5.	0	3	$11\frac{1}{2}$
Gold, sequin of Genoa	53,83	12.01	0	9	$6\frac{1}{2}$

SAXONY.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, ducat.............	53,89	11.86	0	9	5
Double augustus of 10 thalers...........	206,64	41.49	1	12	11¼
Augustus or 5 thalers	103,32	20.74,50	0	16	5½¼
Half ditto...........	51,66	10.37,25	0	8	2¾
Silver, rixthaler since 1763	433,25	5.19,50	0	4	1¼½
Half ditto or florin ..	216,625	2 59,75	0	2	0½½
Thaler of 24 groschen	imaginary	3.89,63	0	3	1⅛
Groschen or 1/32 of rixthaler or 1/24 of thaler	30,694	0.16,21	0	0	1½

SICILY.

Gold, ounce since 1748. ..	67,91	13.73	0	10	10¾
Crown of 12 tarins ..	425,05	5.10	0	4	0½

SOUTH AMERICAN STATES.

1 dollar or 8 reales......		5.48	0	4	4¼
1 peseta column.		1.37	0	1	1
1 real plate „		0.68	0	0	6½

SPAIN.

Gold, Pistole or doubloon of 8 crowns 1772 to 1786.............	417,51	83.93	3	6	7¾
Ditto of 4 doubloons.	208,755	41 96,50	1	13	3¾½
Ditto of 2 doubloons.	104,377	20.98,25	1	16	7¾½
Half pistole or crown.	52,188	10.49,12	0	8	3¾½

	weight in grs. troy	value in fr. cts.	English value £	s	d
Pistole or doubloon of 8 crowns 1786.. ..	417,51	81.51	3	4	8¾
Ditto or doubloon of 4 crowns.	208,755	40.75,50	1	12	4$\frac{11}{42}$
Ditto or doubloon of 2 crowns.	104,377	20.37,75	0	16	2⅛
Half pistole or crown.	52,188	10.18,87	0	8	1$\frac{1}{16}$
Silver, piastre 1772..	417,51	5.43	0	4	3¾
Real of 2 or pesetta or ⅕ of the piastre. ..	92,17	1.08	0	0	10¼
Real of 1 or half pesetta or $\frac{1}{10}$ of a piastre.	46,185	0.54	0	0	5⅛
Reallillo or real of Veillon or $\frac{1}{20}$ of a piastre.	23,542	0.27	0	0	2½

STATES OF THE CHURCH.

Gold, pistole of Pius VI and Pius VII.... .	84,46	17.27,50	0	13	8½
Half ditto....	42,23	8.63,75	0	6	10¼
Sequin 1769 Clement XIV and his successors..............	52,89	11.80	0	9	4½
Half ditto....	26,445	5.90	0	4	8¼
Silver, crown or scudo of 10 paoli or 100 bajocchi............	408,03	5.38,50	0	4	3¼
$\frac{3}{10}$ of a crown or teston of 30 bajocchi.	122,45	1.60	0	1	3½
⅕ of a crown or papeto of 20 bajocchi..	81,606	1.08	0	0	10¼
$\frac{1}{10}$ of a crown or paoli of 10 bajocchi.. ..	40,803	0.54	0	0	5⅛

SWEDEN.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, ducat.	53,75	11.70	0	9	3½
Half ducat..........	26,87,5	5.85	0	4	7¾
Quarter ducat..	13,43,7	2.92,50	0	2	3⅛
Silver, rix dollar of 48 schellings 1720 to 1810.	455.54	5.75,73	0	4	6¾
⅔ of a ditto or double plotte of 32 schellings	215,19,6	3.83,82	0	3	0½
⅓ of a ditto or 16 schellings	107,59,8	1.91,91	0	1	6¼
12 ores or 1 shilling..		.4	0	0	0½

SWISS CONFEDERATIONS.

BASLE.

Gold, old ducat..........	52.48	10.74	0	8	6¼
Pistole..	118.08	23.47	0	18	7½
Florin	47.2	7.63	0	6	0¾
Silver, Crown of 30 batz .	361.03	4.56	0	3	6½
Crown of 40 batz....	455.11	5.90	0	4	8¼

BERNE.

Gold, ducat..	53 29	11 64	0	9	2¾
Pistole....	118.06	23.76	0	18	10½
Silver, crown...........	455.11	5.90	0	4	8¼
4 franken of 1799....	453.41	5.88	0	4	8

GENEVA.

Gold, old pistole 1722	104.54	21.13	0	16	9¼
3 new pistoles..	264.03	53.84	2	2	9
Silver, patagon of 3 pounds current in 1721.. ..	420.65	5.17	0	4	1¼
Great crown.......	469.03	5.86	0	4	7¾

SOLEURE.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Silver, crown of 40 batz 1798............	455.11	5.90	0	4	8¼

REPUBLIC OF SWITZERLAND.

Gold, 32 franken 1804....	236.15	47.63	1	17	9¾
16 „ „	118.07	23.81	0	18	10¾
Silver, 4 franken..	463.89	6.	0	4	9⅛
2 „	231.94	3.	0	2	4¼
1 franc..	115.97	1.5	0	1	2⅛

ZURICH.

Gold, ducat.............	53.89	11.77	0	6	4⅛
Silver, crown 1761	431.32	5.08	0	4	0½
Crown 1781........	386.83	4.70	0	3	8¾
Half crown or florin .	193.41	2.35	0	1	10¼½

SAVOY.

12 pice=1 kabean; 40 kabeans=1 rupee......		2.21	0	1	9
44 kabeans=sicca rupee..		2.42	0	1	11

TUSCANY.

Gold, ruspone or 3 sequins	161,54	36.1	0	8	8½
⅓ of ditto...........	153,846	12.00	0	9	6¼
Half sequin..	26,923	16.01,33	0	4	9¼
Sequin with the figure	53,846	12.04	0	9	6¾
Rosine...	107,692	12.57	0	17	1½
Half a rosine.......	53,846	10.7	0	8	6¾

	weight in gre. troy	value in fr. cts.	English value £	s	d
Francescone of 10 paoli...........	424,65	5.61,67	0	4	5½
Piece of 5 paoli.....	212,325	2.80,50	0	2	2¾
Ditto of 2 paoli.....	84,93	1.12,20	0	0	10¾
Ditto of 1 paoli.....	42,465	0.56,10	0	0	5¼½

TURKEY.

Gold, Sequin zermahboub of the Sultan Abdoul Hamet 1774.......	40,78	8.72	0	6	11
Nisfie or ½ a zermahboub...........	20,39	4.36	0	3	5½
Robebbie or ¼ sequin fondonkli........	13,60	2.43,33	0	1	11⅛
Sequin zermahboub of Selim III.........	40,78	7.30	0	5	9½
Half of ditto........	20,39	3.65	0	2	10¾
Quarter of ditto.....	10,195	1.82,50	0	1	5¼½
Silver, altmichlec of 60 paras 1771..........	444,95	3.52	0	2	9½
Yaremlec of 20 paras 1757.............		0.99	0	0	9½
Roubh of 10 paras 1757.............		0.49,50	0	0	4¾¾
Para of 3 aspres 1773.		0.04	0	0	0⅙
Aspre, 23 to the piastre...............		0.01,33	0	0	0⅕
Piastre of 40 paras 1811.............	278,11	2.	0	1	7
Piece of 5 piastres of Mahmoud 1811...		4.13,67	0	3	3½

UNITED STATES OF AMERICA.

	weight in grs. troy	value in fr. cts.	English value £	s	d
Gold, double eagle of 10 dollars...........	269,85	55.21	2	3	$10\frac{1}{8}\frac{1}{4}$
Eagle of 10 dollars..	134,925	27.60,50	1	1	$11\frac{1}{16}$
Half an eagle of $2\frac{1}{2}$ dollars...........	67,462	13.80,25	0	10	$11\frac{1}{2}$
Silver, dollar.............	416,82	5.42	0	4	$3\frac{1}{2}$
Half a dollar.........	208,40	2.71	0	2	$1\frac{3}{4}$
Quarter dollar.......	104,205	1.35,50	0	1	$9\frac{5}{8}$

WARSAW.

			£	s	d
30 groschen=1 florin....		0.63	0	0	6
8 florins=1 rixdollar...		5.6	0	4	0
18 „ =1 ducat........		11.37	0	9	0

ENGLISH COPPER COINS.

Denomination of Coin.	Number of pieces per Pound Avoirdupois.	Value of One Pound.	Number of Pieces in a Ton.
Pence	24	2*s*.	53,760
Half-pence	48	2*s*.	107,520
Farthings	96	2*s*.	215,040
$\frac{1}{2}$ Farthings	192	2*s*.	430,080
$\frac{1}{3}$ Farthings	288	2*s*.	645,120

Value of 1 Ton of Coined Copper, £224.

N.B.—For this and the two following Tables, the Editor is indebted to Mr. Mushet of the Royal Mint.

ENGLISH SILVER COINS.

Number of Pieces in the Pound Troy.		Standard Weight of each Piece.			Fine Silver in each Piece.			Alloy in each Piece.		
		dwt.	gr.		dwt.	gr.		dwt.	gr.	
792	Pence	..	7	,2727	..	6	7272	..	..	,5455
396	2 Pences	..	14	,5454	..	13	4545	.	1	,0909
264	3 Pences	..	21	,8181	..	20	1818	..	1	,6363
198	4 Pences	1	5	,0909	1	2	9090	..	2	,1819
132	6 Pences	1	19	,6363	1	16	3636	..	3	,2727
66	Shillings	3	15	,2727	3	8	7272	..	6	,5455
26 & 1 Shilling	½ Crowns	9	2	,1818	8	9	8181	..	16	,3637
13 & 1 Shilling	Crowns	18	4	,3636	16	19	6363	1	8	,7273

BRITISH STANDARD OF SILVER.

Oz.	dwt.		
11	2	Fine Silver	per Pound Troy.
	18	Alloy	

N.B.—The assays of silver are reported in pennyweights—the lowest report being ½ pennyweight.

ENGLISH GOLD COINS.

Number of pieces in the Troy pound.		Standard Weight of each Piece.				Fine Gold in each piece.				Alloy in each piece.			
		Oz.	dwt.	gr.		Oz.	dwt.	gr.		Oz.	dwt.	gr.	
$93\frac{9}{20}$	$\frac{1}{2}$ Sovereign	..	2	13	,637	..	2	8	,500	..	..	5	,137
$46\frac{1}{2}\frac{9}{40}$	sovereigns	..	5	3	,274	..	4	17	,001	..	.	10	,273
$23\frac{1}{4}\frac{9}{80}$	£2 pieces	..	10	6	,548	..	9	10	,003	.	.	20	,545
$9\frac{69}{200}$	£5 ,,	1	5	16	,372	1	3	13	,008	..	2	3	,364
178	guineas	..	1	8	3595	.	1	5	6629				
$133\frac{1}{2}$	$\frac{1}{3}$,,	..	1	19	1460	..	1	15	5505				
89	$\frac{1}{2}$,,	..	2	16	7190	..	2	11	3258				
$44\frac{1}{2}$	guineas	..	5	9	4382	..	4	22	6516				
$22\frac{1}{4}$	2 guineas	..	10	18	8764	..	9	21	3034				
$8\frac{1}{2}$	5 guineas	1	6	23	1910	1	4	17	2584				

GOLD STANDARD.

22 Carats, or $\frac{11}{12}$ fine gold } per Pound Troy.
2 ,, ,, $\frac{1}{12}$ alloy }

N.B.—The assays of gold are reported in carats and carat grains.—The lowest being $\frac{1}{8}$ of a carat grain=$7\frac{1}{2}$ troy grains.

TABLE

OF THE

SPECIFIC GRAVITIES AND ATOMIC WEIGHTS OF SIMPLE BODIES.

	Symbols.	Specific Gravity.	British atomic wts.	Continental atomic wts.	Discoverers.
Oxygen	O	1,1111	1,	1,	Priestley & Scheele 1774
Chlorine	Cl	2,5	4,5	2,213	Scheele 1774
Bromine	Br	2,96	10,	4,891	Balard 1826
Iodine	I	8,716	15,75	7,904	Courtois 1811
Fluorine	F		1,25	1,169	
Hydrogen	H	0,0694	,125	,0623	Cavendish 1766
Azote	Az or N	,9722	1,75	,885	Rutherford 1772
Carbon	C	3,5	,75	,764	Long known
Boron	B	,183	1,	1,362	Crell 1800
Silicon	Si	Si O 2,65	1,	2,773	Davy 1808
Phosphorus	Ph	1,7481	2,	1,961	Brandt 1669
Sulphur	S	2,	2,	2,011	Long known
Selenium	Se	4,3	5,	4,945	Berzelius 1818
Tellurium	Te	6,115	4,	8,017	Muller 1782
Arsenic	As	5,672	4,75	4,700	Ancients
Antimony	Sb	6,436	8,	8,064	ib.
Chromium	Cr	5,09	4,	3,518	Vauquelin 1797

Substances.	Symbols.	Specific gravity.	British atomic wts.	Continental atomic wts.	Discoverers.
Uranium	U	7,5	26,	27,113	Klaproth 1789
Molybdenum	Mo	8,62	6,	5,985	Scheele 1778
Tungsten.	Tg	17,4	12,5	11,830	Scheele 1781
Columbium.	Cm	5,61	22,75	11,537	Hatchet 1801
Titanium	Ti	5,3	3,25	3,036	Gregor 1781
Vanadium	V		8,5	8,558	Sefström 1830
Potassium	K	,86507	5,	4,899	Ancients
Sodium.	N	,97223	3,	2,908	Duhamel 1736
Lithium	L		0,75	,803	Arfwedson 1818
Barium	Ba	Ba O 4,	8,5	8,568	Scheele 1774
Strontium	Sr		5,5	5,472	Crawford 1790
Calcium	Ca	Ca O 3,08	2,5	2,560	Ancients
Magnesium	Mg	Mg O 2,3	1,5	1,583	Valentini 1707
Aluminum	Al	Al O 4,2	1,25	1,711	Margraaf 1754
Glucinum	G	G O 2,976	2,25	3,312	Vauquelin 1798
Yttrium	Y	Y O 4,842	4,5	4,025	Gadolin 1794
Cerium.	Ce		5,5	5,747	Klaproth 1804
Zirconium	Z	Z O 4,3	2,75	4,202	ib. 1789
Thorium	Th		7,5	7,449	Berzelius 1828
Iron	Fe	7,843	3,5	3,392	Ancients
Manganese	Mn	8,013	3,5	3,458	Kaim 1770
Nickel.	Nk	8,279	3,25	3,696	Cronstedt 1751
Cobalt	Co	8,5384	3,25	3,689	Brandt 1733
Zinc	Zn	6,861	4,25	4,032	Early known in the east

Cadmium	Cd	8,604	7,	6,967	Stromeyer 1817
Lead	Pb	11,3523	13,	12,945	Early known
Tin	Sn	7,285	7,25	7,352	Early known
Copper	Cu	8,953	4,	3,957	ib.
Bismuth	Bi	9,822	9,	8,869	Germans
Mercury	Hg	13,568	12,5	12,658	Early known
Silver	Ag	10,474	13,75	13,516	ib.
Gold	Au	19,3	12,5	12,430	ib.
Platinum	Pt	21,47	12,	12,335	Wood 1741
Palladium	Pd	11,718	6,75	6,659	Wollaston 1803
Rhodium	R	10,649	6,75	6,513	ib. 1804
Iridium	Ir	18,68	12,25	12,335	Tennant 1803
Osmium	Os	21,2	12,5	12,444	ib.

GASES.

	Composition	Specific gravity.	British atomic wts.	Weight of 100 cubic in. grs.	
Atmospheric air	O+2 Az	1		31,0117	
Hydrogen	H	0,0694	0,125	2,1614	Cavendish 1766
Carburetted hydrogen	C+2 H	0,5555	1,	17,3025	Long known
Ammonia	Az+3 H	0,59027	2,125	18,3837	ib.
Carbonic oxide	C+O	0,9722	1,75	30,2794	Priestley 1800
Azote or nitrogen	Az or N	0,9722	1,75	30,2794	Rutherford 1772
Olefiant gas	2 C+2 H	0,9722	1,75	30,2794	Dutch chemists 1796
Deutoxide of azote	Az+2 O	1,0416	3,75	32,4402	Dr. Hales
Oxygen	O	1,1111	1,	34,6048	Priestley & Scheele 1774

Substances.	Composition	Specific gravity.	British atomic wts.	Weight of 100 cubic in. grs.	Discoverers.
Hydrosulphuric acid....	H + S	1,1805	2,125	36,6816	Rouelle before 1777
Sesquisulphuret of phosphorus............	Ph + S1½	1,21527	5,	37,8491	Margraaf
Muriatic acid..........	H + Cl	1,28472	4,625	40,0121	Long known
Protoxide of azote.	Az + O	1,5277	2,75	47,4691	Priestley 1776
Carbonic acid.........	C + 2 O	1,5277	2,75	47,4691	Dr. Black
Phosphuretted hydrogen.	Ph + 1½ H	1,77088	2,1875	55,1534	Gengembre 1783
Cyanogen..	2 C + Az	1,8055	3,25	56,2316	Gay Lussac 1815
Sulphurous acid.	S + 2 O	2,2222	4,	69,2066	Stahl
Quadroxide of chlorine..	Cl + 4 O	2,361	8,5	72,037	Davy 1815 [1808
Fluoboric acid.	2 B + F	2,3611	4,25	73,5355	Gay Lussac and Thenard
Chlorine	Cl	2,5	4,5	77,8615	Scheele
Chlorous acid	Cl + 3 O	2,729	7,5	84,645	Balard
Arseniated hydrogen...	As + ½ H	2,79305	4,9375	86,9884	Scheele
Hydrobromic acid......	Br + H	2,8125	10,125		Balard 1826
Hypochlorous acid.	Cl + O	2,9916	5,5	92,775	Balard 1834
Chloro carbonic acid. ..	Cl + C + O	3,4722	6,25	108,1400	Dr. Davy 1812
Fluosilicic acid	F + Si	3,6111	3,25	112,4700	Scheele
Hydriodic acid.........	H + I	4,34027	15,875	135,1760	Clement

ENGLISH UNIVERSITIES.

THE observations published last year in the Annual; in reference to these Universities having elicited considerable discussion,* and some facts of importance, we are enabled this year to present a more satisfactory account of these institutions to our readers, although completely deficient as a statistical report, in consequence of the difficulty of obtaining numerical data.

"The University of Oxford is a corporate body known for ages by the style or title of the *Chancellor, masters and scholars of the University of Oxford*, a title confirmed by the legislature itself in the reign of Elizabeth." (13 Eliz. c. 29.)

The commonwealth or University of Cambridge consists of the union of seventeen colleges or societies devoted to the study of learning and knowledge, and for the better service of the church and state. All these colleges have been founded since the beginning of the reign of King Edward I. The present statutes were granted by Queen Elizabeth. Each of the seventeen colleges furnishes members both for the executive and legislative branch of its government. The senate is divided into two houses called Regents and Non-Regents House. Masters of Arts of less than five years' standing and Doctors of less than two compose the Regents: all the rest constitute the Non-Regents House. The University confers no degree whatever unless the candidate has previously subscribed "a declaration that he is *bona fide* a member of the church of England as by law established."

* Letters from Professors Daubeny, Henslow, and Haviland, and answers by the Editor will be found in the British Annals of Medicine for 837, and in the Medical Gazette for the same year.

OXFORD UNIVERSITY.

Professors.

Those marked *, deliver annual lectures according to Dr. Daubeny.

*Regius Divinity, Rev. R. D. Hampden, D.D., 1836.
„ Civil Law, J. Phillimore, D.C.L., 1809.
„ Medicine, J. Kidd, M.D., 1822.
„ Hebrew, Rev. E. B. Pusey, D.D., 1828.
„ Greek, Rev. T. Gaisford, D.D., 1811.
Margaret Divinity, Rev. G. Faussett, B.D., 1827.
Natural Philosophy, Rev. G. L. Cook, B.D., 1810.
Savilian Geometry, Rev. Baden Powell, M.A., 1827.
Savilian Astronomy, S. P. Rigaud, M.A., 1827.
*Moral Philosophy, Rev W. Sewell, M.A., 1836.
*Ancient History, Rev. E. Cardwell, B.D., 1825.
Music, W. Crotch, D. Mus., 1797.
Laudian Arabic, Rev. W. Knatchbull, D.D., 1823.
*Botany, C. G. B. Daubeny, M.D., 1834.
Poetry, J. Keble, M.A., 1831.
Modern History and Languages, Rev. E. Nares, D.D., 1813.
*Anglo Saxon, Rev. R. M. White, B.D., 1834.
Common Law, P. Williams, B.C.L., 1824.
Clinical Medicine, J. A. Ogle, M.D., 1830.
Reader in Arabic, J. D. Macbride, D.C.L., 1813.
Aldrichian Medicine, J. A. Ogle, D.M., 1824.
* „ Anatomy, J. Kidd, D.M., 1822.
* „ Chemistry, C. G. B. Daubeny, D.M., 1822.
*Political Economy, W. F. Lloyd, M.A., 1832.
Boden Sanscrit, H. H. Wilson, M.A., 1832.

Lee's Lecturer in Anatomy, J. Kidd, D.M.
Reader in Experimental Philosophy, S. P. Rigaud, M.A.. 1810.
*Reader in Mineralogy, Rev. W. Buckland, D.D., 1813.
*Reader in Geology, Rev. W. Buckland, D.D., 1818.
Public Orator, Rev. J. A. Cramer, D.D., 1829.
Radcliffe Librarian, J. Kidd, D.M., 1834.
Bodleian Librarian, Rev. B. Bandinel, D.D., 1813.
Under Bodleian Librarian, W. Cureton, M.A., 1834.
Keeper of the Archives, P. Bliss, D.C.L., 1826.
Curator of the Theatre, Rev. B. P. Symons, D.D., 1832.
Keeper of the Ashmolean Museum, P. Duncan, M.A., 1829.
Radcliffe Observatory, S. P. Rigaud, M.A.

Professorships and other University Endowments.

Date.	Foundation.	Designation, or Subject.	Endowment, (as far as known.)
1546	Henry VIII.	Regius Professor of Divinity.	£40 per an. Canonry of Christ Church, Rectory of Ewelme.
"	"	Ditto Hebrew.	£40 per an. Canonry of Christ Church.
"	"	Ditto Medicine.	£40 p. an. Mastership of Ewelme Hospital.
"	"	Ditto Civil Law.	£40 ℔ an. Lay Prebend in Salisbury Cath.
"	"	Ditto Greek.	£40 ℔ an.
1400	Margaret Countess of Richmond.	Professor of Divinity.	40 marks ℔ an. Prebend of Worcester.

Professorships. &c. continued.

Date.	Foundation.	Designation or Subject.	Endowment, (as far as known.)
1618	Sir W. Sedley.	Nat. Philosophy.	Land £120 ℔ an.
1619	Sir H. Saville.	Geometry.	Land £300 ℔ an. (average.)
,,	,,	Astronomy.	Ditto.
1621	Dr. White.	Moral Philosophy.	Rent charge £100 ℔ an.
1622	W. Camden, Esq.	Ancient History.	Manor of Bexley.
1636	A. Laud.	Arabic.	Land.
1728	Dr. Sherard.	Botany.	£3000 bequeathed by Dr. Sherard.
1793	George III.		Grant from the Crown.
	H. Birkhead, Esq.	Poetry.	
1724	Regius George I.	Modern History & Languages.	
1626	Dr. Heather.	Music.	
1750	Dr. Rawlinson.	Anglo-Saxon.	Rent ch. £12,000 to found this and Scholarships.
1755	C. Viner, Esq.	Common Law.	
	The Lord Almoner.	Arabic.	Stipend out of Almonry bounty.
1803	Grant from the Crown formerly out of the hereditary revenue; now by a parliamentary vote.	Chemistry.	
,,	,,	Experimental Philosophy.	
,,	,,	Geology. Mineralogy.	
1825	H. Drummond, Esq.	Political Economy.	Rent charge £100 ℔ an.
1830	Col. Boden.	Sanscrit.	£1000 ℔ an.
1623	R. Tomlinson, Esq.	Anatomy.	Annexed to Reg. Professorship of Medicine.
1772	Earl of Litchfield.	Clinical.	
1803	Dr. Aldrich.	Anatomy.	Annexed to Tomlin's.
,,	,,	Practice of Medicine.	,,
1750	Dr. Lee.	Anatomy.	,,

Professorships, &c continued.

Date.	Foundation.	Designation, or Subject.	Endowment, (as far as known.)
1714	Dr. Radcliffe.	Librarian.	£150 ℔ an.
„	Ditto.	Two travelling fellowships for the study of Medicine.	£300 ℔ an. each.
1722	„	Astronomical observer.	
1780	Rev. J. Bampton.	Eight Divinity lectures.	Annual appointment, Rent of Land.
1755	C. Viner, Esq.	Two Fellowships, & four Scholarships for the study of the law.	Part of the interest of £12000, held for 10 years.
1647	Lord Craven.	Two Scholarships.	£25 each.
1819	„	Three additional.	„
1825	Dr. Ireland.	Four Scholarships for Classical Lit.	£30 each.
1830	Col. Boden.	Two Scholarships for Sanscrit.	£50 each.
1831	University.	Three Mathematical Scholarships.	Held for 3 years, £50 each.
	Subscription for Eldon Testimonial.	Scholarship for law.	£200, held for 3 years.
1834	Rev. Dr Johnson.	Two Scholarships, one Theological, one Mathemat.	Interest of £1200.
1818	Remaining funds of the Hertford College dissolved.	Scholarship for Latin.	
1831	Mrs. Kennicott.	Two Hebrew Scholarships, tenable for four years.	
1832	Pusey and Ellerton.	Three Hebrew Scholarships, tenable for three years.	£30 each, (to be increased.)
1825	Dr. Ellerton.	Theological Prize for an Essay.	£21.
1835	Mrs. Dwyer.	Prizes for two Theological Discourses.	£30 each.
1806	Sir R. Newdigate.	Prize for an English Poem.	£20.
	Chancellor of the University.	Ditto, English Essay, Latin Essay, and Latin Verse.	£20 each.

In the Annual of last year we attempted to give a comparative view of the actual state of the principal universities of Europe and America. Under the circumstances attending our first publication, that account was unavoidably imperfect in some particulars, but more especially as regards the English universities. On the present occasion we shall endeavour to supply the deficiency, at least as relates to Oxford, and we are the more readily induced to offer the following more precise and extended statement, from the circumstance that what we have said, in the former instance, has laid us open to some animadversion which will be best answered by a reference to facts. So great is the difficulty of obtaining any exact data in what we may call *academical statistics* as to afford considerable justification for the brevity of our former statement, and at the same time to render even our present exposé far less complete in its details than we could wish. Our professed design, in a publication of this nature, is of course limited to the bare discussion of facts; and what we propose is simply to give a view of the actual constitution and condition of the university, which we hope to be able to put in such a light as will enable every reader to judge of the real tendency and character of the system. This we wish to do in the most entire spirit of good-will towards so venerable an institution, but at the same time with as great a regard for the public, whose interests are concerned in the case, and who greatly need awakening to the real condition of national academical education, and the direct concern which *all* classes have in its efficiency and improvement.

The university of Oxford is incorporated and chartered by the title of the chancellor, masters and scholars of Oxford. The government of the body is vested in: 1. the chancellor, usually a person of a rank who seldom takes any active part; in fact, the political representative of the university in the House of Lords; 2. in his absence, the vice-chancellor, always one of the heads of colleges, appointed annually by the chancellor, but continued for four years usually, and named in rotation from the four pro-vice-chancellors, who are appointed by the vice-chancellor; 3. the two proctors, who are masters of arts annually elected by their respective colleges, the colleges being taken in succession according to a fixed cycle. The chancellor or vice-chancellor singly, and the two proctors jointly have a *veto* on all legislative measures. The actual exercise of this power is usually *indirect*, by means of a board of the heads of houses, by whose advice the vice-chancellor acts, and who thus exercise the power of the *initiative* in all measures, admitting the proctors to their board on the same principle; 4. the great legislative body is the "convocation," including all who have passed the degree of M.A., (with some technical restrictions.) This body possesses the power of confirming, or rejecting, but not of originating or amending laws; its proceedings are all carried on in latin. 5. A more limited body called "congregation," has only the power of granting degrees, &c. The executive is vested in the vice-chancellor and proctors and their respective deputies. All members are matriculated in the presence of the vice-chancellor who administers the oath of obedience to the statutes, and of supremacy, and witnesses the signature of the 39 articles.

The university recognises four faculties, viz: arts, civil law, medicine, divinity, in each of which the degrees of bachelor and doctor are conferred: in arts the title of master being used instead of doctor. To these is added music, which differs from the others in the particular, that for degrees in this branch no residence or connexion with the university is required. The most essential and characteristic principle is, that *no person is admitted into any of the other three faculties until he has passed through arts;* i. e. has at least performed the exercises, though he may not have formally taken the degree.

1. FACULTY OF ARTS.

In this faculty a student must remain four academical years before he is admissible to the degree of bachelor, and three more to that of master. In his second year he must pass the exercise called responsions. This consists of an examination in one Greek and one Latin classic, and either logic or four books of Euclid at the option of the candidate. The average proportion is (as nearly as we can collect, though but a rough estimate,) about an equal number of candidates who choose logic and Euclid. The examiners are three masters of arts, called masters of the schools, nominated by the vice-chancellor and proctors, and continuing in office two years. These examinations are held three times a-year, and are chiefly conducted vivâ voce.

In the fourth year the candidate must pass the public examination. The times for this are twice in the year, viz.: in Easter and Michaelmas terms. There are seven examiners, (appointed by the vice-chancellor and proctors,) they receive £100 each per an., and continue in office two years. Their labours are distributed as follows; First, there is a separation made of the candidates into those who aim merely at *passing* and those who stand for *honours;* the former are then arranged in several large apartments, to carry on a considerable portion of their examination in writing, under the superintendance of four of the examiners; whilst the other three (taking the work by turns,) carry on a certain part of the examination in a separate place, vivâ voce, to which the candidates are summoned in turn. When these have concluded, the candidates for honours commence. The honours are awarded in two departments, classical and mathematical. Three of the examiners are specially designated as examiners in the mathematics, and chosen with reference to their qualifications for that purpose: and the others in like manner with regard to classical literature. The candidates for classical honours are taken first: at their writing examination, the mathematical examiners keep watch. The classical, (of whom three must always be present,) conduct the vivâ voce part, look over the written papers, and form their decision on the merits of the candidates.

After an interval of three weeks (an important respite for those who aim at honours in both departments,) the mathematical examination commences; conducted solely by the three examiners for this department, and consisting chiefly of the solution of problems in writing, a few questions vivâ voce being put to each candidate. When this is ended, the lists of the classes are printed, circulated, and posted up through the university. The questions also have been usually published.

The pass-examination consists of a written translation of English into Latin, and of some passages from the classics into English: three classic authors must be "taken up," as it is termed, the selection being with the candidate, and some part of the examination in these is vivâ voce, as is also that in the "rudiments of religion," which comprises questions on the evidences, the translation of a passage in the Greek testament, with doctrinal and historical questions, usually raised upon it, and proofs of the thirty-nine articles; besides this, either logic or six books of Euclid at the candidate's option. No data are publicly accessible for discovering the proportions of candidates who choose the one or the other, (they are supposed to be rather in favour of logic,) nor for ascertaining the proportion who fail to pass the examination.

The examination for the classical honours comprises generally critical and philosophical questions in the Greek and Latin languages, translations from the higher classics: a knowledge of the Greek and Roman history and antiquities, derived from the original writing: the rhetoric and ethics of Aristotle, (and occasionally other treatises,) illustrated by the treatises of Cicero, and occasionally those of modern writers: general questions in the moral, political, critical and logical sciences are also given to be answered in writing. The candidate has also to write an essay on a given subject. The precise books and subjects, however, vary considerably both for the different classes to which the candidates may aspire, and with different individuals.

Some portion of each candidate's examination is always conducted vivâ voce, but by far the largest and most important part is done in writing. This examination, as well as that for mathematical honours, is entirely optional on the part of the candidates. There are four classes of honours: the fifth class comprises all who pass without honour. The *names* of the first four are printed; only the *number* of those in the fifth. *In each class* the names are arranged *alphabetically*. In the fourth class it is very common for the examiners to insert the names of those who did not present themselves for honours, but who shewed peculiar excellence in their pass-examination. This applies to the mathematical department also. The great evil of this arrangement of the classes, is the broad and iniquitous line of distinction between the classes, when, perhaps, there is really the slightest possible, between the worst of the first class men and the best of the second, and the immense difficulty of drawing the line.

The examination for the mathematical honours is conducted by means of printed papers of miscellaneous questions and problems in the chief branches of pure and mixed mathematics without reference (except in some few instances,) to particular books. The subjects include the algebraic geometry and trigonometry, differential and integral calculus and its applications: mechanics, dynamics, optics, hydrostatics, the Newtonian theory, and elements of plane and physical astronomy. Very rarely some questions have been introduced relating to other branches of physical science: but the usual practice is to confine the subjects to the precise line of mathematical investigation above described.

These examinations form the most prominent feature in the academical system, and in fact guide all the studies of the university. The results, as affecting the actual state of acquirements and general education, are most important, and worthy of much closer attention than they commonly receive. Perhaps one of the best elucidations we can give, will be to present a statement of the comparative *numbers* of all those who *passed* the examination, and the proportion of those who obtained *honours,* (in any of the classes,) in each department in different years, since the commencement of the system.

Year.	Number of candidates who			
	Passed examination. (Total.)	Obtained classical honours.	Obtained mathemat. honours.	Obtained both classical & math. honours.
1807	22	10	6	6
1808	163	55	12	11
1809	144	6	14	10
1810	152	77	11	9
1811	153	74	15	12
1812	153	51	9	6
1813	182	71	14	10
1814	180	72	14	10
1815	169	56	9	7
1816	163	63	15	11
1817	181	69	12	7
1818	225	58	20	15

Year.	Number of candidates who: Passed examination. (Total.)	Obtained classical honours.	Obtained mathemat. honours.	Obtained both classical & math. honours.
1819	218	69	11	7
1820	225	58	11	5
1821	271	73	15	8
1822	279	98	20	11
1823	280	88	12	9
1824	295	78	8	6
1825	258	68	12	9
1826	284	66	15	9
1827	314	66	20	16
1828	259	70	16	13
1829	303	70	14	8
1830	273	56	16	9
*1831	279	107	22	15
1832	275	104	21	17
1833	291	135	25	16
1334	292	120	21	15
1835	292	105	22	8
1836	276	121	28	19

These examinations having been passed, no other public exercise is required of the candidate for the degree of bachelor. It is requisite that he should have "kept" sixteen terms. The academical year begins October 10 and ends the first week in July. It is divided into four terms: Michaelmas, Lent or Hilary, Easter, Act or Trinity; the exact period of the three

* In this year the fourth class was added.

last depends on the time of Easter. Of these, twelve must be kept by *actual residence* of at least six weeks in the two former and three weeks in the two latter, within the walls of a college or hall (except in cases peculiarly dispensed with). The details are determined by the authorities of the respective colleges; but this and other similar matters being duly certified in congregation, the candidate takes the oath of obedience to the statutes, (some specially), those of allegiance and supremacy, signs the thirty-nine articles, and three articles in the 36th canon, and is then admitted to the degree of bachelor.

For the degree of M.A. three years more must be "kept," that is, the name of the candidate must remain on the college books (involving the payment of certain dues, &c.), and one term of three weeks must be kept by actual residence. At present no public exercises of any kind are required for the degree of M.A. In former times there were a number of disputations, &c. kept up, all of which had long since dwindled away into mere forms, and were in consequence abolished; the last retained of these (called *determining*) is now *suspended* by an annual dispensation, some question having been entertained whether it might not be revived in a useful manner. The admission to the degree of M.A. takes place with similar forms and requisitions to those in the former instance.

The subjects of examination above enumerated are precisely laid down in the "examination statute," which in its last "amended" form came into operation in 1831. These, therefore, are the branches of study which the university publicly allows to constitute its faculty of arts. This forms the *only* public enumeration of the studies required; and of course those branches *alone* which are made essential for the degree, can be considered as essential to the faculty of arts. In this course two things appear most peculiarly striking; one is the limitation of *arts* to a knowledge of three classic authors, with the option of either logic or Euclid, but of *no other science;* the second is the extraordinary anomaly of making a knowledge of *religion* a part of the faculty of *arts.*

There are, however, certain ancient statutes (which have never been repealed) which shew the very different light in which these things were formerly regarded, and clearly point out what the intention of the University was with regard to the course of studies *imperative* upon all candidates in the faculty of arts. These are the statutes respecting the public lectures, which are enjoined to be given by the different professors, on certain stated days and hours in latin, and at which all under graduates and bachelors of arts are required to attend according to a certain scheme, of which the following is an abstract:

		D.C.L.							
Year	D.D.	ords.	hon.	M.D.	B.D.	B.C.L.	M.B.	M.A.	B.A.
1834	5	5	76	3	11	6	4	207	304
1835	1	6	(Instal.) 6	2	0	14	3	173	272
1836	7	5	1	4	14	2	2	200	298

During the first year, grammar and rhetoric; for the second and thenceforward to the bachelor's degree, logic and moral philosophy. From the commencement of the third year, to the end of the first after the degree, geometry (including arithmetic, algebra, trigonometry, mechanics, &c.); during the same time and till the degree of M.A. greek is added. From the first year of the bachelor's degree till that of M.A., natural philosophy, metaphysics, history, hebrew, astronomy, (including geography and optics, &c.) According to the older examination statutes, it was ordained, that the examination of *every* candidate should embrace *all* the sciences, which he was statutably required to have studied. This principle was gradually lost sight of, in the subsequent *amendments*, till the existing system has wholly usurped its place. But the ancient idea clearly was that of *a comprehensive course of all the liberal sciences, as then known*. The latin lectures have long since become obsolete, and the examination had become a mere form. But instead of reviving a more useful kind of lecture, and restoring the spirit of a system so excellent in its principle, the only reform adopted was that of allowing the lectures to cease altogether, and substituting the restricted system of classical examination, which we have described, and the result of which is, that the very rudiments of moral and physical science are practically excluded from the general course. Attempts have been made from time to time by some few friends to improvement, to get these defects remedied; but hitherto without the least success. In the present times, more especially, it will surely be allowed by any one except an Oxford tutor, that a knowledge of the elements of science ought to constitute an essential and indispensable part of any course of general education.*

* The reader who is desirous of seeing a full discussion of these topics, is referred to a public lecture by the Savilian Professor of Geometry Oxford, 1832; and an article in the Journal of Education, No. 13, p. 47.

We have hitherto spoken only of the exercises required of the student in arts, let us now turn to the public means of instruction afforded him. We shall presently give a general list of the University professorships and other endowments, on referring to which, it will be seen that there are means of instruction amply provided in all branches of the faculty of arts, included in the provisions of the old statutes above alluded to, and the professors might be called upon to deliver the obsolete latin lectures mentioned, at which the presence of all students of the requisite standing might be enforced under penalties. It is obvious that such a course would have no useful effect at the present day. These, however, are the only lectures which the professors (of the older foundations) are required to deliver; some of the others have specific regulations laid down by their founders; some are left without restriction; but all are dependent on the contingency of obtaining a class. Some of those under the old statutes have often, and even regularly offered to give voluntary lectures in English of a kind better adapted to the wants of students at the present day. Of these, the professors of moral philosophy, poetry and ancient history, have been usually able to collect an audience, but not perhaps at the utmost consisting of more than from twenty to thirty persons. The subjects of these lectures are directly connected with those of the examination, they are, therefore, sometimes attended by candidates for classical honours.

The Sedleian and Savilian professors voluntarily give notice of their intention to deliver usually, at least, one course in the year; but it rarely happens that any class can be formed; and if any, seldom more than from three to twelve individuals. "A course" generally comprises a lecture three days in the week during term.

The modern sciences, botany, chemistry, experimental philosophy and geology, (especially the last,) do occasionally attract a class, but often none is formed. One course of each, at least, is always proposed to be delivered in the year, and sometimes more.

Of the oriental languages, the same may be said, except that the Sanscrit professor is necessarily provided with auditors from the endowment of Sanscrit scholarships, the holders of which are required to attend the lectures.

The political economy sometimes attracts a class. The endowment requires a course to be proposed, and one lecture at least to be printed in each year. The Vinerian lectures on the laws of England are rarely attended, as is also the case with the lectures on modern history.

Of these lectures many are offered gratis; for others the fee varies from £1. 1*s*. to £3. 3*s* the course.

Such are the means of public instruction in the sciences afforded to the student, and such the use made of them. The causes which have produced this state of things, will be better seen when we proceed to look at the college establishments.

2.—FACULTY OF CIVIL LAW.

Formerly the degree of M.A. was requisite before entering any other faculty. By later statutes, after passing the examination for B.A. the student may, if he please, proceed at once into the faculty of civil law, being termed a "student of civil law," for three years, at the end of which time he is admissible to the degree of bachelor of laws, and in five more to that of doctor. For these degrees, certain ancient exercises are performed, which are little more than a mere form; one term of residence is required for the bachelor's degree.

The degree of B.C.L. thus taken, gives no vote in convocation; those who pass through arts, can take the bachelor of laws degree at three years from that of M.A., and become doctors in four years more. A dispensation for taking the doctor's degree earlier is obtained by those who wish to practice in Doctor's Commons.

3.—FACULTY OF MEDICINE.

Here as in the faculty of civil law, after passing the examination in arts, the student may enter the medical faculty, and proceed at the end of three years to the degree of bachelor, and in three more to that of doctor, no residence being required. The exercises for these degrees were, until within these few years, little more than the mere forms of the ancient disputations. These, however, have now been abolished, and by a late statute, for the bachelor's degree, a public examination is held in the theory and practice of medicine, in anatomy, physiology and pathology; the materia medica, chemistry and botany, as far as they relate to medicine, and in two, at least, of the ancient medical writers, Hippocrates, Aretæus, Galen, and Celsus. The examiners are the Regius Professor of Medicine, and two other doctors in this faculty, appointed by the Vice-Chancellor.

For the doctor's degree, a dissertation on some medical subject, approved by the Regius Professor, is to be publicly recited, and a copy delivered to the professor. For the bachelor's degree the candidate must also present testimonials of his having attended the practice and lectures of some hospital of repute. No one under the degree of M.D. can practice medicine or surgery, in Oxford without a licence from the University.

The number of students in the faculty of medicine is always extremely small. This circumstance is readily accounted for, on the consideration that a place, such as Oxford, can never afford the opportunities requisite for forming a good school of medicine. The circumstance of requiring the student, first to have passed through, at least, the studies and examinations in the faculty of arts, will alone exclude a great number, and limit the pursuit of medical degrees, to those who can rear the superstructure of professional attainments on a basis of classical learning.

The infirmary at Oxford is of insufficient extent to afford any great scope for the practical lectures, and the more elementary courses of anatomy, &c. though usually adapted more for the general student, share the fate of the other public lectures, and seldom attract a class. Those who having passed the under-graduate course, are entering the medical line, go for instruction to the great schools of London, Edinburgh, or others; and return to undergo the examination and receive the degree from their own University.

4.—FACULTY OF THEOLOGY.

After admission to the degree of M.A. for the degree of bachelor of divinity, seven years must be kept; the candidate must be certified to be in priest's orders, and hold what is called a disputation in the divinity school; but the ancient form of the latin disputation has been of late years discontinued, and in its place the candidate reads two disputations on some theological theses, approved by the Regius Professor of Divinity, in English, of which public notice is given. It was at one time attempted to hold a real disputation between two candidates in English; but this being found unavoidably to lead to *too free* a discussion, it was dropped, and the present practice substituted.

For the degree of doctor, four years more are reckoned from that of B.D. and two lectures are required to be read in the divinity school.

The Regius Professor of Divinity usually gives three courses of public lectures in the year, which are always numerously attended, from the circumstance that most of the bishops require a certificate of such attendance as a requisite for ordination. They are attended by bachelors of arts, and even by under-graduates, with special permission from their college. Besides these, the professor usually has private classes, with whom he goes through, in detail, the different branches of theology. The Lady Margaret's professor usually delivers one or more courses in the year, which are also well attended by candidates for orders. The Professor of Hebrew's lectures may also be considered as belonging to this faculty, though a knowledge of that language is not made a requisite for orders, yet the study of it has greatly increased of late years, and these lectures are well attended.

On Sundays and certain other days, there are sermons before the University, which (with some exceptions) are appointed to be preached in turn according to a certain scheme by graduates; but this not being compulsory, certain select preachers are also appointed, who take the vacant turns, which in fact occur very frequently. There exists still a board of inquisition to examine the doctrines broached by the preachers, and condemn them if heretical.

PUBLIC INSTITUTIONS.

The University is furnished with one of the most valuable and extensive libraries in Europe, originally begun by Humphrey Duke of Gloucester, but mainly established by Sir Thomas Bodley. It has since received large augmentations both by bequests, purchases, and the right of a copy of every work entered at Stationers' Hall. It is endowed for a librarian and two sub-librarians with inferior assistants, and is under the management of a board of curators. All graduates have the right of using the books, but none can be taken out. Other persons easily obtain admission. A *complete* catalogue has never yet been accomplished, and the exact number of volumes is unknown.

Dr. Radcliffe's library was founded exclusively for works on medicine and natural history. It is also furnished with works of art.

The Observatory, founded likewise out of his munificent bequest, is endowed for an observer (usually the Savilian professor of Astronomy has been appointed) with a residence and good instruments. Part of the design consisted in smaller instruments for the instruction and practice of students, but few, if any, avail themselves of this advantage.

The Botanic garden was founded by the Earl of

Danby in 1632. Attached to it is a good collection of botanical books including the valuable Herbarium of Dr. Sherard. The whole had gone much to neglect, till on the appointment of the present professor in 1834 a new impulse was given, and by a subscription raised in the University, a new library was built and progress made in improved hot-houses, &c. which are still incomplete. The whole garden, however, has been admirably re-arranged, and every inducement is held out to the study of Botany, by throwing open the garden, houses, and library as widely as possible, and giving an annual course of lectures, by the present professor; it is to be regretted, however, to very little effect. This science shares the fate of all other branches in Oxford; as indeed is inevitable in an University where professional studies cannot be carried on, and where instead of general mental cultivation, and a comprehensive system of sciences, a monopoly is given to the single subject of classical literature.

The Museum founded by E. Ashmole, Esq. in 1683, has been munificently furnished with specimens and arranged almost solely by its late and present curators. It occasionally attracts a few students, who there gain important illustrations of natural history. In connection with this museum in 1828, a Philosophical Society called the Ashmolean, was instituted by a few cultivators of science which has regularly continued its meetings and has printed a series of memoirs comprizing both physical and literary subjects Its ordinary members must be graduates—a few honorary members are likewise attached to it. The numbers were (in January 1837) ordinary members 226, honorary eleven. Under the museum is a chemical laboratory, where lectures are given whenever a class can be collected.

The University press is a most extensive establishment chiefly from the exclusive privilege of printing bibles and prayer books. Its vast profits are (in some measure at least) applied to undertaking works of a kind not likely to be profitable. It is managed by a board of delegates appointed by the Vice Chancellor and proctors.

COLLEGES AND HALLS.

In ancient times the students who frequented the University lived together in certain houses termed "Halls," which by degrees were subjected to certain regulations under the government, each of a principal who was a graduate of the University. For instruction they frequented the public lectures, delivered in the schools, where also the public disputations were held, whilst each Hall had its own internal regulations. The Colleges, which were subsequently founded, differed from the Halls in being *endowed* with property for the maintenance of a head and a certain number of fellows and scholars who were to reside within the walls and pursue their studies, while they also frequented the public lectures and disputations. These institutions partook much of the character of religious houses; they each had services performed in their own chapel, and for the most part the fellows were obliged to enter holy orders. By degrees a system of private instruction arose within each College, especially when they began to admit independent students besides the members of their foundation. Some of the fellows were specially appointed as tutors, or rather perhaps the general practice was for each senior member to have several juniors specially placed under his care and superintendance, who were exercised not only in literary instruction but in general guidance and moral and religious teaching. All this, however, was entirely subordinate and subsidiary to the public university instruction. By degrees this collegiate and tutorial system has encroached upon the University and professional system until the latter has become practically in abeyance. Among the independent members of Colleges, a difference of rank was early recognised and distinguished by peculiarities of the academical costume. *Noblemen* entered as such; an order of *gentlemen commoners* included the more aristocratic and wealthy class; the commoners were the sons of persons of middle station; whilst a class called *battelors* enjoyed certain emoluments, and that of *servitors* of still lower grade opened the advantages of academical education, affording maintenance coupled with the discharge of some menial offices to the more necessitous. The various endowments under the name of exhibitions, pensions, &c., and certain offices in each college all contributed to give assistance to those whose means would not otherwise have enabled them to enjoy the advantages of University learning. The whole of the endowments and much of the same system have been retained, and nearly in the same manner to the present day. The class of battelors has ceased to exist, and that of servitors is recognized only at two colleges, their number being extremely small. At the reformation the whole right and title to College endowments was invaded, and the system remodelled by the Act of Legislature, which imposed upon the holders the condition of conforming to the Protestant forms by law established. At many colleges all the fellows must take orders when of age to do so: they all possess ecclesiastical patronage. The fellows succeed to livings by seniority. In some colleges there are exemptions for a very small number from taking orders, but they must enter some other profession; at others no restriction exists. No person is eligible to a fellow's life who has proceeded beyond the degree of B.A. They are, in many instances, restricted by the founder's will to natives of particular counties or pupils of particular schools; but in many instances are open to free competition decided by an examination, in others by election—in all cases they are vacated by marriage; and at one College (Wadham) are tenable only for a certain term of years. In each College the value of them varies extremely, and is impossible to be ascertained with any certainty. It is supposed that they may be described in general terms as varying in all proportions between £40 and £400 per annum. There are in each college various *offices* always held by fellows: as purser, dean, librarian, &c. besides that of tutor and certain endowed lectorships of small value; the lectures being delivered either in the Hall or chapel, according to the nature of the subject. These are distinct from the tutor's lectures. The under graduate members are divided into classes according to their standing and proficiency, (perhaps from six to twenty in number); these assemble in the tutor's rooms at stated hours and go through certain courses of study prescribed by him, receiving questions and his instruction, explanations, and giving their own translations or answers as the case may be. Each class remains with the tutor an hour. One tutor may take or arrange three classes every day; in each college the number of tutors varies according to that of pupils, from one to six. There are college examinations termed "collections" held at the end of each term.

The institution of colleges is perhaps the characteristic distinction between the English and other universities. No person can become a member of the University unless he be first entered at some College or Hall, nor remain a member, or claim any privilege as a graduate especially that of a vote unless his name be kept on the books of his College, and all customary fees, &c. duly paid. Terms are kept as before explained for degrees according to the statutes of the University; but the colleges impose their own regulations as to the mode and extent of residence. For under graduates it is necessary to take the meals, (or at least pay for them) and to sleep within the College: the gates are closed at nine o'clock, after which no one can go out, and account is kept of those who come in. After ten fines are imposed; and after twelve the offender is subject to censures; and on repeated offences to more serious punishment. Irregularities whether of this kind or of others are always noticed by the College authorities, and when it is found that they are habitual and incorrigible, the individual is either sent away for a time (rustication) or recommended to withdraw altogether, a suggestion which is in fact the practical mode of exercising the power of expulsion, which in its absolute form is hardly ever resorted to: but the indirect exercise of which is in fact the main secret of collegiate discipline.

Out-of-doors discipline is maintained by the rectors and their assistants, including an efficient University police. The College authorities always act in conjunction with the rectors (who have no authority *within* college) and the result is generally allowed to be a most efficacious administration, to the utmost extent which can be rationally expected in a place where perhaps 1500 young men of an age from seventeen to twenty-two are congregated. It must be evident, on the slightest considerations, that there are offences and habits of dissipation and expense which no authority can ever control, prevent, or even detect. The most ordinary fine of penalty for slight offences is an imposition i. e. to transcribe or in some cases translate a passage of a certain length according to circumstances. More serious offences are denounced by the proctors to the College authorities who take measures accordingly; in peculiar cases, the authority of Vice Chancellor is appealed to. The proctors have the power of enforcing the academical costume, which however, is usually not rigidly insisted on, except under particular circumstances. They can also interfere in all amusements, sports, &c. which are, however, connived at within certain limits.

The exact length of the term for under graduates varies at different colleges: the times of the University terms may be seen in the almanacks. Most of the colleges assemble within about a week of the first day of term, and hold their collections (with which the College lectures conclude) within the last fortnight of term. Many under graduates who are engaged in reading for their examination continue in College during the vacations. In each College chapel the church service is read every morning and evening; all under graduates (and bachelors if keeping a term) are required to attend a certain number of times during the week, and always on sundays and other festivals. In four colleges there is choral service performed. Each college is furnished with a library, the use of which is generally allowed to all members, and books can be taken out. After taking the degree of B.A. many continue to reside either in preparation for trial for a fellowship, or taking private pupils. This last practice is extremely general; few aim at honours who do not for a short time at least previously avail themselves of the assistance of private tuition, which is of course most valuable when obtained from those who have recently attained the highest honours themselves. It may be truly said that the practice of private tuition forms the main occupation of resident graduates, and is the clue to the whole system of connexion and patronage which exercises so important an influence on the condition of the University and the Church. This system is in fact only carrying out into further detail the principles of that of College tuition, and as those engaged and interested in it form the great majority of *convocation*, all measures of university legislation are framed with exclusive attention to the advancement of this system, and the *numerous and complicated interests* which it involves. The five existing Halls are established on the basis of very ancient academical houses, but are in every respect under the same regulations as the colleges. They are unendowed: the revenue is solely the rent of the rooms which goes to the principal.

Date of foundation.	Name.	Church preferment annexed to the Headship.	No. of livings in gift.	No. of Fellowships.	No. of Scholarships.	No. of Exhibitions, &c.	No. of Clerks, Chaplins &c.	No. of Independent under graduate members in 1836.
1249	University College.		10	12	16	5		52
1268	Balliol.		20	12	14	14		77
1274	Merton.		18	24	14		4	17
1314	Exeter.	Kidlington V.	12	25	19			114
1326	Oriel.	Purligh R. Prebend at Rochester.	13	18		15	4	76
1340	Queen's.		28	24	32	4	2	51
1386	New.	Colime R.	36	70			31	8
1427	Lincoln.	Twyford R.	10	12	8	12	1	27
1437	All Souls.	E. Lockinge R.	17	40			6	
1456	Magdalen.		37	40	30		31	1
1509	Brazennose.		37	20		19		74
1516	Corpus.		22	20	20	4	2	4
1545	Christ church.		89	101 & 8 canons			25	217
1554	Trinity.	Garsington R.	9	12	13	3		81
1557	St. John's.	Handburg R.	28	50			16	33
1571	Jesus.	Llandissil R. Clannog Vawr R. Llan Wnde V.	20	19	18		4	42
1613	Wadham.		8	15	15	14	4	71
1624	Pembroke.	Prebend of Gloucester	13	14		30		32
1714	Worcester.		8	21	16	3	2	66
1333	St. Mary Hall.					3	1	12
1487	Magdalen.		1		1			72
1438	New Inn.							18
1269	St. Edmund.						1	19
1547	Alban.							5
			436	549	256	126	118	1169

The instruction given in colleges includes classical literature, ancient history, the principal treatises of Aristotle, and logic, the elements of Euclid; and to the few students who may evince a taste for mathematics, a course of pure and mixed mathematics is carried on, and extended to the usual branches. No other subjects of literature or science are introduced; but elementary theological instruction is given, chiefly through the medium of lectures on the Greek testament, but rigidly in accordance to the formularies of the established church. The instruction is entirely in the hands of the college tutors, who are appointed by the heads of the respective colleges. It is most usual for them to make some division of the labour of different departments. Thus nearly every college has now, at least, one tutor capable of carrying his pupils into the higher departments of mathematics. In this system every subject, which is commonly requisite for the examination, is fully put before the student, whether classical or mathematical. Thus the professors entering, even in these departments, which are recognized in the examination, are rendered of very secondary consequence. Those branches of science which have no bearing on the examination, are of course more studied, except perhaps by a very few, in whose case, peculiar circumstances may lead and enable them to indulge in a predilection for following up a particular study. Even those subjects on which it might be expected the lectures would be of a more popular and attractive character, and which cannot be well apprehended, without actually witnessing the experiments and illustrations which can only be exhibited at public lectures often fail to attract a class;

and it is manifestly because those who are idly disposed will do nothing more than they are compelled to do; and those who are disposed to read, will of course apply to that only, which will be of use to them in the examination honours, being in fact the door to all University distinction and preferment.

Thus it is sufficiently apparent what are the causes of the almost total extinction of the professional system of lectures. In fact, at present, these institutions can be regarded as little more than endowments for the encouragement of certain branches of science, and as affording the leisure for cultivating their details. The root of the evil is to be traced to the confined nature of the requisite qualifications for a degree. If the just and rational principle of a comprehensive course of science, as well as the rudiments of literature, were even again to be recognised as compulsory on all who are to obtain a degree in arts, then an attention to those subjects, which can only be studied by means of public experimental and illustrative lectures would survive; and the greatest improvement in the system of academical education would consist in a due combination of the advantages belonging to the tutorial and the professional modes of instruction.

CAMBRIDGE UNIVERSITY.

The University of Cambridge was incorporated by 13th Elizabeth, c. 29, under the name of the Chancellor, Masters, and Scholars of the University of Cambridge.

It consists of seventeen colleges or societies founded since the beginning of the reign of King Edward I. The annual income of the University arises from various sources: the rectory of Burwell and a farm at Barton, produce £1000 per annum; the matriculation fees, amount to £2000; the trading profits of the University press are £2000 per ann.; the whole amounting to £5500 per ann. at the present time. The annual expenditure for servants, officers, observatory, repairs, etc., amounts to £4500, and has even in later years, exceeded the revenue, so as to have almost entirely exhausted the funded and available capital of the University.

Professorships.

Those marked *, lecture annually; the others do not, according to Professor Henslow.

Lady Margaret's Divinity, Rev. H. Marsh, B.D. 1807.
Regius Divinity, Rev. T. Turton, D.D., 1827.
*Civil Law, J. W. Geldart, D.C.L., 1813.
*Regius Physic, J. Haviland, M.D., 1817.
*Regius Hebrew, Rev. S. Lee, B.D., 1831.
*Regius Greek, J. Scholefield, M.A., 1825.
Arabic, T. Jarrett, M.A., 1831.
Lord Almoner's Arabic, T. Musgrave, M.A., 1820.
Mathematics, C. Babbage, M.A., 1828.
Casuistry, Rev F. Barnes, D.D., 1813.
*Chemistry, Rev. J. Cumming, M.A., 1815.
*Astronomy and Experimental Philosophy, J. Challis, M.A., 1836.
*Anatomy, Rev. W. Clark, M.D., 1817.

*Modern History, W. Smyth, M.A., 1807.
*Botany, Rev. J. S. Henslow, M.A., 1825.
*Geology, Rev. A. Sedgwick, M.A., 1818.
*Astronomy and Geometry, Rev. G. Peacock, M.A., 1836.
*Norris Divinity, Rev. J. B. Hollingworth, D.D., 1824.
Natural Philosophy, W. Farish, M.A., 1813.
Laws of England, T. Starkie, M.A., 1823.
Downing Medicine, C. Hewett, M.D., 1814.
*Mineralogy, W. H. Miller, M.A., 1832.
Political Economy, G. Pryme, M.A., 1828.
Music, T. A. Walmisley, Mus. B., 1836.

Lecturers.

Barnaby Lecturers, Rev. G. Thackeray, Simpson, Dalton, Urquhart.
Lady Margaret's Preacher, Rev. R. N. Adams, D.D., 1834.
Sadlerian Lecturers, Algebra, 17 lecturers.
Christian Advocate, Rev. G. Pearson, B.D., 1834.*
Christian Preacher, Rev. H. Howarth, B.D., 1834.

Scholarships.

	umber.	Value.
Travelling Bachelors. .	2	£100 each
Craven's Scholars. .	5	50 each
Battie's Scholars. . .	1	18

* In his answer to Professor Henslow, the Editor inferred that this gentleman was one of the non-operatives. He is indebted, however, to Dr. Harwood of Ridware for the information, that the present advocate discharges his duty most faithfully, having published annually a treatise in answer to the objections to religion of atheists and infidels—the object of the office—he, himself, sustains the expense of publication, so that the surplus which comes to him, does not exceed L100. per annum.

	Number	Value
Browne's Scholars. .	1	£21
Davies's Scholars. .	1 interest of	1000 in 3 per cents
Bell's Scholars. .	8	15,200 ditto
Pitt's Scholar. .	1	1500 in funds
Tyrwhitt's Hebrew do. .	6	4000 in 5 p. cents Navy.
Crosse's Scholarship. .	3	2000 interest of
Lumley's Exhibition's .	10	15 each

The Fellowships in the University are 430.

The *Prizes* for the encouragement of literature, free and open competition for the whole University, amount to upwards of £1300, three fourths of which are given for Classics and English composition, the remainder for mathematics. The amount of the annual prizes in the different colleges is about £600, two thirds of which are given for the encouragement of classical literature.

The *Patronage* of the University alone, amounts to 281 livings. The value of this patronage exceeds £109,844 per annum. The livings are dispersed through the counties of Bedford, Berks, Buckingham, Caernarvon, Cambridge, Cornwall, Derby, Devon, Dorset, Denham, Essex, Gloucester, Hants, Hertford, Huntingdon, Kent, Lancaster, Leicester, Lincoln, Middlesex, Norfolk, Northampton, Nottingham, Oxford, Pembroke, Rutland, Salop, Somerset, Stafford, Suffolk, Surrey, Sussex, Warwick, Westmoreland, Wilts, York.

The fellowships in the various colleges are as follows:

	Fellowsh.	Scholarsh.	Patronage.
St. Peter's College. .	16	59	11 benefices
Clare Hall. . .	22	44	17 ,,

	Fellowsh.	Scholarsh.	Patronage.	
Pembroke College.	16	32	10	,,
Gonville and Caius do.	29*	26	16	,,
Trinity Hall.	12	18	8	,,
Corpus Christi College.	12	59	11	,,
King's College.	70	70	32	,,
Queen's College.	20	26	11	,,
Catherine Hall.	14	43	4	,,
Jesus College.	16	46	16	,,
Christ's College.	15	92	17	,,
St. John's College.	53	114	46	,,†
Magdalene College.	17	43	7	,,
Trinity College.	60	69	61	,,
Emmanuel College.	15	32	17	,,
Sidney Sussex College	12	22 & 17 exhi.	6	,,
Downing College.	16	6	2	,,

The benefices in the patronage of the different colleges are quite distinct from those of the University. Their value, however, is not stated in the Cambridge calendar; the value given in the King's book alone is stated; this we believe to be a valuation made in the time of Henry VIII, and is, therefore, no criterion of the present value even as to proportion.

SCOTLAND.

EDINBURGH, 1582.

Revenue £888 5*s.*

PRINCIPAL, Rev. George Husband Baird, D.D.

* The amount of scholarships is L406 per annum, and of exhibitions L516.

† All livings under L30 in the King's books (valuation in Henry VIIIth's time) are tenable with college preacherships.

	No. of stud. 1825-26.
Divinity, Rev Thomas Chalmers, D.D.....	236
Divinity and Church History, Rev. David Welsh, D.D..........................	129
Hebrew and Chaldee, Rev. Alex. Brunton, D.D.	68
Humanity, James Pillans, A.M...........	419
Greek, George Dunbar, A.M...............	372
Logic, Sir William Hamilton, Bart.........	175
Rhetoric, George Moir.....................	32
Moral Philosophy, John Wilson...........	150
Mathematics, William Wallace.............	172
Natural Philosophy, James D. Forbes, F.R.S.	152
Natural History, Robert Jameson	200
Universal History..........................	25
Civil Law, Douglas Cheape..................	36
Scotch Law, George Joseph Bell...........	227
Public Law.......................... ...	
Conveyancing, Macvey Napier............	110
Anatomy and Surgery, Alex. Monro, M.D.	222
Chemistry, Thomas Charles Hope, M.D.....	527
Botany, Robert Graham, M.D.............	214
Materia Medica, Robert Christison, M.D....	305
Theory of Physic, W. P. Alison, M.D......	210
Practice of Physic, James Home, M.D......	240
Midwifery, James Hamilton, M.D..........	142
Clinical Medicine, Medical Professors......	172
,, Surgery, James Syme...........	36
Military Surgery, Sir G. Ballingall	
Surgery, Sir Charles Bell............ ...	
Pathology, John Thomson, M.D...........	
Medical Jurisprudence, Thomas S. Trail, M.D.	6
Agriculture, David Low..............	30

There are 3 bursaries of the annual value of £100; 6 of £30; 10 of £20; 42 between £10 and £5; 3 under £5, in all, 80. The amount of the annual income for the bursaries is about £1172.

GLASGOW, 1450.

Revenue £9,406 per annum.

	No. of Stud. 1825-26.
PRINCIPAL, Rev. Duncan Macfarlan, D.D.	
Divinity, Rev. Stevenson Macgill, D.D.....	200
Ecclesiastical History, Rev. William Macturk, D.D.	52
Hebrew, Rev. William Fleming, D.D.......	60
Mathematics, James Thomson, L.L.D.......	113
Humanity, William Ramsay, A.B. Cantab. ..	303
Greek, Sir Daniel K. Sandford, A.M. Oxon..	497
Logic, Robert Buchanan, A.M.............	176
Moral Philosophy, James Mylne, A.M.....	144
Natural Philosophy, William Meikleham, L.L.D.	126
Natural History, William Couper, M.D.....	64
Materia Medica, John Couper, M.D........	80
Botany, Sir William Jackson Hooker, L.L.D. F.R.S.	45
Chemistry, Thomas Thomson, M.D. F.R.S..	143
Surgery, John Burns, M.D...............	195
Anatomy, James Jeffray, M.D..	225
Medicine, Charles Badham, M.D. Oxon....	76
Law, Robert Davidson, L.L.D.............	30
Midwifery, William Cumin, M.D....	
Astronomy, William Nicol	

All the professors have salaries varying from £450 to £50. The fees are £3 3s. The medical professors, with the exception of that of Anatomy, are appointed by the crown; the others are a self-elected body. In 1677, John Snell, Esq. left his estate of Uffeton in Warwickshire for the education of students who have been two or three years at Glasgow College, at Balliol College, Oxford. Every scholar to be bound to forfeit £500 if he shall not enter into holy orders, and if at any time he shall accept a benefice in England or Wales, it being the founder's will and desire that every such scholar shall return into Scotland for his preferment. There are now 10 exhibitioners, each of whom, by complying with the rules of Balliol College, has a right for 10 years. The salary is at present £132 to each exhibitioner. Four other exhibitions at the same college, of £20 a-year, founded by Bishop Warner, are generally given to Snell's exhibitioners. It has been alleged, that these exhibitions have been abused; that they have not been filled up by competition, but by relations of the professors, and that the original object of the institution has been totally lost sight of, few or none of the exhibitioners having become clergymen of any denomination. Dr. Adam Smith and Dr. Baillie were educated on this foundation. The fee for M.D. is £25 3s. for C.M. £10 10s. The number of graduates in 1829 was 33. Last year it was above 100. In 1828 the total number of students was 1257. The curriculum for a medical degree is 4 years. All the professors lecture regularly. The session is the same as at Edinburgh.

Bursaries.

1. Adamson's bursary of £12 per annum.
2. Ardkinlass of £200, left by Colonel Blackadder, granted by examination.
3. Armagh. In 1733, £250 were left by the Archbishop of Armagh to purchase lands near Glasgow which were not to be let for more than 21 years, the proceeds to be given to an Irishman or Englishman after 3 years' study. In 1769 the lands of Provan Side, consisting of 100 acres, were bought and let on perpetual lease for £25 per annum. They would now have been of great value.
4. Baxter's bursary of £8 per annum.
5. Boyd's bursaries.
6. Brisbane's bursary, founded 1777, £47 10*s*. per an. for 4 years.
7. Brown's bursary of £5 for 4 years.
8. Craig's bursary of £8 6*s*. 8*d*.
9. Dundonald's 7 bursaries of £30 each.
10. Exchequer bursaries, 6 of £10.
11. Forfar, £8 to several bursars.

In 1811, £1,300 were applied towards payment of the College buildings; by what right it does not appear.

12. 4 foundation bursaries of £10 per annum.
13. Gilhazie's bursary of £6 6*s*. per annum.
14. 8 Hamilton bursaries £22 per annum.
15. Hastie's 3 bursaries of £15 each.
16. Howison's bursaries of £1,000 merks in 1613.
17. Gilchrist's 2 bursaries of £9 each.
18. Hutchinson's bursary of £11.
19. Hyndford's bursary of £5.
20. Leighton's 2 bursaries of £9 each.

21. Mc. Intyre's 2 bursaries, the interest of £2,000.
22. Ross' bursary of £4 4*s.*
23. Lander's bursaries of £100 Scots.
24. Stuart's 2 bursaries of £12 each.
25. Struther's 2 bursaries of £6 13*s.*
26. Walton's bursaries, interest of £400.
27. Williams' 8 bursaries of £40 each. "What time soever prelacy or popery shall be established in North Britain the foresaid grants shall entirely and altogether become null."
28. Wilson's 2 bursaries of £6 13*s.* each.

ABERDEEN, KING'S COLLEGE 1494.

	No. of Stud. 1826-27.
PRINCIPAL, Rev. William Jack, D.D	
Divinity, Rev. Duncan Mearns, D.D.......	69
Civil Law, Patrick Davidson, L.L.D........	
Medicine, James Bannerman, M.D..... ...	
Humanity and Chemistry, Rev. Patrick Forbes, D.D..	80 & 49
Greek, Hugh Macpherson, M.D........... ...	81
Mathematics, John Tulloch, A.M...........	60
Natural Philosophy, Rev. John Fleming, D.D.	51
Moral Philosophy, Hercules Scott, A.M. ...	43
Hebrew, James Bentley, A.M.............	9

The number of students at the college in 1826-27 was 235, of which 150 were divinity. Bursaries, 134; 1 of £50; 1 of £40; 1 of £27; 4 of £25; 4 of £22; 6 of £20; 33 between £20 and £15; the remainder under £15. The value of the bursaries is £1668 per annum.

ABERDEEN, MARISCHAL COLLEGE 1593.

Revenue £902 11*s*.—*Debt* £1352.

	No. of Stud. 1826-27.
PRINCIPAL, Rev. Daniel Dewar, D.D.	
Mathematics, John Cruickshank, L.L.D.....	106
Hebrew, George Gordon McLean, M.D	19
Medicine, Charles Skene, M.D. and John Macrobin, M.D........................	
Chemistry, Thomas Clark, M.D..	11
Natural Philosophy, William Knight, L.L.D.	63
Moral Philosophy and Logic, Rev. George Glennie, D.D...........................	28
Civil and Natural History, James Davidson, M.D....................................	59
Greek, Robert J. Brown, D.D.......... ...	64

The number of bursaries is 106 ; 4 of which are of the value of £26; 10 of £25; 2 of £15; and the remainder under £15. The total amount of income for bursaries is £1100. The number of students attending the college in 1826-27 was 225 of which 68 were medical.

ST. ANDREWS, (ST. SALVATOR AND ST. LEONARD,) 1412.

Revenue £1728.—*Debt* £2667.*

55 bursaries; 7 of £25 and £20 ; 2 of £15; 1 of £14; and 29 of £10.

PRINCIPAL, John Hunter, L.L.D.	
Greek, Andrew Alexander, A.M...........	104
Logic, James Hunter, L.L.D.,.............	59

* This debt was contracted in 1818 for building farm steadings and making repairs, and £15 afterwards increased to £20, set apart for its gradual extinction. Such were the kind of legacies our ancestors left us.

	No. of Stud. 1825-26.
Natural Philosophy, Thomas Jackson, L.L.D.	30
Moral Philosophy and Political Economy, George Cook, D.D.	59
Humanity, Thomas Gillespie, L.L.D.......	119
Civil History, William Ferrie, D.D.	
Mathematics, Thomas Duncan, A.M.......	65
Chemistry, Robert Briggs, M.D.	25
Lecturer on Natural History, Mc Vicar.	40

The number of students at the college in 1825-26 was 223.

ST. MARY'S OR NEW COLLEGE.

Revenue £1076.

PRINCIPAL, Rev. Robert Haldane, D.D.	
Divinity, J. Jackson......................	89
Church History, Rev. George Buist, D.D. ..	ib.
Oriental Languages, William Tennant......	40

The number of bursaries is 17; 1 of £18; 2 of £15; 10 between £15 and £10. The total amount £199. The session lasts four months, commencing at the end of November, and terminating in the beginning of April.

UNIVERSITY OF DUBLIN.

THIS University is a College incorporated by charter, 34 Elizabeth, (1591), under the title of the *College of the Holy and Undivided Trinity, founded by Queen Elizabeth, near Dublin.* The government is entrusted to the Provost and seven senior fellows. The following charges are made half yearly, and include tuition, exclusive of rooms and commons

	Entrance includ. the first half year.			Half year.		
Nobleman. .	£60	0	0	£30	0	0
Fellow Commoner.	30	0	0	15	0	0
Pensioner. .	15	0	0	7	10	0
. .	5	1	3			

Professors and Lecturers.

Regius Divinity, C. R. Elrington, D.D., four assistants, 1829.
Lecturer in Divinity, J. T. O'Brien, D.D , five assistants, 1832.
Catechist, R. MacDonnell, D.D., ten assistants, 1836.
Regius Civil Law, F. Hodgkinson, L.L.D., 1805.
Feudal and English Law, M. Longfield, L.L.D., 1834.
Regius Greek, F. Sadleir, D.D., four assistants, 1833.
Oratory, R. MacDonnell, D.D., one assistant, 1817.
Mathematics, J. MacCullagh, A.M., two assistants, 1835.
Modern History, F. Hodgkinson, L.L.D., one assistant, 1799.
Hebrew, C. W. Wall, D.D., four assistants, 1824.
Astronomer Royal and Professor of Astronomy, Sir W. R. Hamilton, A.B., 1827.
Political Economy, Isaac Butt, L.L.B., 1836.
Physic, W. Stokes, M.D., 1831.
Anatomy and Surgery.
Chemistry, F. Barker, M.D., 1808.
Botany, W. Allman, M.D., 1809.
Lecturer in Natural History, W. Stokes, M.D., 1817.
The King's Professor of French and German, C. Williomier, L.L.D., 1801.

The King's Professor of Italian and Spanish, E. A. Radice, L.L.B., 1827.

There are 7 senior and 18 junior fellows; but nothing is said in the Dublin calendar of their salaries, nor of those of the professors.

FRANCE.

THE education in France being under the superintendance of government,—being in fact directed by a minister in the same manner as the Home, Colonial and Foreign Departments of affairs are managed, the Royal University of France extends its branches over the whole country. The number of functionaries employed in it who are all paid by government is about 5,400. The University, therefore, consists of various Academies, Faculties, &c. distributed over the different towns in France. The number of Academies (which constitute the highest order of seminaries) is 26, the Faculties 14, the secondary Schools of Medicine 18, Examining Committees 22, Royal Colleges 41, Private Colleges 2, Common Colleges 327, and besides numerous Boarding Schools and Institutions under the different Academies. The Academy of Paris, which is a counterpart of the others, and is of the greatest interest to readers in this country, consists of 7 departments, the Seine, the Aube, &c. That of the Seine comprehends the City of Paris; it consists of the Faculty of Theology, the Faculty of Law, the Faculty of Medicine, the Faculty of Sciences, and the Faculty of Arts. There are also 5 Colleges, College Louis-le-Grand, College Henri IV, College St. Louis, College Charlemagne, and College Bourbon, and also a normal school with various branches for preparatory education. The Professors of Law have each 12000 francs, (£476 per annum), without any perquisites. The professors of the Faculty of Arts, Sciences, and Theology have each 6000 francs, (£238) per annum. The Professors of the Faculty of Medicine receive a fixed salary of 7000 francs, (£278 per annum), and for their presence at business and examinations in rotation they receive 3000 francs, (£119). If, however, they absent themselves without a proper excuse, they not only lose their claim to this sum, but are fined 50 francs, (£2.) The Professors of Clinical Medicine and Clinical Surgery, are each assisted at the Hospital by a *chef de Clinique* and an *aide de Clinique*, the former of whom has 1200 francs, (£47), the latter 500 francs, (£19). The *élèves externes* (house surgeons or clerks) receive 500 francs, per annum, (£19 17s), lodging in the Hospital, and board when they are on duty. The *élèves internes* (equivalent to the Clinical Clerks in Scotland) receive no salary nor lodging. All the *élèves* both *internes* and *externes* are elected by public competition. Foreigners are admitted to compete upon the same terms as Frenchmen. Several Englishmen have attained this honorable station, and all the distinguished medical men of Paris have held the situation of *internes* in the Parisian Hospitals. This is a sufficient argument, if any were wanted, in favour of the system. The Physicians and Surgeons of the Hospitals receive only 1200 francs, (£47). The Professors of the Faculty of Medicine, of Montpellier and Strasbourg, receive each 4000 francs, (£159), and 2600 francs, (£79), for attending examinations. The Professors of the Museum of Natural History, at the

Garden of Plants, receive 5000 francs, (£199), and lodging, a Superintendant of Anatomy 3000 francs, (£119), and the Assistant Naturalists 1500 (£59).

All these appointments are understood to be made by public *concours*, different candidates being examined in public as to their qualifications, and the person best fitted for the appointment being chosen. As this system of competition commences at the Elementary Schools, the life of a man of Science in France is one scene of efforts to improve; if he becomes indolent, those who are behind him will soon practically supersede him, and he feels that he is constantly in danger of having his heels trod upon.

The Royal Academy of Medicine was instituted in 1820, for the purpose of affording information to government with regard to the state of the public health in reference especially to epidemics, vaccination, &c. It is divided into 12 departments, each of which takes up the management of different branches of science. This society receives annually from government 40,000 francs, (£1588), and during the year for exigences, from 6 to 10,000 francs. The salary of the perpetual Secretary is 4000 francs, (£159), with lodging; that of the Secretary of the Council is 3000 francs, (£119).

Faculty of Medicine of Paris.

(Each Professor 7000 *francs,* (£278), *and* 3000 *francs;* (£119) *for Examinations).*

Dean of the Faculty, Orfila, 1831.
Anatomy, Breschet, 1836.

Pathological Anatomy, Cruveilhier, 1835.
Physiology, Berard, 1831.
Medical Chemistry, Orfila, 1819.
Medical Physics, Pelletan, 1831.
Medical Natural History, Richard, 1831.
Pharmacology.
Hygiène.
Surgical Pathology, Marjolin, 1818, Gerdy, 1818.
Medical Pathology, Dumeril, 1801, Andral, 1828.
General and Therapeutic Pathology, Broussais, 1831.
Operations and Instruments, Richerand, 1807.
Therapeutics and Materia Medica, Baron Alibert, 1821.
Legal Medecine, Adelon, 1826.
Obstetrics and Diseases of Women and Children, Moreau, 1830.
Clinical Medicine, Fouquier, 1820, Chomel, 1827, Bouillaud, 1831; Rostan, 1833.
Clinical Surgery, Roux, 1820; Cloquet, 1831; Velpeau, 1834, Sanson, 1836.
Clinical Obstetrics, P. Dubois, 1834, Lallemand.
Honorary Professors, De Jussieu, 1796.
Winter course begins 2nd November.
Summer course begins 2nd April.
Price of a degree £43 13*s*.
Chef des travaux Anatomiques 3000 francs, (£119).
3 Prosecteurs, each 1200 francs, (£47).
3 Aides d'Anatomie, 500 francs, (£19).

School of Pharmacy.

Director, Bouillon Lagrange

Assistant, Pelletier.
Treasurer, Robiquet.

Chemistry applied to Pharmacy

Professor, Bussy.
Joint-professor, Gaultier de Claubry.

Practical Pharmacy.

Professor, Lecanu.
Joint-professor, Chevallier.

Natural History of Simple Drugs.

Professor, Guibourt.
Joint-professor, Guilbert.

Botany.

Professor, Guiart.
Joint-Professor, Clarion.

Physics.

Professor, Soubeiran.

Toxicology.

Caventou.
Commissaries, Messrs. Dumeril and Richard.

The object of this school is to teach all the sciences connected with Pharmacy, and to receive such *pharmaciens* as give proof that they have sufficient knowledge to practise their profession. The necessary study is eight years in the dispensatory of a *pharmacien*, or attendance for three years at the School of Pharmacy, paying annually 36 francs, (£1 8*s*), and three years in a dispensatory. In becoming a candidate every one must bring a certificate of his being 25 years of age.—2. A certificate of the necessary study.—3. A certificate of his character signed by two householders, and two *pharmaciens*.—4. He must deposit with the Treasurer 1500 francs, (£59 11*s*). The examinators are two professors of the School of Medicine, the Director of the school and at least two professors. There are four examinations, the 1st upon the principles of Pharmacy; the 2nd upon the Botany and Natural History of simple drugs; the 3rd and the 4th on the practice, last for four days, and consist of at least ten Chemical or Pharmaceutical operations, which the candidate must perform himself, describing the materials, process, and results. If at one of these examinations the candidate is not found competent, he is remanded for three months; at the third trial the examination is adjourned for a year. The interval between each examination is for a month. The candidate is not passed if two third of the votes are not in his favour. 90 *pharmaciens* passed this school in 1835. In England there is no such institution as this. The Apothecaries Company was intended to supply its place, but they have fallen from their original station. A college of Pharmacy ought to be instituted in England.

Faculty of Sciences.

DEAN, Baron Thenard.
Diff. and Integ. Calculus, Lacroix, D. C. Fourcy.
Astronomy, Biot.

Mechanics, Baron Poisson.
Chemistry, Pelouze.
Physics, Dulong.
Algebra, Francœur, Duhamel.
Mineralogy, Beudant.
Botany, Mirbel.
Zoology, G. St. Hilaire.

Joint professors.

Calcul des probabilités, Libri.
Botany, veg. organography, A. St. Hilaire.
Zoology, Ducrotay de Blainville.
Chemistry, Dumas.
Physics, Pouillet.
Geology, Prevost.
Secretary, Fouchy.

Museum of Natural History.

EACH PROFESSOR £199 AND LODGING.

Jardin du Roi.

Human Anatomy, Flourens.
Rural Botany, De Jussieu.
Botany and vegetable Physiology, Brongniart, fils.
Invertibrate Animals, *Articulated*, Audouin; *Inarticulated*, Valenciennes.
Zoology of Quadrupeds, Geoffry St. Hilaire.
Comparative Anatomy, De Blainville.
Chemistry applied to the Arts, Chevreul.
General Chemistry, Gay Lussac.
Geology, Cordier.
Mineralogy, Brongniart, père.

Cultivation and Naturalization of Vegetables, Mirbel.
Zoology of Reptiles and Fishes, Dumeril.
Iconography, *Plants*, Redouté, sen. *Animals*, Chazal.

Royal Academy of Sciences.

(EACH MEMBER £59 PER ANNUM.)

Mathematical Sciences.

1. *Geometry*, Biot, Puissant, De Libri, Lacroix, Biot Poinsot.
2. *Mechanics*, Baron de Prony, Poncelet, Maulard, Cauchy, Baron Dupin, Navier.
3. *Astronomy*, Comte Cassini, Le Français Lalande Bouvard, Savary, Mathieu, Baron de Damoiseau.
4. *Geography and Navigation*, Beautems Beaupré, Baron Roussin, De Freycinet.
5. *General Physics*, Savart, Gay Lussac, Poisson, Girard, Dulong, Becquerel.

Physical Sciences.

6. *Chemistry*, Deyeux, Thenard, D'Arcet, Chevreul, Dumas, Robiquet.
7. *Mineralogy*, Beaumont, Berthier, Brongniart, père, Brochant, Cordier, Beudant.
8. *Botany*, Jussieu, Ad. de Jussieu, Brongniart, fils Richard, Mirbel, A. St. Hilaire.
7. *Rural Economy, Veterinary Art*, Tessier, Huzard Silvestre, Turpin, Dutrochet, Morel Vindé.
10. *Anatomy, Zoology*, G. St. Hilaire, F. Cuvier, J. St Hilaire, Dumeril, Savigny, De Blainville.

11. *Medicine and Surgery,* Double, Larrey, Magendie, Serres, Roux, Breschet.

Perpetual Secretaries, Arago of Mathematical, Flourens of the Physical Sciences, 6000 francs, (£238) each.

Polytechnic School.

The object of this school is to educate students for the Artillery, Marines, Army and Navy, civil and military engineers, manufacturies of gunpowder and saltpetre, and for all the public situations which require an extensive knowledge of the physical and mathematical sciences. The pupils are admitted by *concours,* which is opened on the 1st of August every year at Paris, and in the principal cities of the kingdom. The subjects for examination are published on the 1st of April. The candidate must be a Frenchman between 16 and 20, and must have been vaccinated or had the small pox. There are four examinators to the school. The length of study is two years; in certain cases three years are allowed, but never longer. The studies are Analysis, Mechanics, Analysis applied to Geometry, descriptive Geometry, Geodesy and Topography, Statistics, Physics, Chemistry, and Manipulations, Architecture, French composition (during the first year), German and English (during the second.) Every year the students are publicly examined. At the end of the 2nd year the students who have completed their studies state the service which they prefer.

The scientific professors are,

Director of studies, Dulong, 10,000 francs, (£397.)

5000 *francs each,* (£198.)

Professors of Analysis and Mechanics, Mathieu, and Navier.

Professor of Descriptive Geometry, Leroy.

„ Physics, Lamé.

„ Chemistry, Gay Lussac, and Baron Thenard.

Professor of Geodesy, &c. Savary.

2000 *francs each* (£78).

Répétiteurs, Analysis, Coriolis and Liouville.

„ Geometry, Olivier.

„ Physics, Lehot.

„ Chemistry, Dumas, and Pelouze.

„ Geodesy, Duhamel.

1500 *francs each,* (£59.)

Keepers of the Museum, Obelliane, Gaultier de Claubry and Brocchi.

The candidates for admission into the school are examined, 1st upon Arithmetic, Logarithms; 2nd Elements of Geometry, comprising the properties of spherical triangles; 3rd Algebra, comprehending equations of the first and second degree indeterminate equations, the binomial theorem, the resolution of numerical equations by approximation, &c.; 4th Rectilinear Trigonometry, and the use of tables of sines; 5th the Composition and decomposition of forces acting on the same plane, the composition or equilibrium of parallel forces, the equilibrium of simple machines, &c.; 6th the Complete discussion of lines represented by equations of the first and second degree with two unknown quantities, and the principles of comic sections; 7th an Example of the resolution of a rectilinear triangle is proposed to each of the candidates in order to shew his knowledge of the use of Logarithmic Tables, with tables of 7 decimals; 8th a Translation of a portion of Latin, and to treat in French a subject given; 9th they must copy a drawing partly shaded in chalk. The number of candidates who underwent these examinations in 1835, and were admitted as pupils was 132.

The following on the authority of Mr. Bulwer are the emoluments of Professors Thenard, Gay Lussac and Poisson.

*Baron Thenard.**

	fr.	£
Minister at the Conseil Royal............	12000	480
Professor at the Polytechnic School.......	5000	200
Dean of the Faculty of Sciences..........	6000	240
Professor at the College of France........	5000	200
Member of the Committee of Arts and Manufactures..........................	2400	96
Member of the Institute.................	1500	60
		1276

M. Gay Lussac.

Professor at the Polytechnic School......	5000	200
Professor at the Faculty.................	4500	180
,, Tobacco Manufacture	3000	120
Member of the Committee of Arts and Manufactures.........................	2400	96
Member of the Committee of the Council of Powder and Saltpetre Manufactory, with a house at the Arsenal................	4000	160

* From Bulwer's England and the English, vol. 2, p. 192.

	fr.	£
Assayer of Mint	20000	800
Member of the Institute	1500	60
		1616

M. le Baron Poisson.

Member of the Royal Council	12000	480
Examinator at the Polytechnic School	6000	240
Member of the Board of Longitude	6000	240
Professor of Mechanics at the Faculty		
Member of the Institute	1500	60
		1020

DENMARK.

Copenhagen University, 1479.

Chemistry, Oersted.
Botany, Schouw.
Mineralogy, Forchhammer.
Pharmacology and Forensic Medicine, C. Otto.
Anatomy, D. F. Esricht.
Surgery, J. L. Saxtorph.
Physiology, D. J. Herholdt.
Pathology and Therapeutics, C. L. Bang.
The total number of professors is 37 in the four Faculties
The expense of a medical degree is £9 10*s*.

The test is a dissertation which must be defended during a whole day.

The income of the ordinary Professors is £100 per annum, and of the extraordinary, £80 without any perquisites

PRUSSIA.

UNIVERSITY OF BERLIN 1809.

This University musters 16 ordinary professors of Medicine, among whom are Hufeland, Link, Rust, and Müller, and 10 extraordinary professors. All the ordinary and 4 of the extraordinary professors receive salaries, the joint amount of which is £2,300—303 medical students—total students 1800.

BONN 1818.

11 Ordinary, and 1 extraordinary professors of Medicine; their joint annual salaries amount to £1,695 —156 medical students—total students 816.

BRESLAW 1811.

7 Ordinary and 2 extraordinary professors of Medicine; annual amount of salaries £997—students 829 —medical students 107

GREIFSWALD 1456.

4 Ordinary professors; annual salaries jointly £619 —students 187—medical students 60.

HALLE 1694.

4 Ordinary and 2 extraordinary professors; their joint salaries amount to £1,350—students 742—medical students 114.

KÖNIGSBERG 1544.

5 Ordinary and 2 extraordinary professors of Medicine, joint salaries £797—students 422—medical students 83. The kingdom of Prussia contains no less

than 124 colleges for general instruction, in which the number of teachers is 1,334 and of scholars 24,461. The annual school fees in these colleges amounts to £3.

SWEDISH UNIVERSITIES.

UNIVERSITY OF UPSALA.

FOUNDED 1477 BY STENO STURE.

PROFESSORS.

Theology.

Johannes Thorsander, Primarius Professor of Theology.
Christianus Ericus Fahlcrantz, Dogmatic, Moral and Symbolic Theology.
Andreas Ericus Knös, Pastoral Theology.
Johannes Albertus Butsch, Ecclesiastical History.

Law.

Laurentius Georgius Rabenius, Jurisprudence and Law of Commerce.
Jacobus Edvardus Boëthius, Roman and Civil Law.
Carolus Johannes Schlyter, History of Law.

Medicine.

Petrus von Afzelius, Emeritus Professor of Medicine.
Georgius Wahlenberg, Medicine and Botany.
Henricus Wilhelmus Romanson. Anatomy and Surgery
Israël Hwasser, Theory and Practice of Medicine.
Adamus Afzelius, Materia Medica and Dietetics.

Philosophy.

Olavus Kolmodin, Rhetoric.

Jöns Svanberg, Junior Mathematics.
Johannes Bredman, Astronomy.
Samuel Grubbe, Ethics.
Ericus Gustavus Geijer, History.
Laurentius Petrus Walmstedt, Chemistry.
Petrus Daniel Amadeus Atterbom, Latin Literature.
Fredericus Rudberg, Physics.
Petrus Sjöbring, Oriental Languages.
Johannes Henricus Schröder, Literary History and Archæology.
Adolphus Törneros, Rhetoric and Poetry.
Elias Fries, Practical Economy.
Wilhelmus Fredericus Palmblad, Greek.
Ericus Augustus Schröder, Logic and Metaphysics.

ADJUNCTI.

Theology.

Andreas Bernhardi, Lundquist.
Carolus Jonas, Almquist.

Law.

Carolus Olavus Delldén, Roman and Civil Law.
Petrus Ericus Bergfalk, Law of Economy and Commerce

Medicine.

Petrus Jacobus Liedbeck, Prosector of Anatomy

Philosophy.

Elavus Wallquist, Practical Chemistry.
Henricus Falck, Mathematics and Natural Philosophy.
Gustavus Svanberg, Astronomical Observer.

Henricus Gerhardus Lindgren, Greek and Oriental Literature.
Jonas Bernhardus Runsten, Rhetoric.
Jonas Sellén, Latin.
Andreas Södermark, Greek.
Claudus Olavius Ramström, Oriental Languages.
Petrus Wilhelmus Afzelius, Librarian.

DOCENTES.

Theology.

Felix Sjöstedt,
Thure Annerstedt,
Samuel Laurentius Ljundahl.

Law.

Johannes Christophorus Lindblad.

Philosophy.

Christophorus Jacobus Boström,
Petrus Jacobus Emanuelsson,
Carolus Julius Björlingsson,
Ericus Almquist,
Justus Collén,
Otto Fredericus Tullberg,
Carolus Augustus Hagberg,
Johannes Albertus Dahlström,
Jacobus Udalricus Segerstedt,
Johannes Spongberg,
Nicolaus Johannes Berlin,
Olaus Wingquist,
Petrus Ericus Ludovicus Thyselius,
Carolus Johannes Tornberg,

Carolus Wilhelmus Böttiger,
Fredericus Ferdinandus Carlson,
Carolus Edvardus Zedritz,
Carolus Julius Lénström,
Emanuel Gabriel Björling,
Jacobus Edvardus Ström,
Ericus Engelbertus Ostling.

MAGISTRI.

Carolus Gustavus von Bahr, Riding.
Israël Strömberg, Teutonic Language.
Jonas Kullenberg, Gustavus von Heidenstam, Gymnastics.
Johannes Way, Painting.
Carolus Fredericus Lignell, French and English.
Johannes Ericus Nordblom, Music.

UNIVERSITY OF LUND.

FOUNDED 1668 BY CHARLES XI.

Dean.—Jac. Sönnerberg.

PROFESSORS.

Theology.

Andr. Jac. Hellstenius, Primarius Professor of Theology.
Martinus E. Ahlman, Dogmatic Theology.
B. J. Bergquist, Professor of Theology.
J. H. Thomander, Professor of Pastoral Theology.

Law.

Fredricus Cederschöld, Morals.
Joh. Holmbergson, Civil Law.

Medicine.

Arv. Henr. Florman, Anatomy and Surgery *enjoys vacation.*

Eberh. Z. Munck af Rosenschöld, Theory of Medicine enjoys vacation, N. H. Lovén. lectures.

C. F. Liljevalch, Obstetrics.

J. B. Pramberg, Osteology.

Philosophy.

Jon. Alb. Engeström, Physics and Chemistry.
Jonas Brag, Astronomy and Physic.
Andr. O. Lindfors, Rhetoric and Poetry.
Ebbe Samuel Bring, History.
C. Georgius Brunius, Greek.
B. Magnus Bolmeer, Oriental Languages.
Laur. Fredr. Westman, Moral Philosophy.
Car. Joh. Dis Hill, Algebra and Trigonometry.
S. Nilsson, Natural History.
Joh. Weilh. Zetterstedt, Botany.

ADJUNCTI.

Theology.

H. Reuterdahl,
Joh. Pettersson.

Law.

Carolus Johannes Schlyter,
Fred. Schrevelius.

Medicine.

Joh. Rabbén,
Arvid Bruzelius.

Philosophy.

Ad. Wilh. Ekelund, Mathematics.
Carl Fredr. Fagerström, Chemistry.
Petrus Sam. Munck af Rosenschöld, Natural Philosophy.
Abraham Cronholm, Antiquities.
Andreas Hallström, Greek.
Johannes Gustavus Ek, Latin.
Alexis Eduard Linblom,
S. Rydberg.

MAGISTRI DOCENTES

Theology.

N. O. Ahnfelt,
Johannes Magnus Melin,
Haquinus Hellman.

Medicine.

N. H. Lovén, teaches the Theory of Medicine.
F. T. Berg, Anatomy.
A. L Huasser, Practice of Medicine.

Philosophy.

Carolus J. Sundevall, Zoology.
Carol. Fredr. Leche, French, German and English.
A Borgström, History and Statistics.
A. Gust. Dahlbom, Natural History
Assar Lindeblad, Fine Arts.
Bror Emil Hildebrand, Numismatics.
Johannes Matthias Löfmark, Physics.
S. L. Lovén, Natural History.
Chr. Tegnér, Literature.

S. F. Krook, Hebrew.
Henricus Schönbeck, Fine Arts.
Joh. V. Hoflund, Practical Philosophy.
Eduardus Guilielmus Berling, History.
Jacobus Georgius Agardh, Botany.
J. M. Agardh, Arithmetic.
And. M. Stenkula, Economy.
Matthias N. Cederschiöld, Greek.
Fredricus Emanuel Borg, Arabic.

Artium Cultiorum et Equestrium Magistri.

Emanuel Wenster, Music.
G. J. Schartau; Joh. M. Lang, Gymnastics.
Jöns Boström, Sculpture.

1. Lectures.—The public lectures are delivered four times a week and during one hour, viz. Monday, Tuesday, Thursday and Friday—Wednesday and Saturday are devoted to practical exercises in Anatomy, Chemistry, Botany, Painting, Music, Riding, Use of Arms, &c. The session lasts from the 1st October for eight months.

2. Emoluments of professors.—The salaries of the Professors amount to between 1300 (£296) and 1500 (£342) rix-dollars. The Theological Professors usually obtain a church in the neighbourhood of the University. The Professors give voluntarily private lessons. Students are not obliged to attend, but those who do so pay five rix dollars (£1 3s.) for every six months. The receipts of the Professors from this source rarely exceed 400 rix dollars (£91). A number of the professors do not even realise 200 rix

dollars (£45 10s.) The students pay nothing to the University except on their admission. This expense does not exceed 25 rix dollars (£3 12s.). Admission is also granted to the faculties of medicine—Jurisprudence and Theology by paying a few rix dollars.

3. DEGREES.—The degrees granted by the Universities are—Liberalium artium Magister (Dr. in Philosophy); Dr. Medicinæ; Juris utriusque Dr.; S. S. Theologiæ Dr. There are no regulations with regard to curricula or to the time required for attending the universities in order to acquire a degree. When a student considers himself sufficiently prepared, he requests each professor to examine him privately. This examination is termed *Tentamen.* If the professor finds him qualified he admits him to the examination before the faculty. The faculty examination must follow the *tentamen* within six months. But if the student allows six months to elapse between the examinations, he cannot undergo the faculty examination without again submitting to the *tentamen.* These private examinations last for four or five hours, and the professor examines in all the branches of the science which he teaches. There are no methods prescribed for eliciting the knowledge of the candidate; the professors extend or contract the limits of the examination according to will. The students previously know the qualifications of the professors and prepare themselves accordingly *(les élèves savent fort bien d'avance les prétentions du professeur et mesurent en conséquence leurs efforts.)*

The faculty of Philosophy gives the degree of Master of Arts, but it gives also the sub-degree of *candidatus medico philosophiæ,* to students of the faculty of medicine and of *candidatus juridico philosophiæ*, to the students of the faculty of jurisprudence. To those who intend entering into the civil service of the state this examination is modified according as the destination is the Chancery—the College of Commerce or the College of Mines.

The degrees are conferred by the Dean of the Faculty with great solemnity at the altar of the cathedral. The graduates are at the expense of this ceremony; the expense varies. When the number is great, the expense is less than when it is smaller; but it rarely exceeds sixty-six rix dollars (£15); the mean sum may be estimated at forty rix dollars (£9). The faculty of philosophy grants degrees every three years; formerly the number was limited to fifty, now it is not limited. At Upsala it does not exceed eighty—at Lund it is between one half or two-thirds of this number. The faculty of medicine grants degrees at indefinite intervals, and as often as the number of candidates is sufficient to support the expense of the ceremony. The mean number of graduates may be estimated at twenty-five, it varies from sixteen to fifty annually.

The faculties of jurisprudence and theology grant degrees very rarely, not above once in ten or twenty years. In the faculty of theology the King nominates the candidates for degrees;—it is a title rather than a degree. The nomination by the King affords all the privileges of the title; but it is not until the ceremony takes place that the Doctor's hat *(chapeau)* is given, which the Doctors in Theology always wear afterwards, and which is held in high esteem by the clergy. The graduates are always of an advanced age, generally persons distinguished by long service in the church. A few of them have undergone examinations before the faculty; this degree is similar to that of Doctor of Laws in England which is only honorary. The examinations in the faculty of philosophy which confer the titles of *candidatus philosophiæ, medico philosophiæ* and *juridico philosophiæ* are held in the apartments of the faculty with closed doors; generally five or six are examined at a time, so as to leave one student with each professor in a separate room. The examination is a mere form, in which a number of the professors take no part because they become acquainted with the qualifications of the candidate by the *tentamen* and give their opinion accordingly. The candidates after examination receive their qualifications by the application of certain terms according as they deserve, as follow: *Admittitur cum admonitione; Admittitur; Admittitur cum approbatione; Adprobatur; Adprobatur non sine laude; Adprobatur cum laude: laudatur; laudatur in optima forma.*

In the other three faculties two examinations are required to attain the degree of Doctor. The first gives the title of *candidatus* and is private—but before the whole faculty. The second gives the title of *Licentiatus* and is conducted before this faculty, and in presence of the other students of the faculty.

4. Election of Professors.—Persons who consider themselves competent, give in their names to the faculty in which the vacancy occurs; the faculty compares and examines their competency; the senatus academicus elects three individuals from whom the king chooses one. The professors have retiring pensions termed *salaria emeritorum.*

5. Number of Students.—The number of students at the Universities of Sweden fluctuates considerably. The mean number may be estimated at 1200 at Upsala and 800 at Lund.

SWEDISH SCHOOLS AND INSTITUTIONS.

SCHOOL OF MEDICINE AT STOCKHOLM.

Each Professor 1200 *rix dollars* (£273.)

Anatomy and Physiology, A. Retzius.
Organic Materia Medica, P. Wahlberg.
Inorganic Materia Medica, Pharmacy and Chemical Physiology, C. G. Mosander.
Theoretical and Practical Medicine, Von Dobeln.
Surgery, Ehstrâmer.
Obstetrics, Cederschold.

Prosector, Sunderwall.
Laborator, Wielander.
Demonstrator, Biorhman.
} *each* 300 *rix dollars* (£68.)

The school possesses dissecting rooms, a laboratory, a museum of anatomical, physiological and pharmaceutical preparations and chemical apparatus; a library, apartments for lodging the students, two great hospitals near the school, a lying-in-hospital, a garden with pharmaceutical plants, &c.—This school has only existed for twenty years. By a strange regulation of government (*bizarrerie du gouvernement*) the pupils of this school cannot be employed in the medical service of the state, and cannot acquire the title of Doctor. From this circumstance the school is very inactive. The students who study medicine at the Universities without hospitals, without dissecting and merely by learning by heart the lectures of the professors, not half so numerous as at the Stockholm school, are eligible after undergoing an examination on surgical operations to all the military and civil medical situations in Sweden. It is to be hoped that a change will speedily be effected, and that the study of medicine will be principally carried on at Stockholm—the only place in Sweden where there are hospitals of sufficient size to afford experience to the students—and which at present are not available.

VETERINARY SCHOOL AT STOCKHOLM.

Director and Professor of Veterinary Medicine, Norling.
Professor of Comparative Anatomy, G. Billeng.
,, ,, Veterinary Pharmacy, R. Dahlstrom.

This school possesses a large building for lodging the professors and students, a very beautiful museum and stables for diseased animals, a botanic garden, a dispensary, a forge, &c. The number of students is from thirty to forty. The salary of the professors is 1200 rix dollars (£273.)

Military Academy at Carlberg near Stockholm is conducted by General Levren. It has sixteen professors and 200 students, between thirteen and twenty years of age. It affords only preparatory knowledge.

School of Officers of Artillery, Navy and Army at Marienberg near Stockholm. It is under the direction of the Prince Royal. It has fourteen professors and five assistants (*répétiteurs.*) The number of students varies from thirty to fifty; the course of study lasts two years.

TECHNOLOGICAL SCHOOL at Stockholm under the dirction of M. Schwartz—has four professors and some fine manufactories.

The FORESTER'S SCHOOL at Stockholm under the direction of M. Ström, has two professors.

SCHOOL OF PAINTING AND ARCHITECTURE under the direction of the Academy of Fine Arts, has thirteen professors.

SCHOOL OF MINES at Fahlun under the direction of the College of Mines, has two professors, and from twenty to thirty students.

SCHOOL OF AGRICULTURE at Degeberg in West Gothland under the direction of the proprietor of Degeberg, M. Nonnen, has four professors and about thirty pupils.

SWEDISH ACADEMY of Belles Lettres, Secretary M. V. Beshow, salary 600 rix dollars (£136.)

ACADEMY OF SCIENCES, of the Mathematical, Physical, and Economical Sciences, Secretary M. Berzelius, salary 1333 rix dollars (£304.) Native members 100, foreign members seventy-five.

ACADEMY OF BELLES LETTRES History and Antiquities. The object of this institution is History, but principally Antiquities as well as the rectification of inscriptions on public monuments and on medals struck by government, corporations or private individuals. Secretary M. Hildebrand, salary 500 rix dollars (£115); native members forty, foreign members ten; corresponding members, number unlimited.

ACADEMY OF AGRICULTURE. Director M. Mörner, salary 400 rix dollars (£91); Secretary M. Grunbe salary 666 rix dollars (£151); native members sixty-two, foreign members twelve; corresponding number unlimited.

ACADEMY OF MUSIC. Secretary M. Frigel, salary 100 rix dollars (£23); number of members unlimited.

ACADEMY OF FINE ARTS. Director M. Blom, Secretary M. Gerss, salary 300 rix dollars (£68.)

ACADEMY OF MILITARY SCIENCES. Secretary M. Bysffröm, salary 800 rix dollars (£174); number of members 200.

MEDICAL SOCIETY. Secretary M. Setterblad, salary 500 rix dollars (£115); number unlimited.

SOCIETY OF SCIENCES at Upsala. Secretary M. J. Wanberg; number of native members forty-five, foreign members twenty-four.

SOCIETY OF SCIENCES AND BELLES LETTRES at Gottenbourg. Secretary M. Fahraus; number unlimited.

SOCIETY OF INDUSTRY at Stockholm. Secretary M. Seheutz; salary 500 rix dollars (£115.)

PUBLIC LIBRARIES OF SWEDEN.

Royal library at Stockholm - - -	80,000 vols.
Library of Academy of Sciences - -	15,000 do.
Library of Engeström - - - -	30,000 do.
Library of the University of Upsala -	60,000 do.
Library of the University of Lund - -	25,000 do.

The Gymnasia or provincial schools of Sweden have each their library which in general is small.

LEIPZIG 1409.

ORDINARY PROFESSORS.

Physiology, General Anatomy and Human developmental Anatomy, Osteology and Syndesmology, Weber

General Physiology, Kühn Sen.
Special Therapeutics and Materia Medica, Haase and Cerutti.
Clinical Surgery, Theoretical Surgery, Operative Ophthalmology, Kuhl.
Clinical Medicine (public), Auscultation and Percussion, Cutaneous Diseases, Clarus.
Clinical Obstetrics, Diseases of Children, Jörg.
Criminal Psychology, Heinroth.
Medical Police, Forensic and State Medicine, Wendler.
Chemistry, Pharmacy and Practical Chemistry, Kühn Jun.
Botany and Natural History, Schwägrichen.

EXTRAORDINARY PROFESSORS.

Pharmacognosy and Pharmacology, Schwartze.
Special and General Therapeutics, and Pathological Anatomy, Cerutti.
General Therapeutics, Ophthalmology and Dietetrics, Radius.
Clinical Ophthalmology, Ritterich.
Clinical Medicine and Surgery, Walther.
Lecturer on Diseases of the Lungs and Heart, Braune.
Comparative Anatomy, and Experimental Physiology, Volkmann.
Botany, Kunze.
General Surgery and Diseases of the Eyes, Carus.

PRIVATI DOCENTES.

History of Medicine, Formularies, Diseases of the Eyes and Ears, Kneschke.

Surgical Anatomy, Bock.
General and Comparative Pathology, Funk.
Pharmacology, Scheidhauer.
General Pathology, Neubert.

OTHER PROFESSORS.

Astronomy, Moebius.
Experimental Philosophy, Fechner.
Zoology, Poeppig.
Botany, Petermann.

The anatomical collection consists of above 1000 anatomical and physiological preparations dried and prepared in spirits, of as many pathological specimens, 600 zoological, and fifty wax preparations.

GOTTINGEN, 1734.

Natural History, Physiology and Comparative Anatomy, Blumenbach.
Botany, Schrader and Bartling.
Mineralogy, Hausmann.
Physics, Weber.
Chemistry, Woehler.
Anatomy and Surgery, Langenbeck.
Clinical Medicine and Surgery.
Physiology, Comparative Anatomy, Zoology, Berthold.
General and Special Pathology, Marx.
Obstetrics, Osiander.

Formerly the number of students amounted to 1600; at present it is only 800 or 900. The Surgico-Ophthalmic Hospital which is attended by Dr. Langenbeck, and formerly by Himly, by Privat.-Doc.-Dr. Pauli, assistant to Dr. Langenbeck, and Dr. Ruete, assistant to the Hospital contains 36 beds, and affords medical aid for 250 to 300 patients per annum.

PRIVATI DOCENTES.

Physiology, Pathological Anatomy, Herbst.
General Nosology, Materia Medica, Kraus.
Chemistry and Pharmacy, Stromeyer.
Obstetrics, Trefurt.

RUSSIAN UNIVERSITIES.

It is subject of regret that the application to the Russian government functionaries has not been attended with the success, which requests in other quarters have met with. The following summary has been derived from the report presented to the Emperor at the end of 1835, by the Minister of public instruction.

1. UNIVERSITY OF ST. PETERSBURG.—This university possesses 52 *professors* or functionaries, and 230 *students*. It is connected with eight gymnasia divided among six governments. The library of the university contains 21,751 volumes.

2. UNIVERSITY OF MOSCOW.—This institution possesses 161 *professors* or functionaries and 456 *pupils*, of whom in 1835, 200 took their degrees. In the nine governments over which it presides, there are a lyceum, an institute for nobles, nine gymnasia, five boarding-schools, seventy-five central schools and 152 parochial

schools. The library contains 44,881 volumes. The students are overlooked by an inspector and five sub-inspectors. A second gymnasium is forming at Moscow. The government has sanctioned the request of the merchants of this city, that a gratuitous school should be established for the sons of merchants.

3. UNIVERSITY OF CRACOW—possesses fifty-four *professors* and 389 *pupils*. It includes eight governments which contain seven gymnasia. The library contains 24,210 volumes and manuscripts. It has besides a cabinet of medals and a botanic garden.

4. UNIVERSITY OF KASAN—has seventy *professors*, 238 *students*, and a library composed of 28,502 books and 244 manuscripts. The nine governments of its jurisdiction possess nine gymnasia. In future, courses of Arabic, Persian, Tartar, Turkish and Mongol will be given. Since the middle of 1834 it has published literary announcements.

5. UNIVERSITY OF DORPAT—possesses sixty-eight *professors* and 524 *students*. In 1835 it granted diplomas to 132 young persons. The library contains 58,936 volumes. The botanic garden contains 14,535 species of plants, and the museum 13,365 objects. In the three governments of the jurisdiction there are four gymnasia, 156 boarding schools or schools with 3750 pupils. The professors of its university since 1834, have published above forty works, dissertations or discourses. The institute of professors sent in 1833, thirteen young persons to Berlin, under the special care of Professor Kramchfeld, and more lately of Major Mansurow. At the request of the latter, the Emperor has granted to these students, an addition to the 700 crowns, which

they receive annually. This addition amounts in some cases to 200, in others to 300 Prussian crowns.

6. UNIVERSITY OF KIEW OR ST. WLADIMIR—has forty-three *professors* and sixty-two *pupils*. Its jurisdiction comprises four governments, a lyceum, seven gymnasia, twenty-five boarding-schools with 119 *professors* and 461 *pupils*. It is enriched with the spoils of that of Wilna, which has been suppressed. Its annual revenue amounts to 249,304 roubles.

7. UNIVERSITY OF WHITE RUSSIA—comprehends five governments, twelve gymnasia, and a boarding-school.

8. UNIVERSITY OF ODESSA — there are at the lyceum of Odessa thirty-seven *professors*, and in the three governments and province, over which it possesses jurisdiction, five gymnasia, thirteen boarding-schools and 608 *pupils*.

9. *In the Provinces beyond Caucasus* there are a gymnasium, a boarding-school for nobles and twelve central schools.

10. The SCHOOLS OF SIBERIA are in great want of *professors*, and the same observation holds with regard to the other schools of the empire.

RUSSIAN SCIENTIFIC INSTITUTIONS.

1. The IMPERIAL ACADEMY of Russia consists of sixty-three members, exclusive of seventeen honorary members. It has a library of 4083 volumes and 112 manuscripts. In its weekly meetings it is occupied with a new improved edition of a Russian dictionary.

One of its members is engaged with the Egyptian Archeology. In the first part he examines the system of Champollion; the second rule contains the hieroglyphics and the mysteries of the writings of the priests; the third will be devoted to the explication of the sacerdotal or holy writing.

The ACADEMY OF SCIENCES of St. Petersburg published in the course of the year 1835, micrometric measurements of 272 stars by Struve, the observations of Kuppfer on his journey to the Caucasus, and the continuation of the work of Marshal Bieberstein on the Flora of Caucasus. Buildings to the extent of 25,000 roubles have been undertaken in order to increase the conveniences for the natural history collection. The Academy give works published by itself to the amount of 36,000 roubles to the different gymnasia and schools for the purpose of promoting science.

3. The INSTITUTION for the education of SCHOOLMASTERS in St. Petersburg has forty-five *professors* and 144 students. The library contains 5,120 volumes; purchases of books to the extent of 16,000 roubles have since been made.

5. The OBSERVATORY, it is calculated, will cost 1,310,446 roubles. The purchase and transport of the great telescope, made at Munich by Utzcheider, will cost at least 231,428 roubles.

5. The IMPERIAL LIBRARY contains 395,199 volumes and 16,941 manuscripts. In the number are included 115,790 volumes taken from the library at Warsaw.

6. The MUSEUM OF RUMJANZOW has a library of 30,381 volumes, 632 manuscripts, 606 geographical charts and plans, a cabinet of mineralogy containing

12,974 specimens arranged according to the system of Werner, and a cabinet of medals containing 1,594 medals or coins.

7. The PHARMACEUTICAL SOCIETY of St. Petersburg composed of 124 members and 128 honorary members, with a school for students of pharmacy which had sixteen pupils in 1834.

8. The MINERALOGICAL SOCIETY consisting of 266 members and receiving from government 10,000 roubles. It held eighteen meetings in 1835, in which it examined sixteen works and published six. Its cabinet contains 9,500 fossils.

9. The SOCIETY OF NATURALISTS of Moscow consists of 573 members and held ten meetings in 1835, examined thirteen treatises and published seven volumes of reports with engravings.

10. The SOCIETY OF RUSSIAN ANTIQUARIES has seventy-one members, and has published the sixth part of its transactions.

11. The SOCIETY OF THE FRIENDS OF NATIONAL LITERATURE of Kasan has sixty-nine members, who have agreed upon changing its name to *The Philosophical History Society.* Its object is to publish historical and statistical documents with reference to the Eastern provinces of Russia, and dictionaries of the languages of the people which inhabit them.

12. The RIGA SOCIETY OF LETTONIAN LITERATURE, has 113 members, and publishes a journal.

13. PRACTICAL LITERARY SOCIETY of Riga has seventy-six members with a school of arts, possessing 130 pupils. Its director publishes the *Stadtblatter.*

14. ANTIQUARIAN SOCIETY for the provinces of the Baltic at Riga.

15. The Courlandish Society of Mittau of the Friends of Literature and Arts consisting of 244 members, possesses a library of 3062 volumes and 3000 pamphlets.

16. Museum and Athæneum of Mittau has eighty-six members. Its object is to collect the antiquities of the Baltic provinces.

17. The Literary Society of Ahrensburg, fifty members. Its object is to investigate the language of Esthonia.

The following table exhibits the great improvements made in education under the Russian government during the present century.

	1804.		1835.	
	Schools.	Pupils	Schools.	Pupils.
Schools under the Minister of public instruction	499	33,481	1,681	85,707
Military Schools	15	29,000	152	179,500
Ecclesiastical Schools	100	15,000	701	67,024
Special Schools	13	31,775	1,622	127,864

Of the schools 2,841 are supported at the expense of the state, of the pupils 252,311 are bursars. The total amount of money expended by government on education is 28,734,141 roubles. The population of Russia in Europe has been estimated at 48,000,000; and the number educated at 1,058,000.

PUBLIC LIBRARIES AND BOOKS.

The contents of the Public Libraries of Europe, which cannot amount to fewer than between seven or eight hundred, have been estimated by Malthus at 19,847,000 volumes. Of these contents there are preserved in

Germany	Austrian States	2,220,000	6,741,000
	Prussian do.	997,000	
	Other Ger. do.	3,524,000	
France			6,427,000
Italy			3,139,000
Great Britain			1,533,000
Russian Empire			880,000
			12,720,000

TABLE OF THE LARGEST LIBRARIES IN THE WORLD, ANCIENT AND MODERN, FROM M. BALBI. &C.

	Vls. pr.	MSS.		Vls. pr.	MSS.
Paris, *Royal*	626,000	80,000	Florence, *Magliabecchian*	150,000	12,000
Munich, *Royal*	540,000	16,000	Breslau, *University*	150,000	2,300
St. Petersburg, *Imperial*	432,000	15,000?	Munich, *University*	150,000	2,000
Copenhagen, *Royal*	410,000	16,000	Edinburgh, *Advocates'*	150,000	6,000
Vienna, *Imperial*	284,000	16,000	Jeddo,	150,000?	
Berlin, *Royal*	280,000	5,000	Miaco,	150,000?	
Pekin, *Imperial*	280,000		Alexandria, *Ptolemy's*	110,000?	
Dresden, *Royal*	260,000	2,700	Tripoli in Syria, *of the Kadis*	110,000?	
Göttingen, *University*	250,000	5,000	Cairo, *Caliphs'*	110,000?	
London, *British Museum*	220,000	22,000	Alexandria, *burnt by Arabs*	100,000?	
Oxford, *Bodleian*	200,000	25,000	Rome, *Ulpian*	100,000?	
Wolfenbuttel, *Ducal*	200,000?	4,500	Cordova, *Caliphs'*	100,000?	
Madrid, *Royal*	200,000	2,500?	Edinburgh, *University*	77,200	
Paris, *Arsenal*	186,000	5,000	Glasgow *University*	30,000	
Stuttgard, *Royal*	174,000	1,800			
Milan, *Brera*	169,000	1,000			
Naples, *Museum*	165,000	3,000			

CONTENTS OF THE ROYAL LIBRARY AT PARIS IN 1822.

Volumes of every description	.	.	450,000
450,000 pamphlets and fugitive pieces,—equal to vols.	.	.	45,000
1,200,000 maps, diplomas, &c.	„	do. .	24,000
80,000 manuscripts .	„	do. .	80,000
1,200,000 engravings, prints, &c.	„	do. .	6,000
			605,000

Since 1822, this library, according to M. Balbi, has been increasing at the rate of upwards of 8,000 volumes a year.

CONTENTS OF THE IMPERIAL LIBRARY AT VIENNA.

Volumes printed since the year 1500 .	270,000
Volumes of *Incunables* (i. e. printed in the 15th century)	12,000
Manuscripts	16,016
Volumes, Portfolios, &c. forming a collection of Maps	1,242
	299,258

M. Balbi enumerates 42 libraries in Vienna, which together contain, 1,143,000 volumes.

PUBLIC COLLECTIONS OF MAPS.

		Number.
Paris, (Cabinet of Maps) .	more than .	1,400,000
Munich, . . .	do. . .	300,000
Vienna, . . .	about . .	300,000

			Number.
Dresden,	. . . about	. .	250,000
London, (British Museum)	. do.	. .	100,000
Copenhagen,	. . do.	. .	80,000
Amsterdam,	. . do.	. .	70,000

ANNUAL ENDOWMENT OR EXPENDITURE OF SEVERAL OF THE EUROPEAN LIBRARIES.

	£		£
Bodleian, Oxford, .	3,000	University, Gottingen,	795
Imperial, Vienna, .	1,880	Royal Madrid, .	554
Royal, Berlin, .	1,174	Edinburgh, University	500
Advocates', Edinburgh,	990	Royal, Dresden, .	397
Royal, Copenhagen, .	896		

LIBRARIES IN THE UNITED STATES WHICH CONTAIN AS MANY AS 10,000 VOLUMES EACH.

Libraries.	Vols.	Libraries.	Vols.
Philadelphia, . .	44,000	St. Mary's College,	10,500
Cambridge University,	42,000	Virginia University,	10,500
Boston Athenæum,	29,100	Yale College, . .	10,000
New York City, .	25,000	N. York Historical Society, . . .	10,000
National, Washington,	24,500	Phil. Society, Philadelphia, . . .	10,000
Charleston, S C., .	15,000	Maryland State, Annapolis, . . .	10,000
Andover Theol. Sem.,	13,000	South Carolina College, . . .	10,000
Baltimore, . . .	12,000	Boston, . . .	10,000
Georgetown College,	12,000		
Antiquarian Soc., Worcester, . .	12,000		
New York Mercantile,	11,400		
New York, Apprentices', . . .	10,800		

GERMAN BOOKS.

The catalogue of the Easter fair, at Leipzig, is much more considerable than the preceding year, it contains an advertisement of 4,251 Works published; of 487 Works that will appear shortly; and of 105 geographical maps. The catalogue of 1836 did not contain more than 3941 Works, and that of 1835 only 1,974. But the increase in the number of Books is yet nothing to be compared with the increase of the numbers of authors. In 1787, Germany had only 6,000; in 1837 no less than 18,000; of that number, there were only twelve females in 1797; in 1837 there are no less than 200 female authors.

The following table gives the different subjects of the German publications in which the year 1787 is compared with that of 1837.

Subjects.	Numbers of Works. in 1787	1837
1 Philosophy	49	47
2 Theology	334	753
3 History	154	285
4 Philology	69	366
5 Jurisprudence	101	193
6 Political Economy	57	146
7 Natural Sciences	113	209
8 Medicine and Physiology	153	328
9 Geography	100	155
10 Mathematics	23	79
11 Military Sciences	14	66
12 School books	120	462
13 Commerce and Industry	25	79

		Numbers of Works	
14	Domestic Economy and Rural	57	176
15	Literature and fine Arts	316	557
16	Miscellaneous writings	288	250
		1,974	4251

CRIME IN ENGLAND, FRANCE AND BELGIUM.

NUMBER ACQUITTED AND CONVICTED.

1.—OFFENCES AGAINST THE PERSON. (*Annual mean.*)

	Acquitted.	Convicted
England	269	343
France	1,070	914
Belgium	46	154

This gives a per centage as follows:

England	44	56
France	54	46
Belgium	23	77

2.—OFFENCES AGAINST PROPERTY.

England	3,287	13,025
France	1,884	3,472
Belgium	96	470

Which affords a per centage of

England	20	80
France	35	65
Belgium	17	83

3.—OFFENCES IN GENERAL.

England	3,556	13.368
France	2,954	4,386
Belgium	142	624

Giving a per centage of

	Acquitted.	Condemned.
England	21	79
France	40	60
Belgium	19	81

COMPARISON OF THE NUMBER OF MEN AND WOMEN ACCUSED.

	In general		Against the person		Against property	
	Men	Women	Men	Women	Men	Women
England	84	16	„	„	„	„
France	82	18	86	14	80	20

COMPARISON OF THE NUMBER OF CONVICTIONS AND DIFFERENT PUNISHMENTS.

Sentenced.	England.	France.	Belgium
Death	1,351	111	13
Perpetual labour / Transportation for life	426	267	46
Temporary labour / Transportation for 14 years	614	1,031	120
Reclusion / Transportation for 7 years	2,318	1,102	187
Imprisonment	8,341	29,667	7,108

COMPARISON OF THE NUMBER CONVICTED WITH THE POPULATION

	England.	France.	Belgium.
Offences against the person	39,358	35,558	25,794
„ „ property	1,036	9,361	8,511
„ in general	1,009	7.410	6,410
Petty crimes		219	225
Crimes and petty crimes		196	224

NUMBER OF PERSONS CONDEMNED TO DEATH IN ENGLAND 1827—1833.

	Condemned.	Executed
Murder and attempted murder . .	397 .	40
Incendiarism	100 .	50
Coining	27 .	9
High treason and rebellion . .	152 .	6
Highway and household robbery, etc.	8,366 .	159
Petty crimes	204 .	15
Rape and unnatural crimes . .	84 .	32
False money, return from transportation, piracy, threatening letters, destruction of machines, fraudulent bankruptcy	127 .	2
	9,457	310
Annual mean .	1,351	44

NUMBER OF CAPITAL OFFENCES.

In France	from 1825 to 1832	108 or 1 to	296,000	inhts.
England	„ 1827 — 1833	1351 — 1 —	9,360	„
Belgium	„ 1796 — 1815	35 — 1 —	91,400	„
and	„ 1815 — 1834	97 — 1 —	330,000	„

CRIMES IN SCOTLAND AND IRELAND IN 1834.

SCOTLAND.

	Convicted.	Acquitted.	Executed
Offences against the person	790 .	50 .	3
„ „ property with violence . . .	928 .	17	
„ without violence	1,225 .	79	
Malicious offences against property	53 .	3	

	Convicted.	Acquitted.	Executed
Forgery and offences against currency	94	9	
Other offences	251	14	1
	2,711	172	4
Male offenders	2,115		
Female do	596		

Proportion of offenders to the population 1 to 872.

IRELAND.

Offences against the person	5,439	752	38
,, ,, property with violence . .	81	90	1
Offences against property without violence . .	3,383	1,091	
Malicious offences against property	11	24	1
Forgery and offences against the currency . . .	5,256	532	3
	14,253	2,535	43

OPERATIONS OF THE AMERICAN MINT IN 1836.

The coinage executed during the year 1835, has amounted to $ 5,668,667, comprising $ 2,186,175 in gold coins, $ 3,443,003 in silver, and $ 39,489 in copper; and composed of 15,996,342 pieces of coin, viz.

Half eagles .	371,534	pieces, making .	$ 1,857,670
Quarter eagles.	131,402	" " .	328,505
Half dollars, .	5,352,006	" " .	2,676,003
Quarter dollars.	1,952,000	" " .	488,000

Dimes,	. 1,410,000	"	"	.	141,000
Half Dimes	. 2,760,000	"	"	,	138,000
Cents,	. 3,878,400	"	"	.	38,784
Half cents,	. 141,000	"	"	.	705
	15,996,342				$5,668,667

The deposits of gold within the year have amounted, in round numbers, to $1,845,000, of which $698,000 was from bullion derived from the gold mines in the United States.

The amount of gold bullion in the vaults of the Mint at the end of the year, was $77,880, all of which was deposited in December. The amount of silver bullion in the vaults was $780,600, all of which was deposited in November and December.

AMOUNT OF GOLD RECEIVED ANNUALLY FROM THE GOLD REGION OF THE UNITED STATES FROM 1824 TO 1835, INCLUSIVE.

Years.	Virginia.	N. Carolina.	S. Carolina.	Georgia.	Tennessee.	Alabama.	Not ascertained.	Total.
1824	.	d5,000	.	.	.	.	.	d5,000
1825	.	17,000	.	.	.	.	.	17,000
1826	.	20,000	.	.	.	.	.	20,000
1827	.	21,000	.	.	.	.	.	21,000
1828	.	46,000	.	.	.	.	.	46,000
1829	d2,500	134,000	d3,500	.	.	.	.	140,000
1830	24,000	204,000	26,000	d212,000	.	.	.	466,000
1831	26,000	294,000	22,000	176,000	d1,000	d1,000	.	520,000
1832	34,000	458,000	45,000	140,000	1,000	.	.	678,000
1833	104,000	475,000	66,000	216,000	7,000	.	.	858,000
1834	62,000	380,000	38,000	415,000	3,000	.	.	898,000
1835	60,400	263,500	42,400	319,900	100	.	12,200	698,500
	312,900	2,317,500	242,000	1,478,900	12,100	1,000	12,200	4,377,500

AMERICAN STATES.

REPUBLICS OF NORTH AMERICA.

	Population.	Capitals.	Population.	Presidents.
United States .	12,866,020	Washington,	18,827	Andrew Jackson.
Mexico, . . .	7,847,292	Mexico,	170,000	*Santa Anna.
Central America,	1,800,000	Guatimala,	45,000	Gen. Morazan.
Hayti, . . .	935,335	Cape Haytien,	15,000	J. P. Boyer.
REPUBLICS OF SOUTH AMERICA.				
United Prov. La Plata, . . .	2,379,888	Buenos Ayres,	80,000	Gen. Rosas.
Peru, ...	1,700,000	Lima,	70,000	Gen. Obregoso.
Chili, ...	1,500,000	Santiago,	65,675	Gen. Prieto.
Bolivia, ...	1,300,000	Chuquisaca,	12,000	Gen. Santa Cruz.
New Grenada, .	1,227,680	Bogota,	60,000	Gen. Santander.
Venezuela, . .	659,638	Caraccas,	40,000	Dr. Vargas.
Paraguay, . .	600,000	Assumption,	9,000	Dr. Francis, *Dict.*
Equator, . . .	481,966	Quito,	60,000	Gen. Flores.
Uraguay . . .	175,000	Monte-Video,	10,000	Gen. Ribeira.
EMPIRE.				Emperor.
Brazil, . . .	5,130,458	Rio Janeiro,	160,000	Pedro II.

BRITISH AMERICAN PROVINCES.

NORTH AMERICAN PROVINCES.

	Year.	Pop.	
Lower Canada,	1831	539,822	Earl of Gosford, *Governor-General.*
Upper Canada,	1833	296,544	Major-Gen. F. B. Head, *Lieut-Gov.*
Nova Scotia,	1827	123,848	Major-Gen. Sir C. Campbell, *do.*
New Brunswick,	1834	119,116	Major-Gen. Sir A. Campbell, *do.*
Prince Edw. Isl. }	1833	28,925	Sir A. Young, *do.*
Newfoundland, }	1828	58,088	Captain Prescott, *Governor.*
Cape Breton,	estim.	30,000	
Total,		1,196,343	

* Now a captive.

BRITISH WEST INDIES 1833.

Whites - - - - - -	77,460
Free coloured - - - - -	113,890
Slaves - - - - - -	692,700
Total	884,050

EUROPEAN STATES,

WITH THE POPULATION AND THE NUMBER OF THE DIFFERENT RELIGIONS BELONGING TO EACH.

States.	Catholics.	Protest'ts	Greek Ch.	Jews.	Total.
1 Anhalt-Bernburg,		43,165		160	43,325
2 Anhalt-Cothen, .	1,050	35,800		200	36,000
3 Anhalt-Dessau, .		55,985		1,640	57,629
4 Austria, ...	25,441,000	2,750,000	2,900,000	470,000	33,482,692
5 Baden, ...	810,330	377,530		19,423	1,208,697
6 Bavaria, ...	2,880,383	1,094 633		57,574	4,187,397
7 Belgium.	3,420,198	12,394		782	3,827,222
8 Bremen, ...	1,500	50,000			52,000
9 Brunswick, . . .	2,508	242,000		1,400	248,000
10 Cracow, ...	105,463	1,500		17,694	123,157
11 Denmark, ...	2,000	2,048,091		6,000	2,067,079
12 France, ...	30,620,000	1,310,000		60,000	32,560,934
13 Frankfort, . . .	6,000	42,800		5,200	54,000
14 Great Britain, . .	6,100 000	18,000,000		12,000	24,271,398
15 Greece, ...			830,000		830,000
16 Hamburg, ...	3,060	138,890		7,500	150,000
17 Hanover, ...	210,000	1,342,850		12,300	1,662,500
18 Hesse-Cassel, . .	103,000	518,349		8,300	629,909
19 Hesse Darmstadt, .	177,888	516,687		22,174	718 373
20 Hesse Homburg, .	3,000	20,000		1,050	24,050
21 Hohenzol'n-Hechingen	21,000				21,000
22 Hohenz. Sigmaringen,	42,260			100	42,360
23 Ionian Islands, . .	35,200		133,898	5,500	188,717
24 Liechtenstein, . .	5,800				5,800
25 Lippe-Detmold, . .	1,600	75,118			76,718
26 Lippe-Schauenburg,	100	23,128			23,128
27 Lubeck, ...	400	45,703		400	46,503
28 Lucca, ...	145,000				145,000
29 Mecklenburg-Schwerin	565	457,05		3,121	460,529
30 Mecklenburg-Strelitz,	50	83,97		662	84,690
31 Modena, ...	380,000			1,500	381,500
32 Nassau, ...	163,053	193,483		5,932	362,652

States.	Catholics.	Protest'ts.	Greek Ch.	Jews.	Total.
33 Netherlands, . . .	280,000	2,050,000		50,000	2,763,608
34 Oldenburg, . . .	70,880	175,912		980	246,885
35 Parma, ...	440,000				440,000
36 Portugal, ...	3,530,000				3,530,000
37 Prussia, ...	4,924,153	7,962,221		167,430	13,068,960
38 Reus-Elder Line, .		24,000		} 300	24,000
39 Reus-Younger Line,		57,696			57,696
40 Russia,*	6,600,000	2,643,000	33,326,000	361,000	41,866,317
41 St. Marino, . . .	7,000				7,000
42 Sardinia, ...	4,142,177			30,000	4,460000,
43 Saxe-Altenburg, .	150	113,898			114,048
44 Saxe-Coburg, . .	2,200	109,593		1,100	130,231
45 Saxe-Meiningen, .	450	140,584		1,030	142,064
46 Saxe-Weimar, . .	9,563	225,392		1,420	236,375
47 Saxony, ...	27,693	1,526,577	39	874	1,558,153
48 Schwartz Rudolstadt,	150	59,683		167	60,000
49 Schwartz-Sondersh'n,	200	51,567			51,767
50 Spain, ...	12,280,000				12,280,000
51 States of the Church,	2,574,329			16,000	2,592,329
52 Sweden and Norway,	4,000	4,023,000		845	4,028,045
53 Switzerland, . . .	731,343	1,248,183		1,840	2,037,030
54 Turkey,†	310,000	3,000	2,550,000	2,50,000	10,163,000
55 Tuscany, ...	1,310,700			930	1,320,000
56 Two Sicilies, . . .	7,416,936		85,000	2,300	7,504,236
57 Waldeck, ...	800	54,700		500	56,000
58 Wurtemberg, . .	484,376	1,082,612		10,670	1,586,372
Total,	117,546,105	51,593,915	39,739,821	1,655,991	218,945,744

British Association for the Advancement of Science.

The meeting for 1838 will be held at Newcastle-upon-Tyne in the beginning of August.

ANNUAL CONTRIBUTION £1, COMPOSITION £5.

President.—His Grace the Duke of Northumberland.

* The several numbers and the sums total are given in this table as they are found in the Weimar Almanac; but they are not all consistent with each other.

† Turkey in Europe has 7,150,000 *Mahometans*, Russia 800,000, and Austria 500 :—total, 7,950,500.

Vice Presidents.—The Bishop of Durham; the Rev. Vernon Harcourt; Prideaux John Selby, Esq.

Treasurers.—The Rev. W. Turner; and Charles Bigge.

General Secretaries.—The Rev. George Peacock; and R. I. Murchison, Esq.

Secretaries.—J. Adamson, Esq.; Robert Hutton, Esq.; and Professor Johnston, of Durham.

Mr. Baily; Professor Christie; Professor Graham, of London; Professor Graham, of Edinburgh; Professor Lloyd; Professor Henslow; Professor Powell; Colonel Sykes; Mr. Hutton, M.P.; Mr. Greenough; Mr. J. Yeates; Rev. F. Hope; Dr. Hodgkin; Dr. Roget; Mr. M'Leary.

Auditors.—Messrs. Hutton, Lubbock and Porter.

University of London.

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Clerk to the Senate.—Mr. H. Moore.

A LIST OF THE COUNCILS OF VARIOUS SOCIETIES AND INSTITUTIONS IN LONDON; AT THE END OF WHICH WILL BE FOUND A LIST OF THEIR VARIOUS MEETINGS.

Royal Society Incorporated 1663.

SOMERSET HOUSE.

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4. The council also propose to give one of the Royal Medals in the year 1839 to the most important unpublished paper on Physiology communicated for insertion in their

ES OF LONDON FOR 1837-8.

ch.	April. Easter Sun. 15	May.	June. Whit. Sund. 3	SOCIETIES.
22,29	5, 26	3,10,17,24,31	14, 21.	ROYAL.
26	9, 23	14, 21*, 28	11, 25	GEOGR
22,29	5, 23*	3,10,17,24,31	14, 21	ANTIQ.
19	16	14	18	STATIS.
	11(Wednesday)	11	8	ASTRON.
1	4, 25	9, 23	6	GEOLOG.
0	3, 17	1, 24*	5, 19	LINNEAN.
23,30	6, 27	1*,4,11,18,25	1, 8	R. INSTUT.
26	9, 23	7*, 21	11, 25 July 9, 23	ARCHIT.
0, 27	3, 10, 24	1,8,15,22,29	....	C. ENGIN.
27	10, 24 5, 30*	8, 22 3	12, 26 7	ZOOLOG.
2	12, 26	10, 24	14, 28	LITERAT.
0	3, 17	1*, 15	5, 19	HORTIC.
	2	7	4	ENTOMOL.

B… May, June, July and August; and from 10 till 4 the rest of the
, and all Fast or Thanksgiving Days ordered by Proclamation.
es above-mentioned when the Museum is closed, from 9 till 7
open to Students having tickets every day in the week, except

R… *Library* is open daily from 10 till 4; and a *Reading Room* is

G…
R…
Z… rsday, and for Scientific Business on the second and fourth

… The *Museum* is open from 12 till 4.

…, 1 P.M.	Zoological Society ....April 30, 1 P.M.
…, 1 P.M.	R. S. Literature................April 26.
…	Horticultural Society ... .May 1, 1 P.M.
…, 8 P.M.	Entomological ....Jan. 22, 8 P.M.
…, 7 P.M.	

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Transactions after November 30th, 1836, and prior to the termination of the session in June 1839.

The Royal Medals for 1836 were awarded to Sir J. F. W. Herschel, K.H. F.R.S. for his papers on Nebulae and clusters of stars published in the Philosophical Transactions for 1833, and to George Newport Esq. for his series of investigations on the Anatomy and Physiology of Insects contained in his two papers published in the Philosophical Transactions within the last three years.

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3. *Prize for the application of steam to navigation.*—" Au meilleur ouvrage ou mémoire sur l'emploi le plus avantageux de la vapeur pour la marche des navires et sur le système de mécanisme, d'installation, d'arrimage et d'armement qu'on doit préférer pour cette classe de bâtimens." The value of the prize is 600 francs. The period terminates on 1st of May 1838.

4. Prize offered by Professor Manni of the University of Rome, 1500 francs. " What are the distinctive

characters of apparent death? "What are the means of preventing premature interment?" Limit of the concours 1st April 183?.

5. *Mechanical prize* (Montyon foundation.)—This consists of a gold medal of the value of 500 francs, and is given by the academy to the person who has rendered himself worthy by inventing or improving instruments useful for the progress of agriculture, the mechanical arts and sciences. Limit of the concours 1st May.

6. *Statistical prize* (Montyon foundation.)—This is an annual gold medal value 530 francs for the best work which has for its object one or more questions on the statistics of France. 1st May is the limit.

7. *Lalande prize.*—This is a medal of 635 francs, granted to the person who makes the most interesting observation or writes the memoir most useful to the progress of astronomy.

NUMISMATIC PROCESS.

The engraving representing the signs of the zodiac has been executed in Paris by M. Achille Collas, mechanician, and affords a good specimen of an important new invention. We leave the public to estimate the merit of this engraving, which presents a very remarkable effect, and in which all the delicate touches of the medal are most faithfully copied. We must, however, draw the attention of our readers to the excellent application of this process of engraving, as exhibited in the publication entitled: Numismatic and Glyptic Treasure, or a general collection of medals, coins, engraved stones, bas-reliefs, &c. ancient and modern. The portrait of James Watt, which constitutes the frontispiece to the present volume, was also executed by M. Collas of Paris.

London, J. B. Baillière.

SKETCH

OF THE

HISTORY AND PRESENT STATE OF GEOLOGY.

By THOMAS THOMSON, M.D. F.R.S. L. & E., &c.

REGIUS PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF GLASGOW.

The object of *Geology*, in the modern acceptation of the term, is to investigate the successive changes to which the globe of the earth has been subjected since its original creation, and to inquire into the causes of these changes and determine, if possible, the manner in which they have been brought about. As a science, Geology is quite modern, and may be said to have originated in our own time, or a very few years before it.

The ancient philosophers of Greece and Italy, especially of the latter country, could hardly avoid observing the fossil shells so abundant in their country. And if any confidence can be placed in the opinions of Pythagoras as stated by Ovid,* it is plain that he was of opinion that the earth had undergone numerous and successive changes.

* Ovidii Metamorph, lib. 15, l. 262.

Vidi ego, quod fuerat quondum solidissima tellus
Esse fretum; vidi factas ex æquore terras;
Et procul a pelago conchæ jacuere marinæ;
Et vetus inventa est in montibus anchora summis.
Quodque fuit campus, vallem decursus aquarum
Fecit; et eluvie mons est deductus in æquor:
Eque paludosa siccis humus aret arenis:
Quæque sitim tulerunt, stagnata paludibus ument,
Hic fontes Natura novos emisit, at illic
Clausit: et antiquis tam multa tremoribus orbis
Flumina prosiliunt; aut excæcata residunt, &c.

It is needless to continue the well-known quotation which goes on, for many additional lines, to describe the numerous changes which the earth had sustained.

Strabo, in the second book of his Geography, states at some length the opinions proposed by the ancient Greek philosophers to account for the numerous fossil shells which exist in such quantities in various rocks. He rejects their opinions and ascribes the phenomenon to the gradual elevation of beds formerly deposited under the sea.

After an interval of many ages, it is well known that learning began to revive again in Italy in the 14th and 15th centuries. The learned in that country naturally paid some attention to the fossil shells with which that country abounds. Three opinions respecting their origin were supported and maintained. According to some, nature possesses a certain plastic power which enables it to fashion stone into organic forms. Hence they concluded that these fossils were not the remains of animals that had once lived, but mere *lusus naturæ*, mere sports of nature, which led her to imitate in stones what existed in animals. According to others, these fossil shells had been deposited where we perceive them at the time of the Mosaic deluge, and had remained there ever since. The third opinion was, that they had formerly belonged to living animals who had formerly lived and multiplied where their exuviæ are now found. This last opinion was strenuously supported by Fracastoro in 1517. The Mosaic deluge, according to him, was too transient: and if it had transported shells to a great distance, must have strewed them over the surface instead of burying them at vast depths in the interior parts of mountains.

Notwithstanding the clear and forcible arguments with which Fracastoro maintained his opinions, the dogma that these supposed fossils were mere lusus naturæ continued for many years the prevalent one. And after it had been completely refuted by Steno and others, most writers on the subject acquiesced in the conclusion that the fossil shells, wherever found, had been deposited at the time of the Mosaic deluge. Many theologians entered the field of controversy and maintained that all those who refused to subscribe to this opinion disbelieved the whole of the sacred writings. This foolish controversy lasted during a century and a half. Indeed, I am not sure if even at present it can be considered at an end; though no person who examines the phenomena with the requisite attention can hesitate an instant what conclusion to come to.

One of the first persons who examined the different beds which constitute the surface of the globe, as far at least as England was concerned, was Dr. Woodward. His systematic collection of specimens bequeathed to the University of Cambridge, and still preserved there as arranged by him, shows how far he had advanced in ascertaining the order of superposition. But his anxiety to accommodate every thing to the Mosaic deluge prevented him from drawing the proper consequences from his observations. He conceived the whole terrestrial globe to have been taken to pieces and dissolved at the flood, and the strata to have settled down from this promiscuous mass as an earthy sediment from a fluid. He affirmed, in consequence, that marine animals are lodged in the strata in the order of their gravity, the heavier shells in stone, the lighter in chalk, and so of the rest. The slightest attention to facts would have shown him the inaccuracy of these statements.

Dr. Woodward was a physician; but in 1681 Thomas Burnet, a clergyman, published a philosophical romance under the title of *A sacred Theory of the Earth.* The surface of the earth before the deluge, according to him, was smooth and level, and consisted of a thin crust covering the waters. Hence it enjoyed a perpetual spring; this thin crust being fissured by the sun's rays burst and fell by its gravity into the ocean beneath. Hence the flood and hence the inequality of the surface and the numerous fossils scattered through the strata. It is not a little curious that this theory, so absurd and so inconsistent with the phenomena which it was intended to explain was praised at the time as a work of profound science.

In 1696, Whiston, so well known for his eccentricity and his honesty of character, published a *Theory of the Earth,* the object of which was to reconcile the Mosaic account of the creation and flood with the astronomical doctrines of Sir Isaac Newton. He ascribed the deluge to the tail of a comet coming so near the earth, that its waters were attracted by that planet and its surface overwhelmed. This book was also very successful, and ran through several editions during the author's lifetime.

In this short sketch it is hardly worth while to notice the theory of Leibnitz, that the globe of the earth was originally in a state of incandescence, and that it has been constantly cooling ever since the creation. This opinion with certain modifications was adopted by Buffon. But it would be wrong not to mention Vallisneri, who in 1721 refuted and overturned the extravagant theories of Woodward, Burnet and Whiston. In 1740 Lazzaro Moro, in a work "on the Marine Bodies which are found in the mountains," attempted to reconcile the facts observed by Vallisneri with the Mosaic account of the creation. On the third day, he observed the globe was every where covered to the same depth with fresh water, and when it pleased the Supreme Being that the dry land should appear, volcanic explosions broke up the smooth and regular surface of the earth composed of primary rocks. These rose in mountain masses above the waves and allowed melted metals and salts to ascend through fissures. The sea gradually acquired its saltness from volcanic exhalations, and while it became more circumscribed in area, increased in depth. Sand and ashes ejected by volcanoes were regularly disposed at the bottom of the sea and formed the secondary strata, which in their turn were lifted up by earthquakes.

The theory of Moro was admirably illustrated in 1749 by Generelli, whose work showed a far greater progress of Geology in Italy than had taken place in any other part of Europe during the first half of the 18th century.

But it is to Werner that Geology is chiefly indebted for the high rank which it at present holds among the sciences. He was professor of Mineralogy in the Mining Academy of Freyberg in Saxony, and possessed an influence over the minds of his students that has seldom been equalled, and never surpassed. He examined the structure of that part of Saxony where he resided, and determined the relative position of the different rocks. He then boldly generalized his observations, and affirmed that the structure of the whole earth was similar to that portion of Saxony which he had examined. His pupils, actuated by an enthusiasm which nothing could damp, set about verifying the opinions of their master. Every corner of Europe was examined with this particular object in view. At first they scarcely ventured to differ from the dogmas of their teacher; yet knowledge accumulated prodigiously; and after the examination of the volcanic regions of the globe, which the Saxon professor had never had an opportunity of studying, some of the most fundamental positions of Werner were combatted and rejected.

The regular distribution of the secondary rocks,* on every part of the earth's surface, was maintained by the pupils of Werner. The secondary rocks or *formations* (as Werner had named them) were distinguished by appropriate names, derived from the nature of the rocks of which they were considered as composed. They were found in every part of Europe

* *Secondary rocks* were those containing petrifactions or alternating with those that do. *Primary rocks* those which contain no petrifactions and which were considered in consequence as in their primitive state.

and America, and from the practice of giving the same name to rocks situated at a great distance from each other, and from considering them as having been deposited at the same time on every part of the earth where they occur, much confusion got into the descriptions, and Geology was in danger of reverting again to a state of chaos and confusion, when Mr. William Smith conceived the happy idea of verifying formations by the fossils which they contain, and of tracing the same formations by means of the identity of their fossils to great distances, and of determining this identity, even when the stony matter of which they were composed was entirely different.

Mr. Smith was a practical engineer in the neighbourhood of Bristol. The country round that city has been cut through in various directions in consequence of the peculiar position of the coal beds. This made Mr. Smith well acquainted with the numerous rocks or formations in that interesting locality. The rocks round Bristol contain many fossils, chiefly shells. It struck Mr. Smith as very remarkable that every particular formation contained, and was distinguished by containing particular species of shells not to be found in the other formations. He made a collection of these shells and found that by his knowledge of them he could trace particular formations to a great distance from Bristol. He generalized these observations, and concluded that every formation may be distinguished by the petrifactions which it contains.

To verify this idea, he undertook a survey of England and the south of Scotland, and after an arduous labour of twenty years constructed his geological map of

England exhibiting the mineralogical structure of that country. This map was published in the year 1815; but Mr. Smith was acquainted with the structure of a great part of England and with the fossils peculiar to each bed as early as the year 1799, if not earlier. For during that year he communicated his views on the subject to Mr. Townsend and various other geologists.

The great merit of Werner lay in pointing out the connexion between geology and mining, and in establishing the identity of the position of the different formations with respect to each other in every part of the globe. His cosmogony was hardly superior to that of Woodward or Burnet. He laid it down as a first principle, that all the strata which constitute the surface of the earth to an unknown depth existed originally in solution in an aqueous fluid, which at first covered and enveloped the whole globe. The first deposits from this chaotic fluid were in crystals and constitute what Werner and his disciples distinguished by the name of *primitive rocks*.

After the depositions of the ocean were so far cleared as to become fit for the habitation of living beings, animals accordingly, and vegetables were created. These at first were of the lowest order, such as *corralines*, *ferns* and *rushes*. After the depositions of the primitive rocks, the surface of the ocean became lower than before; though neither Werner nor his disciples made any attempt to find a receptacle for this superfluous water. The next set of rocks which were deposited he called *transition formations*, because in his opinion they were deposited when the earth was passing from a state unfit for animals and vegetables to a state fit for them. The height of the transition rocks is less than that of the primitive because a portion of the ocean had disappeared. It is in transition rocks that petrifactions first begin to make their appearance.

After the deposition of the transition formations, the height of the water again diminished and a new set of rocks began to be deposited at the bottom of the ocean to which Werner gave the name of *flœtz*, from their greater approach to horizontality. They consisted, not like the primitive formations of crystallized ingredients, but were formed in a great measure from the destruction of the primitive and transition formations, and contained abundance of petrifactions of the animals and vegetables existing at that time on the earth.

All these formations were formed at first under the surface of the sea, and have emerged in consequence of the waters of the ocean becoming continually lower and lower. It seemed to be an opinion of Werner that the quantity of water on the globe was continually diminishing, and that in a course of a long series of ages it might finally disappear, and this of course would be attended by the destruction of all the animals and plants that live upon its surface.

I am not sure that any person in this country adopted this whimsical and absurd theory to its utmost extent. Kirwan was an advocate for the aqueous origin of rocks. But he no where expresses himself with such precision as to enable us to judge whether his notions were the same as those of Werner. The great object which he seems to have had in view was to vindicate the Mosaic cosmology and every thing which could not be directly drawn from Moses's account of the creation, he seems to have viewed with the same horror and to have ascribed to the same motives as the Pope and his conclave of cardinals, and the Inquisition of Rome did the doctrines of Galileo, that the earth revolves round the sun.

A cosmogony very different from that of Werner was advanced in 1788 by Dr. James Hutton in a paper read to the Royal Society of Edinburgh. Dr. Hutton was a partner in a Sal ammoniac work in Edinburgh, which was carried on with considerable emolument to the proprietors, till Mr. Pitt laid a tax upon sulphate of soda, which destroyed all the sal-ammoniac manufactures of Great Britain without being of the least benefit to the revenue. He was a man of the most amiable simplicity of manners and all his acquaintances were attached to him with a degree of enthusiasm, that could leave no doubt respecting the goodness of his heart and the sincerity of his views. He turned his attention pretty early to the structure of the earth, and was in the habit of making frequent tours through different parts of England and Scotland, and acquired considerable skill as a geologist, though he never seems to have attended particularly to mineralogy.

He published a separate edition of his Theory of the Earth in 1795 in two octavo volumes, and his views were afterwards taken up by Professor John Playfair, who published his illustrations of the Huttonian theory written with that glowing eloquence which could not fail to draw the attention of geologists to the opinions of Hutton.

" The ruins of an older world," said Hutton, " are visible in the present structure of our planet, and the strata which compose our continents have been at one time beneath the sea and were formed out of the waste of pre-existing continents. The same forces are still destroying by chemical decomposition or mechanical violence even the hardest rocks and transporting the materials to the sea, where they are spread out, and form strata analogous to those of more ancient date, although loosely deposited along the bottom of the ocean; they become afterwards altered and consolidated by volcanic heat and then heaved up, fractured and contorted. Dr. Hutton had convinced himself, by actual examination, that basalt, greenstone, and other trap rocks were of igneous origin and had been injected in a melted state through fissures in the older strata. His observations in Glentilt and Lough Ranza in Arran, induced him to draw the same conclusion with respect to granite, and this was farther confirmed by Mr. Playfair's subsequent examination of the numerous granite veins running through the clay-slate at St. Michael's Mount in Cornwall.

Granite had hitherto been considered as the fundamental rock, over which all the others had been deposited. It contained no animal or vegetable remains, and therefore was triumphantly referred to not only by Werner, but by all the Italian geologists as still existing in the very state in which it had come from the hands of the Creator—as really and truly a primitive rock. When Hutton affirmed that it was not only not a primitive rock, but that it was in reality one of the newest of all the rocks, and when he brought forward proofs of these assertions, the whole orthodox zeal of the country was roused into a paroxysm of religious fury, and he was anathematized as an impious atheist whose sole object was to overturn the established opinions of the country and to substitute anarchy and democracy in their place.

When we calmly review the opinions of Dr. Hutton and his followers, it is impossible to avoid surprize at the violence with which he was attacked. He simply affirmed that the present continents were derived from the ruins of continents formerly existing; that our present continents, from causes obviously operating, and which he pointed out, are in the act of being washed into the sea, and that other continents will be hereafter elevated to supply their place. We see no beginning and can trace no end of these revolutions. How these opinions interfere with or are inconsistent with the Mosaic account of the creation it is not easy to see.

The great merit of Dr. Hutton was in perceiving that granite, porphyry and trap-rocks had been formerly in a state of fusion, and that they had been forced from below upwards while liquid, and consequently instead of being the oldest might be new, and in fact were newer than several rocks containing fossil remains. His defect consisted in giving an undue influence to subterraneous heat. In fact, he laid it down as a first principle that the internal parts of the globe are in a liquid state—a position of which we have no proof whatever.

The formation of the Geological Society of London constitutes a memorable era in the progress of geology. It included a considerable number of very active young men who devoted themselves, in the first place, to a thorough investigation of the position of the different strata which constitute the surface of England. In this they were materially assisted by Mr. Smith's map. It is only necessary to mention the names of Greenough, Macculloch, Conybeare, Buckland, Sedgwick, De la Beche, Mantell, &c. &c. to be satisfied of the immense services conferred upon geology by the members of that society. Instead of speculating about cosmology, they devoted themselves to the collecting of observations. Mr. William Phillips, who was a member of this society, thought of arranging all the facts brought to light by its members, which he published under the title of *Geology of England and Wales*. In the second edition of that book he was assisted by Mr. Conybeare, who contributed many original articles, and rendered the *Geology of England and Wales*, so far as it goes, a very complete work indeed.

Thus in Great Britain in consequence of the liberal exertions of the Geological Society assisted by Mr. Smith's map, and by a map constructed afterwards by Mr. Greenough, a vast number of geological observations were made, and a great mass of facts collected. The investigations of M. Cuvier of the fossil remains of quadrupeds which exist in such quantity in the environs of Paris, began about the commencement of the present century and continued with admirable skill till the *Essai sur la Géographie Minéralogique des environs de Paris* was published by him and Alexandre Brogniart in the year 1809, and constitute a no less memorable era in geological science. The country in the neighbourhood of Paris lies above the chalk beds which exist in such abundance in the north-eastern portion of France. One of the most remarkable of the beds of which it consists is the gypsum in which chiefly these fossils have been found. Cuvier ascertained and classified the fossil remains of seventy-eight species of extinct quadrupeds found either in the gypsum or in the ceds above it in the series. Forty-nine of these are species hitherto unknown to naturalists. Eleven or twelve others have such an entire resemblance to species already known, as to leave no doubt of their identity. The remaining sixteen or eighteen have considerable traits of resemblance to known species, though all doubts on the subject have not been removed.

Of the fourty-nine new species, twenty-seven are referrible to seven new genera, while twenty-two are referrible to genera or sub-genera already known; of the seventy-eight species fifteen are animals of the class of oviparous quadrupeds, while the remaining sixty-three are of the mammiferous class. Twelve are ruminating animals, seven are gnawers, eight carnivorous animals and twelve toothless animals of the sloth genus.

Thus Cuvier demonstrated that the formations round Paris, which are higher than the chalk, and which consequently have been deposited after the chalk beds had assumed their present aspect, contain numerous fossil remains of animals no longer existing on the globe. The number of extinct species of quadrupeds has been increased since by the discovery of several new species in England, and also in other countries.

Several of the beds round Paris contain numerous fossil shells, and the same remark applies to the beds near London, particularly the *crag* of Norfolk and Suffolk. These shells have been carefully examined by the conchologists of Paris and London; no fewer than 1234 species have been collected and described. Of these only forty-two are living species which exist in the neighbouring seas. All the rest consist of species which are extinct or at least which never have been observed in the seas surrounding Great Britain and France. The existence of extinct species of shells was obviously recognized by Dr. Lister in his great work on shells published in 1678, at a time when the Italian geologists, who had made such progress in examining the structure of the earth, were not aware that any fossil shells existed different from those at present found in the seas surrounding Italy. The reason was, that the fossil shells in Italy are mostly recent, while those in the neighbourhood of London are mostly extinct.

Thus the existence of the extinct species both of quadrupeds and shells came to be recognized, and it was soon perceived that, as shells are scattered in much greater abundance through rocks than the bones of quadrupeds, an accurate knowledge of conchology both fossil and recent was the best means of determining the identity or diversity of strata. This had been already pointed out by Mr. Smith, and the subject was taken up with enthusiasm by the Geological Society of London and by various other similar societies established in different parts of Europe, especially in France. The consequence has been the discovery and arrangement of several thousand fossil shells belonging to species no longer existing.

In terminating this short historical sketch of the progress of geology it would be unpardonable to omit the *Principles of Geology* by Mr. Lyell, first published in 1831. The object of this work is to explain the former changes of the earth's surface by referring them to causes now in operation. This book has done more to render geology popular than all the others which preceded it. Mr. Lyell has brought together such a vast multitude of important facts, which he has arranged with so much judgment, and stated with such clearness and in so engaging a manner that the reader's attention is fixed, and he peruses the work with the same delight that he feels when engaged in a well written romance. Mr. Lyell's attempt to show that the causes which have produced the changes which the earth has undergone are still in operation, that these changes have not been produced by fits and starts or by causes so violent and so sudden, that the whole inhabitants of the globe must necessarily be destroyed by the convulsions; but slowly and gradually and that they are going on at present in the same way as they always have done; this attempt is scarcely less important than the vast multitude of facts by which it is supported and elucidated. It will have the effect of withdrawing geologists from those hypothetical opinions respecting cosmogony in which they have been too prone to indulge. The changes visible in the formations of which the surface of the earth is composed have been brought about, according to one party, by the action of water; according to another by the action of fire. Both hypotheses according to Mr. Lyell's views are right, and both are wrong. Water and heat have both played their part, and are still playing their part in producing the changes that are going, and will continue to go on as long as the globe is subjected to the regular laws of nature.

Whether the nature of the fossil remains of animals and vegetables so abundant in England and other northern countries does not point to a time when the climate of England and even of Siberia must have been at least as hot as the torrid zone is at present, and whether the alteration of temperature that has since taken place does not indicate the operation of causes which do not operate sensibly at present, are questions upon which we do not mean to enter. Different views of these and other points in geology will naturally be taken by different individuals, and this must lead to discussions which cannot but tend to the progress of geology by inducing each party to bring forward new facts in order to support his opinions.

There is one point more which it will be right to advert to. It is now admitted, by all geologists. that mountains have been gradually elevated to their present height by a force acting from below. This force is conceived to be analogous to the volcanic energy acting at present in so many regions of the globe. Ranges of mountains often run in straight lines or at least approaching to that form. Now, it has been shewn by Von Buch, that volcanoes generally run in a similar direction. If mountains have been pushed up from below by the action of volcanic energy, it is obvious that the matter immediately acted on by the volcanic fire must have been in a state of fusion. If the fused matter (granite for example) constitute the mountain, then there will be no stratification visible. But if the fused matter has not made its way so far as the surface, and if the plane upon which it acted was originally stratified, it is clear that these beds at first horizontal, must have been pushed upwards by the melted mass. From being horizontal they will become inclined or almost vertical; and should the melted matter make way to the surface at the summit, the old horizontal beds will be wrapt round it in an inclined position leaning every where against the sides of the granite nucleus. In this way we meet with mica slate, or clay slate, wrapt mantle wise (as Werner called it) round the granite central portions. In this way we find granite itself wrapt round the central nucleus of felspar porphyry in the mountain Ben Nevis.

Now M. Elie de Beaumont first showed how advantage might be taken of this state of things to determine the relative age of mountains. If the beds in the neighbourhood of a mountain existed before its elevation it is obvious that, by that elevation their position must be altered. From horizontal, which they had been originally they must have become inclined, and the more so the nearer they are to the central nucleus of the mountain and the higher the elevation of the mountain is. But if a bed has been deposited after the elevation of a mountain, its horizontality will not be affected how near soever it may lie, even though it should abut against the shoulder of the mountain.

Hence, when we examine the strata lying in the neighbourhood of a mountain, we can judge of their relative age by their position. If they are inclined, they are older than the mountain; but if they are horizontal they are newer.

If we apply this test to the mountains of Great Britain, the oldest is probably the chain which runs from St. Abbs head to Loch Ryan. The lake mountains in Cumberland are about the same age. Professor Sedgwick has shewn that they were elevated before the deposition of the old Red sandstone.

The mountains which run from the border of Scotland through the north of England as far as Derbyshire and Yorkshire, and distinguished by the Romans by the name of the Penine Alps, have been obviously elevated before the deposition of the upper part of the coal bed series. Probably their elevation is coeval with the deposition of the oldest of the coal beds.

The Pyrenees must have been elevated at a much later period. Beds of green sand and chalk are found at the very summit of these mountains: of course their elevation must have been subsequent to the deposition of these beds. The tertiary formations stretch themselves horizontally at their feet and consequently have been deposited after their elevations. The Appennines in Italy seem to be nearly of the same age with the Pyrenees.

The chain of mountains, called the Alps, has been elevated at different times. The western Alps are manifestly subsequent to that tertiary formation to which the French geologists have given the names of *molasse coquillière*. This formation lies near Lyons in horizontal beds and covers the primary rocks at Forez. But as it approaches the Alps, it becomes elevated, and at Rigi reaches a height of 6152 feet. This shows clearly that the western Alps were elevated after the deposition of the *molasse coquillière.*

The valley of the Isere, of the Rhone, of the Saone and the Durance exhibit two very different alluvial formations, well distinguished by their position and character. The inundations which brought the materials of the first of these formations appear to have proceeded from the fresh water lakes which once covered the northern side of the department of the Isere, and of other places situated in the departments of the lower Alps. The materials of the second formation, on the other hand, appear to have been deposited from streams which rushed with violence into the Mediterranean. They are usually called diluvial streams, though they must have existed before the creation of man; but when other animals which they destroyed existed on the earth, M. Elie de Beaumont has shown by a copious induction that the principal alpine chain was elevated after the deposition of the former of these diluvian formations and before the latter. So that the elevation of the eastern Alps is much newer than that of any of the mountain chains in Great Britain.

Let us now take a view of the present state of our knowledge of the different formations constituting at present the different continents elevated above the surface of the ocean.

1. Granite, porphyry and trap-rocks are never found regularly stratified like all the other formations. They never contain any remains of animals and vegetables. From a multitude of observations respecting their position and connexion with other rocks, it has been inferred that they have been forced up from below in a state of fusion. Hence the reason why no fossils have been found in them. They either come from a depth

below the existence of any animal: or if they contained original animal or vegetable remains, the state of fusion to which they had been brought by heat necessarily destroyed all these remains. These substances have been elevated at very different times, and these times can only be deduced from the rocks with which they are connected. When we observe felspar porphyry rising through the granite which constitutes the base of Ben Nevis, we can have no doubt that it is a later formation than the granite of that country. When we observe trap dykes cutting through the coal beds and heaving and displacing them, we can have no doubt that these dykes made their appearance after the deposition of the coal beds. If we find the new red sandstone or the magnesian limestone lying over these dykes without being penetrated by them, we cannot avoid concluding that the new red sandstone beds were deposited after the formation of these trap dykes.

2. The oldest of the stratified rocks are gneiss and mica slate, which run gradually into each other. Gneiss consists of alternate layers of felspar, quartz and mica. In the oldest gneiss, that for instance which constitutes so great a proportion of the surface of Scandinavia, felspar is by far the most abundant ingredient. In mica slate, mica prevails. The felspar is scarcely perceptible and the quartz but small in quantity. So that the oldest gneiss and the newest mica slate may be considered as constituting the extremes of a series of rocks gradually verging from felspar to mica. No petrifactions have ever been observed in gneiss or mica slate. As they are stratified rocks, there is reason to conclude, that they were deposited at the bottom of

the sea. But as they contain no fossils, this deposition must have taken place before the earth was the habitation of animals or vegetables; or if fossil remains ever did exist they must have been obliterated by the high temperature to which these rocks have obviously been exposed. But as this high temperature has not obliterated the stratification, it is more reasonable to conclude that gneiss and mica slate were deposited before the earth became the habitation of animals and vegetables.

3. *Clay slate* is the next formation in the order of position. It is a rock well known in this country, being employed for roofing houses. Mountains composed of it are abundant in the Grampians, in Wales and in Cornwall. The well known mountainous tract through which the Rhine flows from Birgen to below Cologne is composed of clay slate. It is the first formation in which petrifactions have been found. These petrifactions are not abundant. They consist chiefly of coralines and shells. Several casts of shells considered as *productas* and *hysterolites* have been figured from Snowden in the Annals of Philosophy (2nd series) iv. plate 17. Shells have also been found petrified in the clayslate or killas of Tintaget in Cornwall.* The Cornish killas alternates in the neighbourhood of Plymouth with limestone containing shells and corralines.

The shells and corralines found in clayslate differ from all those that at present exist. They are so few in number, and have been so imperfectly determined,

* They are figured in the Transactions of the Geological Society vol. iv, p. 25.

that it would be premature to hazard an opinion; yet they seem to bear a certain degree of relation to the shells which exist in the coal beds.

4. The fourth series of formations are those to which the names of old red sandstone and greywacke have been applied. That there exists a red sandstone under the coal beds, for example in the neighbourhood of Bristol, cannot be denied. But I believe that the name *old red sandstone* has sometimes been applied to the sandstone of the coal beds. Nobody can doubt that the sandstone quarried in such abundance in the neighbourhood of Glasgow is the coal sandstone. It may be traced uninterruptedly from Glasgow to Helensburgh, where it lies immediately over the clayslate, and where it is considered as old red sandstone. The red sandstone in Arran, the Cumbraes and the west coast of Renfrewshire is also a continuation of the Glasgow sandstone. One cannot perceive a good reason for distinguishing the sandstone at Helensburgh from that at Glasgow. They resemble each other perfectly, and are connected together in an uninterrupted series.

Greywacke is a sandstone or conglomerate containing fragments of clayslate. Sometimes the constituents are of a large size as in the greywacke at Oban in Argyleshire, sometimes so small as hardly to be distinguished by the naked eye.

The old red sandstone and greywacke, alternate with clay slate. They contain a few petrified vegetables: namely segillariæ, stigmariæ, some filices, some calamites and some algæ, all belonging to genera which no longer exist. About sixty-seven species of zoophytes, thirty-one species of radiatæ, fourty-eight species of crustacea, four species of annelides, eighty-eight species of conchifera, and eighty-two species of mollusca have been found in the old red sandstone and greywacke beds. No quadruped or bird in a petrified state has been met with.

5. Next, above the red sandstone lie the coal measures, so important to the inhabitants of the earth in consequence of the vast quantity of fuel which they contain. The coal beds occur usually in valleys or troughs and they extend to a considerable distance all around without any great alteration in the dip or position of the various beds, except where they have been altered by the interposition of *dykes* or by *slips* as they are called, that is to say, by the elevation of one part of a coal field and the depression of another. No connexion can be traced between the different coal fields; yet as similar strata occur in all coal fields there can be no doubt that (with certain exceptions) they were all deposited under similar circumstances and during the same period of time.

A coal field consists of a great number of beds placed very regularly above one another, varying much in their constitution and thickness, and generally dipping to a particular line which constitutes the lowest part of the basin where the coal metals are situated. The rocks which constitute these coal measures are *sand stone*, *slate clay*, and *coal*. Sometimes limestone is mixed with these beds. It always contains numerous fossils, most commonly shells, generally sea shells; but in some cases fresh water shells. The sandstone contains casts of trees, usually the trunks and roots, seldom the branches, and perhaps never the top. Their casts are sandstone, but the form of the tree is recognised by the bark, which has been converted into coal. The slate-clay or *shale* as it is called when black, contains numerous impressions of the leaves and stems of various plants. Beds of *clay iron-stone* or *carbonate of iron* occur also in the coal measures. The coal measures are much intersected by dykes of green-stone and basalt running through them in various directions. In general the coal in the immediate neighbourhood of these dykes is injured in its quality. But what is more remarkable, the beds of the coal measures upon one side of these dykes are almost always higher than on the other side. Hence these dykes are often called *troubles*, on account of the great trouble which they give the miner to discover the bed of coal upon the other side of a dyke, which they have dug out on the side at which they were working as far as the dyke itself.

The sand-stone which occurs in the coal beds varies much in its colour and the size of its grains. These grains are mostly quartz, obviously water worn and interspersed with particles of mica, as if the sandstone had been derived from granite, the felspar of which had undergone decomposition while the quartz and mica were reduced into small fragments. Sometimes nodules of slate clay or of carbonate of iron occur in this sand-stone, and it is seldom quite free from fossil wood converted into coal. The sand-stone consists of a number of beds lying above each other like the leaves of a book. Some very thin and others many feet in thickness.

The slate clay varies a great deal in its appearance.

Often it is a brown coloured soft clay consisting of very thin slatey beds lying above one another. Very often it contains a great deal of mica in small scales, and grains of sand are seldom wanting. It may have been also formed from decomposed granite, the felspar of which has been converted into clay. It often passes into sand-stone, and during this passage it puts on a great variety of appearances.

The beds of coal vary in thickness from the leaf of a book to 80 feet.

These beds alternate with each other a great number of times in the coal basins. In the Northumberland coal field 240 beds constituting a thickness of 4035 feet have been cut through. Of these, thirty are beds of coal, sixty-two are sand-stone beds, the lowest of which has a thickness of 228 feet. There are twenty lime-stone beds. The remaining 128 beds are chiefly of slate clay. In the Edinburgh coal field there are 337 beds, eighty of which are beds of coal. The Bristol coal field is 4440 feet thick. It contains thirty-one beds of coal, most of them very thin.

There is complete evidence that all the beds of coal found in the earth have been formed from vegetables, which at one time had grown upon the surface of the earth. Now, if we consider the number and thickness of the beds of coal and the numerous interposing beds of sand-stone, slate-clay and limestone, some faint idea may be formed of the vast length of time that must have elapsed during the deposition of these beds.

The number of casts of plants found in the coal measures is very great, more than 300 species having been examined and classified; about 200 of these belong to cryptogamous plants; but most of the others are dicotyledonous. These casts are most abundant in the slate-clay, which has preserved fine impressions of the leaves, and even occasionally of the stems. In the sandstone we usually find casts of trees, and as has been mentioned before, these trees almost always want their tops and branches. The number of fish observed in the coal beds, chiefly in the lime-stone beds is very considerable. The petrified zoophytes are not numerous, amounting only to thirty-four species, the radiata to twenty species, the crustacea to eight species, the annelides to two species, the conchifera 130 species, and the mollusca to 108 species. No quadruped or bird has been found petrified in the coal measures.

6. Over the coal beds and in an unconformable position lies the *new red sand-stone* formation. In this country it consists of two distinct rocks; namely the new red sand-stone which is uppermost, and the magnesian lime-stone which is undermost. The *muschelkalkstein,* which in Germany exists in the upper part of this formation has not yet been discovered in Great Britain. It occupies a large portion of Hanover and Westphalia. In south Germany it extends from Hanau to Stuttgard. In Germany the beds which correspond with our magnesian lime-stone have received the name of *Zechstein.*

The new red sand-stone formation taken in its most comprehensive sense, consists of the following beds, beginning with the uppermost.

1. Variegated marl.
2. Muschelkalk.
3. Red or variegated sand-stone.
4. Zechstein or magnesian lime-stone.

5. Red conglomerate, the *Todliegende* of the Germans. A considerable number of petrifactions occur in this formation. The impressions of twenty-seven species of plants, ten of which are ferns and five fucoides have been observed chiefly in the sand-stone beds. Only thirty species of zoophytes, seven species of radiata, one species of crustaceous fossil, two species of annelides, forty-eight species of conchifera, and thirteen species of molluscs have been hitherto met with—chiefly in the muschelkalk and magnesian limestone. Fish also have been met with but no quadrupeds. The footsteps seemingly of a bird have been observed impressed upon the new red sand-stone of Connecticut. There is a certain resemblance which exists among the fossils of the red sand-stone, the coal measures, and the new red sand-stone. An immense interval must have elapsed from the commencement of the greywacke deposits till the termination of the new red sand-stone deposits. But we have not sufficient evidence to prove that either the temperature or the inhabitants of the earth were altered during the whole of this period. All these beds must have been deposited before the earth was inhabited by birds or quadrupeds. But the existence of coal beds and of various fresh water shells in the lime-stone belonging to the coal series shows irresistibly that dry land must have existed during a very considerable portion of this long series of ages, and that this dry land must have been covered with plants.

7. The next formation, which is very extensive and consists of a great number of beds, has received from British geologists the name of the *great Oolite formation*, and this name has been generally adopted on the con-

tinent. It may be divided into three subordinate formations; namely,

1. Upper Oolite.
2 Middle Oolite.
3. Lower Oolite.

each of these is separated by a valley, filled with clay or calcareous clay, which valleys are distinguished by the names of

1. Kimmeridge clay
2. Oxford clay.
3. Lias lime-stone.

The lias lime-stone lies immediately above the newest bed of the new red sand-stone. Taken as a whole, it may rather be described as consisting of thick argillaceous deposits intermixed with limestone, than an argillaceous limestone. The upper portion consisting of about two-thirds of the whole depth consists of beds of a deep blue marl containing only a few irregular and rubbly lime-stone beds. Lias lime-stone has a dull earthy aspect and a large conchoidal fracture. The slate-clay with which it alternates is grey, brown or black, is frequently bituminous and often divides into laminæ as thin as common pasteboard. Coal beds occur sometimes in this formation. The Whitby beds, the Sutherland beds, and the coal in the southern extremity of Sweden may be mentioned as examples.

No fewer than thirty-six species of plants have been found in this formation, chiefly, as might have been expected, in the coal beds. It contains also a good many fossil shells; those that characterize the formation are the ammonites Bucklandi, gryphea incurva and plagiostoma gigantea.

most of the secondary formations. Its fossils are very numerous, but the variety of genera and species is not so great as in some of the other formations. The remains of fishes, of several bivalve and univalve shells are found; but its most numerous petrifactions belong to the classes of zoophytes and radiata. Only fourteen species of plants have been found with chalk, and most of these are sea plants.

9. The chalk is the uppermost of what are termed by geologists, secondary formations. Over them lie the tertiary formations. They have been divided by Mr. Lyell into three classes; namely the *eocene*, the *miocene* and the *pliocene* formations. These names are derived from the fossil shells which these formations contain in such abundance. In the eocene about 3½ per cent of these fossil shells belong to species still living, the rest belong to extinct species: in the miocene about 17 per cent of the shells belong to living species, while in the pliocene formations above half of the shells found fossil belong to living species.

To the eocene formations belong the beds in the neighbourhood of Paris, in which so great a number of fossil quadrupeds and birds have been found. During the deposition of these beds the earth must have been inhabited by quadrupeds and birds as it is at present. But as these quadrupeds and birds belong to species no longer existing, it is obvious that the state of the globe, at that remote period, must have been different from what it is at present.

The miocene formations contain also numerous petrified bones of quadrupeds, almost all belonging to genera of animals at present existing, though the fossil species are all different from the living species.

The crag of Suffolk and Norfolk belongs to the pliocene formations. But few fossil remains of quadrupeds are found in this formation, and the identity of none of them with living species has been made out.

10. Above the pliocene formations occur the alluvial formations, which are in the act of being formed at present by the filling up of lakes, the action of rivers, the sea, &c. It is very remarkable that no fossil remains of man have been found in any formation older than the alluvial. Hence, we have no evidence that man existed on the face of the earth till our globe had nearly reached the state which it at present exhibits. All the geological facts correspond with the statement of Scripture, that the creation of man cannot be dated much further back than a few thousand years.

Thus it has been demonstrated by evidence of the most satisfactory nature, that the globe of the earth has undergone a suite of remarkable changes since its original creation. What it was when it issued originally from the hands of the Creator we have no means even of conjecturing. All formations at present existing have been formed at the bottom of the sea by the destruction of formations older than themselves. And five different periods may be marked out in the deposition of our present formations.

1. The first period seems to have been anterior to the existence of animals or vegetables on the globe. At least no petrifactions have been observed in the gneiss and mica slate rocks, which are the oldest of all the rocks that we have an opportunity of examining.

2 The second era, beginning with the clay-slate and

terminating with the new red sand stone, must have been of very long duration. During its existence, the globe was inhabited both by shell-fish and by vegetables. Fish also must have existed. But we have no evidence that either amphibious animals, or quadrupeds or birds existed; except the impressions of the feet of birds on the new red sand-stone when it had been in a soft state. These birds must have existed after its deposition, and how long the interval was that elapsed before it became concreted into a hard sand-stone we have no means of estimating.

3. The third era commences with the deposition of the lias, and terminates with that of the chalk. Plants, both land and sea, existed; amphibious animals also of an enormous size, and an animal of the opossum tribe; but, with this solitary exception, we have no evidence of the existence of land animals during the immense period which elapsed between the deposition of the lias and the chalk.

4. The fourth period constitutes the era of the deposition of the tertiary beds. During this period land animals and birds existed in abundance; but all of them constitute species which with several of the genera no longer exist. Several of these animals had been of enormous size, and judging from appearances the temperature of the globe must have been higher than at present. For the quadruped fossils found in France, Germany, and England approach nearer the animals at present inhabiting the torrid zone than those adapted to our present climate.

5. The fifth and last era embraces the period of alluvial deposits, when the animals were the same

as they are at present, and where the remains of man occasionally present themselves.

Such is a rapid sketch of the changes which have taken place upon the surface of the earth since its original creation. It has been affirmed by some wrong headed or fanatical individuals that the facts disclosed by geology are inconsistent with the Mosaic account of the creation, and on that account attempts have been made to discourage the cultivation of geology. Now nothing can be worse judged than such an attempt. It is a kind of acknowledgement that improvement in science is inconsistent with the prosperity of the christian religion, and that ignorance is the mother of devotion.

Now it never was the intention of revelation to teach science to mankind. Such a proceeding would have been inconsistent with the obvious intention of the Deity—that scientific investigations should occupy mankind, and that progress in them should be rewarded by a feeling of happiness of no ordinary kind, resulting from their successful pursuit.

The object of revelation was obviously to teach mankind their duties to their God, their neighbours and themselves. Had it displayed more science than existed at the time when it was given, it would not only have defeated the very object in view, but it would have been unintelligible to those for whom it was intended.

The cosmogony of Moses is nothing more than this: "In the beginning God created the heavens and the earth;" a proposition which no man of science can refuse to admit, and with which all true geological knowledge is perfectly compatible. To attempt to deduce geological theories from the writings of Moses is to apply them to a purpose for which they were never intended, and to which they can never apply.

Indeed geology, when properly considered, affords an evidence for the truth of the Christian religion of a very important kind, and which none of the other branches of physics is capable of supplying. The very idea of a revelation necessarily supposes a *particular providence*, or the direct interference of the Deity with the economy of man. The scriptures inculcate this doctrine in almost every page. Both the old and new Testaments are full of the direct interference of the Divinity in human affairs. But when we take a view of the material world around us every thing appears to be regulated by general laws. The motions of the planets are determined by the laws of gravitation, and these laws have been regulated with such consummate skill, that all irregularities mutually compensate each other; they run a certain period and then disappear. So that the motion of the heavenly bodies, unless they are actually stopped by the direct interference of the Creator, may continue, and will undoubtedly continue for ever. We observe the same interminable series both in the animal and vegetable kingdoms, the same general laws regulate the seasons and the rise and fall of nations.

It has been objected against revelation, that nothing in the material world leads to the notion that the Deity ever interferes except by general laws. And no satisfactory answer has ever been given to this objection. But geology furnishes an answer of the most obvious and demonstrative nature. Since the original creation of the earth, its whole inhabitants have more than once completely changed. Certain genera have disappeared, and others have occupied their place, and this not once or twice but a great many times. Now a new species or a new genus of animal or vegetable could not have thus appeared unless it had been actually created by the divine energy to supply the place of other species or genera now no longer adapted to the altered state of the earth. Every such act of creation is an actual interference of the Deity, or in other words, an evidence of the existence of a particular providence.

The doctrines of equivocal generation countenanced by some late physiological experiments affords an argument of the same kind. For what other meaning can equivocal generation have than the actual creation of a new being by a special interference of the Divinity?

ON THE

PRINCIPLES OF CLASSIFICATION

AS APPLIED TO THE

PRIMARY DIVISIONS

OF THE

ANIMAL KINGDOM.

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GENERAL OBSERVATIONS.

Generalizations are the necessary results of all scientific inquiries, and their value depends on the extent of the basis on which they rest. The memory is greatly aided by methodical arrangements in the acquisition of knowledge; and classifications, which keep pace with the march of discovery, become powerful means of advancing its progress, especially in Natural History where the multitude and diversity of the objects most require such aid. In generalizing, we abstract the mind from differences, and seek some common resemblance in the objects—a unity of character for their classification, and thus from the property of resistance we form a material universe, from growth by internal development an organic kingdom, and from the want of this an inorganic. This binary division of matter into organized and inorganized is founded on a *unity of principle*, the importance of which in all classifications is as obvious as that of classifications themselves, and naturalists have constantly endeavoured to discover and apply it in all the three kingdoms of nature. The mineralogist has sought this unity of principle for the establishment of his primary groups, in the primitive crystalline forms, in the chemical constitution, or in the more common physical properties of the bodies to be classified. The botanist has sought for it in the modes of reproduction, in the endogenous and exogeneous modes of growth, in the modifications of the sexual system, or in other common properties of plants.

In the animal kingdom, Aristotle found a similar unity of principle in the *white* and *red* characters of the *blood*, Lamarck in the different *intellectual conditions* of animals, and modern zoologists in the *vertebrate* and *invertebrate* conditions of the skeleton. Animals, like other objects, are to be associated by resemblances and separated by differences; they are associated with vegetables by being, like them organized, but they are separated from them by the possession of an internal sac, and by those higher *organs of relation* which are superadded in consequence of this internal source of nutrition. They are, therefore, associated together chiefly by those organs of relation which are wanting in the vegetable kingdom, and on the modifications of these, as common characters, the primary divisions of the animal kingdom might be founded. A common principle of classification ought to be extended only to divisions of the same value; a character found advantageous for the distribution of a kingdom or class, may be ill-adapted for the distinction of species or any other subordinate groups. In establishing primary divisions of a *kingdom*, the objects to be classified are not *species* but *classes*, and as the classes of animals are now so numerous, a mere *binary* distribution of these, as of *organized bodies* into two *kingdoms*, would be of little practical utility in their study. The divisions of natural history being arbitrary and conventional, should always be made as proportionate as possible to the number and diversity of the objects they embrace, and they are of least utility in assisting the mind where there is no unity of principle or common bond of connexion in their formation.

The most important and most influential of the organs of relation is the *nervous system*, the central system of animal life, and most intimately connected with all the vegetative functions of animals. As this system is apparent in every division of the animal kingdom, and as its modifications correspond more than those of any other system with the general condition of all the other systems of the body, and with the general external forms of animals, it appears peculiarly adapted for the establishment of primary groups or sub-kingdoms. The *motor*, the *sensitive*, and the *sympathetic* portions of this system I have shown to be developed simultaneously nearly from the lowest tribes of animals, and they are obvious in all the higher divisions, but the great symmetrical or moto-sensitive axis is that which corresponds with all the higher relations of animals, and presents modifications the most important for indicating the natural affinities of classes.

In the animal kingdom the *nervous filaments* precede perceptible *ganglia*, as the ganglionic form precedes the cerebral or *encephalic*, but besides the *neurose*, the *gangliated*, and the *encephalic;* conditions of this system in animals, each of the two former presents modifications of form, in its *circular* or *longitudinal* development, which are as important as the encephalic itself for the purposes of classification. This axis is perforated by the œsophagus in the invertebrated classes, and is entirely on the dorsal side of the alimentary cavity in the vertebrata; its form corresponds with the general form of the body, being *circular* in the short round bodies of the *radiated* and *molluscous* animals, and extended longitudinally or *straight* in the lengthened bodies of the *articulated* and *vertebrated* classes.

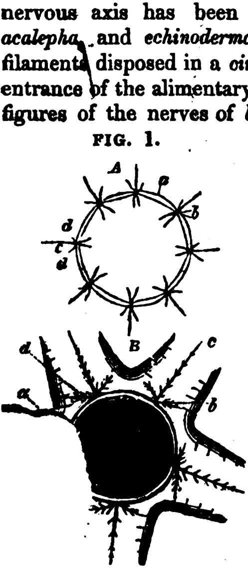
The unconnected and uninfluential characters expressed by the terms *(radiata, articulata, mollusca,* and *vertebrata)* at present employed to designate the sub-kingdoms, convey no idea of gradation, or development, or any kind of concatenation, and they were never supposed to be of *universal* application to the objects which they characterize. The characters and designations for the *primary divisions,* which I have established on modifications of the nervous system, are likewise to be considered, like every similar attempt, as merely conventional, and of general, not universal, application; but they are founded on *one system,* and that the most influential in the economy of animals, and they distinctly point out, not only a connexion, but a gradation of development, in the objects classified.

FIRST SUB-KINGDOM.

CYCLO-NEURA OR RADIATA.

Characters may be imperceptible without being opposed, and where they cannot be detected, the common affinities and analogies of the objects assist in their classification. No nervous system has ever been detected in the *polygastric* or in the *poripherous* animals; yet the natural affinities of these classes show the former to be connected with the *helminthoid*, and the latter with the *radiated* sub-kingdom. Wherever the nervous axis has been detected in the *polypiphera*, *acalepha*, and *echinoderma* it consists of almost simple filaments disposed in a *circular form* around the buccal entrance of the alimentary cavity, as seen in the annexed figures of the nerves of *beroe pileus* (Fig. 1. A.) and of *asterias* (Fig. 1. B.) The ganglionic enlargements on the sensitive filaments here, as in the embryos of higher classes, are still scarcely apparent, and the term CYCLO-NEURA applied to this sub-kingdom expresses not only the common *circular form* of this system, but also its rudimental state of simple *filaments*. The animals of this lowest sub-kingdom are entirely aquatic, with a short alimentary canal or simple digestive sac; they are often fixed, or with limited means of

FIG. 1.



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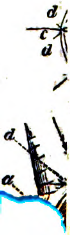

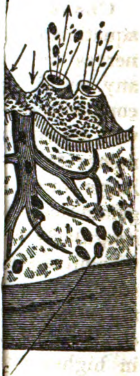

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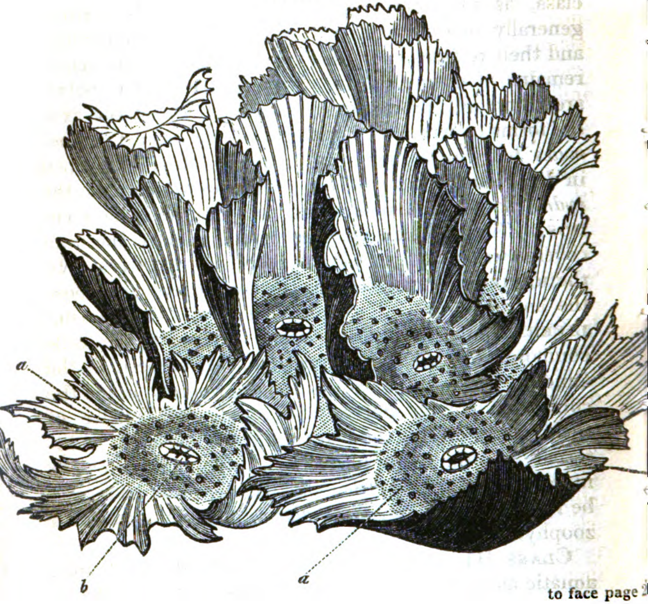
locomotion, and generally with a plant-like exterior form; they are mostly predaceous, and with an imperfect development of their glandular apparatus, and of their organs of sense; they are still destitute of a muscular heart, and breathe by branchiæ or by their general surface. Their internal organs being few and as variable as the outward form of their body, no single definite principle has been adopted for their division into *classes*, and these have been characterized chiefly by the condition of their nutritive organs or of their skin. Four distinct classes are established in this sub-kingdom, viz. *Poriphera, Polypiphera, Malactinia* and *Echinoderma*.

CLASS I. PORIPHERA.—These are simple, soft, aquatic animals with a fibrous axis, without perceptible nerves or muscular filaments or organs of sense or any circulating or glandular organs. Their body is composed of a soft gelatinous flesh, traversed internally with numerous ramose anastomosing canals which commence from superficial minute *pores* and terminate in larger open vents. They are gemmiparous, and the gemmules move spontaneously by vibratile cilia disposed irregularly on their surface. The body of the *poriphera*, without distinct stomach or branchiæ, is digestive and respiratory, and similarly organized in every part, a universal *blastema*, like the primitive cellular embryo-condition in which the organs are successively developed in higher classes of animals. Figure 2 represents one of these animals, the common *halina papillaris* of our coasts, as seen alive under water. The currents for nutriment and respiration enter by the superficial pores (2 *a. a. d.*) traverse the internal canals (2 *f.* * *f.* *), and issue by the large vents (2 *b. b.*) at the ends of the prominent papillæ. The gemmules (2 *f*.) pass out with the currents by the vents. This class is subdivided into three ORDERS by differences in the condition of the skeleton, which is the part most constant in its characters in these polymorphous animals. In the lowest order, most abundant in colder latitudes, the skeleton is composed of minute *silicious* crystalline spicula, and the species of this order are thence denominated HALINIDA. In the second order the spicula are *calcareous* and the body is of a white colour: these animals are thence termed LEUCONIDA. In the species of the third order, termed KERATOSA, the axis is entirely composed of tubular *horny* anastomosing filaments, and these animals are chiefly confined to the warmer parts of the ocean.

CLASS II. POLYPIPHERA.—Soft, aquatic animals of a plant-like form, generally fixed and supported by an extra-vascular *axis* of a calcareous or horny texture. Instead of the *pores* of the former class, the common fleshy mass of the body here developes small tubular digestive sacs called *polypi*, the margins of which are furnished with sensitive *tentacula*, and the sides of the tentacula are almost always furnished with sensitive or prehensile or vibratile *cilia*. The nutriment elaborated in the polypi is commonly transmitted by their pyloric orifice to ciliated canals which convey it, without peristaltic action, to all parts of the body.

Like the poriphera, they are found both in fresh waters and in the ocean, and they subsist chiefly on small floating animals which they attract by their vibratile cilia, seize by their tentacula, and digest in their polypi. Their nerves and muscles are seldom perceptible, and ocular

FIG. 3.



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points, like those around the respiratory orifice of certain cynthiæ, are observed in few species of this class, as in some *actiniæ*. Their solid axis consists generally of carbonate with a little phosphate of lime, and their remains compose entire strata, like the silicious remains of poriphera and of polygastrica. The polypi are commonly protected by permanent *cells* of the axis, the forms of which vary with the species, and the *gemmules* by which they propagate are often developed in deciduous *vesicles*. Those zoophytes which, like the *hydra*, have no solid skeleton, compose the order CARNOSA. Those which, like the *sertularia*, have the flesh covered with a horny sheath are termed VAGINATA. In the RETIFORMIA the cells aggregated together compose the entire reticulated axis, as in *flustra*. The LAMELLIFERA have a solid calcareous axis with the cells composed of radiating vertical lamellæ, as seen in the annexed Fig. 3 of the *pavonia lactuca*, where *a. a.* are the contracted polypi, and *c. c.* the radiating lamellæ of their cells. In the CORTICIFERA the skeleton is internal and the flesh forms an enveloping cortex as in *corallium* and *gorgonia*, and to this order may also be referred *virgularia*, *umbellularia*, and other calamoid zoophytes.

CLASS III. MALACTINIA *(soft-radiated)*; soft, free, aquatic animals, of a simple structure, entirely marine, generally of a transparent gelatinous texture and radiated structure or form, luminous, and emitting an acrid secretion from their surface which is capable of irritating and inflaming the human skin like the stinging of a nettle, from which the name *acalephæ* (nettles) has been commonly given to this class. Their nervous moto-sensitive axis is circular where it is obvious, as in beroe and aurelia; the organs of vision, perceptible in some, are provided with a complicated crystalline lens, and there are commonly numerous filiform sensitive tentacula disposed around their vertical axis. The alimentary canal has one, two, or many orifices, and is sometimes provided with hepatic follicles. The skeleton when present is light and flexible, the sanguiferous system consists of vessels without a pulsating cavity, and the respiration is effected by vibratile cilia, and through the soft naked surface of the body without special organs. The species are numerous in individuals, gregareous, predaceous, feeding on the smaller floating animals, they abound in all seas, and are divided according to the forms of their locomotive organs. Some as *beroe* move by vibratile cilia, and are thence termed CILIOGRADA; others as *physalia* float by means of air-sacs, and compose the order PHYSOGRADA; the highest order termed PALLIOGRADA contains those which move by the muscular contractions of a superior discoid mantle, as the *rhizostoma Cuvieri* (Fig. 4. A. B.) and *aurelia aurita* (Fig. 4. C. D.)

CLASS IV. ECHINODERMA.—Simple aquatic animals, with a radiated, globular or elongated body, covered with a spiny shell or with a coriaceous skin. They are entirely marine, slow-moving or fixed, predaceous, and commonly provided with a distinct nervous, muscular, sanguiferous, and respiratory system, and organs of sense. These animals are not organised for swimming through the sea like the *malactinia*, but are usually attached or burrow at the bottom, and hence their solid exterior protection, wanting in the former class. They are termed *echinoderma* from the surface of their

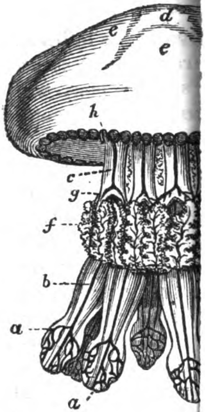
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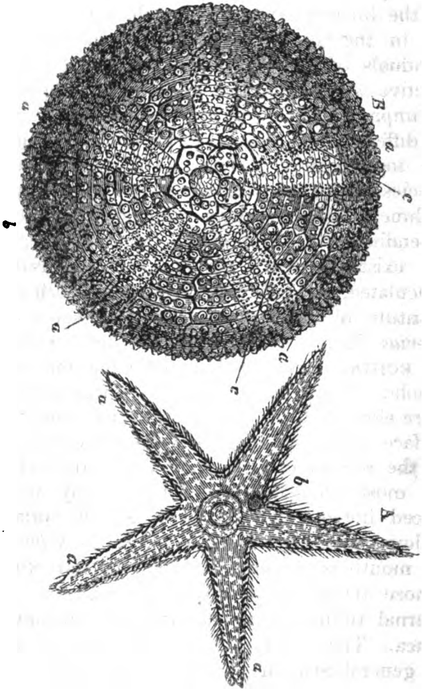
FIG. 5.



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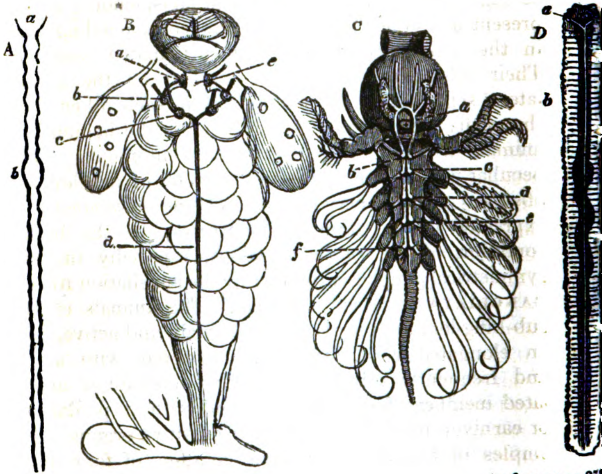
skin being generally covered with calcareous spines, whether the surface be calcified or coriaceous. Their axis is generally vertical and short, with the mouth central and inferior, and their parts are nearly equally developed around the axis, with but slight indications of the bilateral symmetry established in higher classes. As in the inferior cyclo-neurose animals, all the individuals of species are still organised alike, and productive without mutual excitement or apparent organs of impregnation. The *orders* of this class are founded on differences of general form, and are designated from the most typical genera. The CRINOIDA are those species, chiefly fossil, which are fixed by a jointed peduncle, and have long ramified articulated tentacula extending from around the abdominal cavity, as in the existing genera *encrinus* and *pentacrinus*. Those articulated, free, flexible, stellated species which are destitute of peduncle, and with a short axis, as the *asterias* (Fig. 5. A.) compose the order ASTERIDA. In the ECHINIDA, the body is inflexible and covered with a solid articulated shell. The vertical axis is generally more elongated than in the asterida, and the exterior surface is covered with moveable calcareous spines, as in the *echinus*, (Fig. 5. B.) The HOLOTHURIDA have the most elongated form of the body, with the axis placed horizontally, and with a soft coriaceous skin seldom protected with spines, as in the *holothuria*, where the mouth is surrounded with long retractile and often ramose tentacula, and the respiration is effected by internal tubular ramified branchiæ opening from the cloaca. The holothurida, in the elongated form and the general structure of their body, in their soft covering, and the horizontal extension of their axis, and especially in the extended form of their nervous axis, approachthe nearest of all the cyclo-neurose animals to the helminthoid and other forms of articulata.

SECOND SUB-KINGDOM.

DIPLO-NEURA OR HELMINTHOIDA.

Since I first pointed out the *motor function* of the interganglionic nerves of articulated animals, and of the *motor columns* which they chiefly form by passing continuously over all the symmetrical ganglia of the longitudinal nervous axis, I have shown the universal occurrence of these superior motor columns throughout the articulated classes, the existence but not the function of which had been previously distinctly pointed out only by Muller in the scorpion; I have thus established the analogy which had been long conjectured to exist between these *inverted* moto-sensitive longitudinal *columns* of the articulated animals and the spino-cerebral axis of the vertebrata. The elongated form of the nervous axis in the *helminthoid* and *entomoid* sub-kingdoms corresponds with the lengthened form of the body in these animals; and the *inverted position* occupied by their motor and sensitive columns I have shown to correspond with that of their vascular and other important systems, and the inverted position of their whole body with relation to that of the vertebrata. In the *helminthoid* classes, comprehending the various forms of *worms*, FIG 6.



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the trunk of the insect is almost alone developed, without those *articulated members* which serve to characterise the *entomoid* tribes; consequently the nervous columns extending along the ventral surface of their body have generally the ganglionic enlargements so slightly developed as to be little conspicuous, and to present a marked inferiority to the corresponding parts in the articulated classes with articulated members. Their inferiority is likewise marked by the greater lateral separation of the columns from each other along the median line, commonly observed in the helminthoid animals when compared with the entomoida. This peculiar condition and inferior character of development observed in the nervous axis of the *helminthoida* is expressed by the term DIPLO-NEURA, as the higher condition of the *entomoid* classes, especially in their symmetrical ganglia, is implied by the appellation DIPLO-GANGLIATA assigned to them. The animals of this sub-kingdom are mostly aquatic, small, and active, with an elongated vermiform trunk, covered with a soft and frequently subannulated skin, destitute of articulated members for locomotion, and with a predaceous or carnivorous character of their nutritive organs. Examples of the ventral nervous columns of four diploneurose classes are seen in Fig. 6, where A represents the double abdominal nervous filament of the *ascaris* among the SUCTORIA; B. *c. d.* the same columns in the *hydatina* among the ROTIFERA; C. *b. c. f.* those of the *anatifa* among the CIRRHOPODA; and D. those which extend along the ventral surface of the trunk in the *lumbricus* one of the pulmonated ANNELIDA. This sub-kingdom comprehends the classes *Polygastrica*, *Rotifera*, *Suctoria*, *Cirrhopoda*, and *Annelida*.

Class V. Polygastrica.—Minute, transparent, soft, aquatic animals, with numerous stomachs or cœca communicating with an internal alimentary cavity, without perceptible nerves or muscles, moving by external vibratile cilia, commonly provided with organs of vision and with numerous long, parallel, moveable teeth arranged in form of an exsertile buccal syphon. Their stomachs are analogous to the biliary follicles of other helminthoid classes, and admit the food into contact with their secreting surface, as in the primitive condition of the liver in all higher classes. The digestive organs of the polygastric animalcules being almost the only important parts developed, and being more constant in their characters than the exterior form of the body, their modifications serve for the establishment of three distinct *orders*. In the lowest order termed ANENTERA (Fig. 7. A.) there is no intestine, and the stomachs filling the general cavity of the body communicate with the buccal orifice (7. A. *a.*) by a single wide pharynx (7. A. *b.*) surrounded with long vibratile cilia, as seen in the *monas atomus* (Fig. 7. A.) The order CYCLO-CŒLA (Fig. 7. B. C.) is distinguished by the circular form of the intestinal canal which passes round the abdominal cavity, giving off numerous cœca or stomachs in its course, and returning to the same buccal orifice where it commenced. This circular intestine is sometimes simple, as in *vorticella citrina*; in others it is sacculated in its course, as in *stentor polymorphus*. Those which have the intestine passing entirely through the body, and opening by two distinct terminal apertures on the surface, compose the order DIA-CŒLA (Fig. 7. D. E.); the intestine sometimes passes straight through the body, as in *enchelys pupa* (7. D. *a. b.*) and in others as *leu-*

FIG. 7.

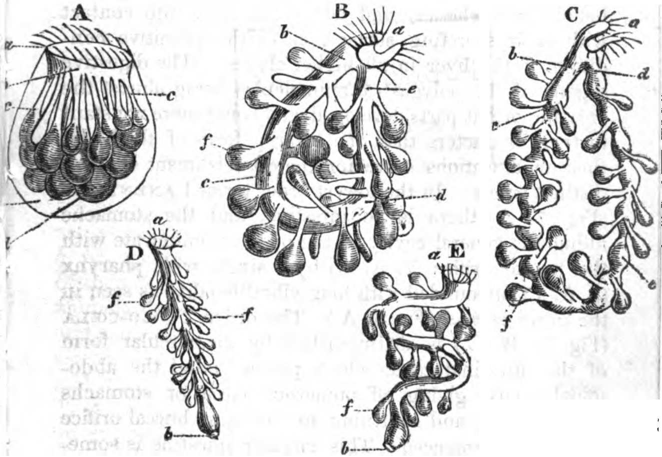

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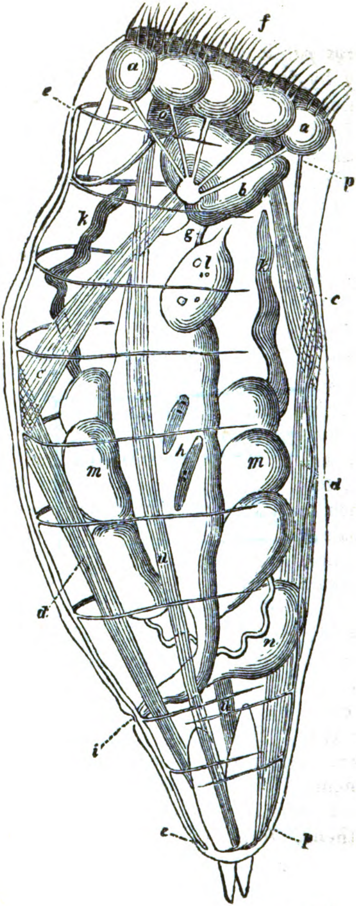
FIG. 8.



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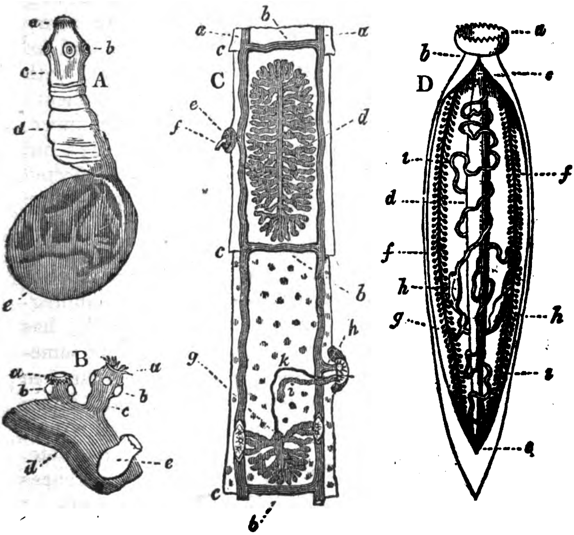
cophrys patula (7. E. *a. b.*) it is tortuous. It is especially by this highest diacœlous order that the polygastrica have the closest affinities to the other helminthoid classes.

CLASS VI. ROTIFERA.—Minute, transparent, soft, aquatic animals, with distinct muscular and nervous systems, provided with eyes, lateral maxillæ, an intestine with distinct buccal and anal openings, a dorsal vessel for circulation, and with vibratile cilia disposed generally in a circular order around the anterior part of the body. They are called *rotifera* from the appearance of revolving wheels produced by the rapid movement of the cilia placed around the mouth, as seen in the *hydatina senta* (Fig. 8. *f.*), and they are allied to the articulated classes by the elongated form of their body, by their ventral nervous columns (8. *p. p.*), by the dorsal vessel (8. *e. e.*) their straight alimentary cavity (8. *g. h. i.*), their transverse jaws, and the high development of their organs of motion and sensation. They are free animals; all the individuals of species are productive and similarly organised; they are oviparous, predaceous, remarkable for their fertility and their tenacity of life, and they exhibit no branchial or pulmonary organs. Those which have the surface of the body protected by an exterior sheath compose the order LORICATA, and those which have the surface naked and soft are thence termed NUDA.

CLASS 7. SUCTORIA.—This class comprehends the *entozoa* and a few other helminthoid animals allied to them in structure and form. They are mostly parasitic, internal, or fixed animals, of cylindrical or lengthened form, of a white colour, and destitute of solid skeleton, without articulations, and almost destitute of organs of sense. The mouth is adapted for sucking fluid aliment, and is commonly provided with sharp marginal recurved teeth, organs of adhesion, and an exsertile proboscis. They are generally covered with an elastic, transparent, soft, and permanent integument; their muscular and nervous systems are most imperfectly developed, their alimentary cavity has often but one opening, sometimes two; their circulation is effected by vessels without the aid of a heart, and they are destitute of distinct respiratory organs. Some species are gemmiparous, without sexual organs; others are provided only with female organs, and in other species sexual distinctions are established and internal impregnation. The nervous system, when perceptible, has the diploneurose form; the organs of vision are sometimes compound, and sometimes present only in the free embryo state, like those in the class *cirrhopoda*. Some remain permanently free, residing in fresh or sea water; others as the epizoa are free only in their larva state. The *orders* of SUCTORIA are founded on differences of the general form of the body. Those destitute of an anal aperture, which have one or more buccal orifices leading into a terminal cyst compose the order CYSTICA, as seen in the *cysticercus longicollis* (Fig. 9. A.) where the head is single, and in the *cœnurus cerebralis* (9. B.) where numerous heads lead to one cyst. The CESTOIDEA have a long, depressed, flat, articulated form, without anal aperture, as seen in the *tænia solium* (Fig. 9. C.) where each segment has distinct nutritive and generative organs. The TREMATODA have a short, broad, depressed body without distinct anus and with

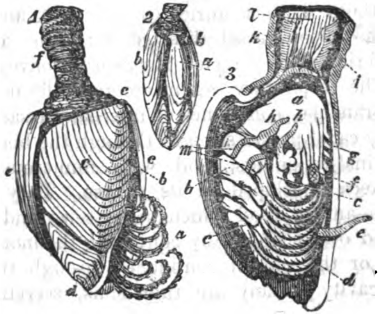
FIG. 9.



one or more orifices leading into a ramified alimentary canal, as in the *distoma hepaticum*. The ACANTHOCEPHALA have an elongated cylindrical body with the anterior part closely covered with small sharp spines; and the oral aperture leads to a ramified alimentary canal destitute of anal opening, as in the *echinorhynchus gigas*. The NEMATOIDEA have a long, cylindrical and often filiform, naked, inarticulated body traversed by a straight alimentary canal open at both ends, and with distinct sexes and internal impregnation, as in *strongylus armatus* (9. D.) The EPIZOA have a more short and entomoid form, with a sub-articulated trunk, a biforate intestine, with rudimentary mandibles, palpi, proboscis, and sometimes antennæ and eyes. They are free, active and natant larvæ, commonly with organs of vision, till they fix themselves permanently by strong organs of attachment to the soft superficial parts of aquatic animals, as in the *lenæocera cyprinacea.*

CLASS 8. CIRRHOPODA.—Aquatic, subarticulated, diploneurose animals, with numerous lateral articulated cirrhi, distinct branchiæ for respiration, a pulsating dorsal vessel for circulation, body covered with a fleshy mantle and fixed inverted in a sessile or pedunculated multivalve shell. They are entirely marine; the branchiæ, as in crustacea, are attached to the bases of the articulated members; the mouth, as in higher articulata,

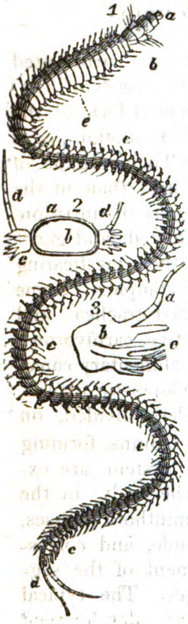
FIG. 10.



is provided with lateral mandibles, maxillæ and palpi; the approximated nervous columns extend along the ventral surface of the body with symmetrical pairs of ganglia corresponding to the lateral members. They are free, natant, and possess organs of vision, only in the larva state. Those which are enclosed in fixed, sessile multivalve, conical shells, as the *balanus*, compose the order BALANIDA. The order ANATIFIDA comprises those which have the enveloping shell attached by means of a long fleshy contractile tubular peduncle, as seen in the anatifa or *pentalasmis* (Fig. 10. 1. 2. 3.)

CLASS 9. ANNULIDA.—Long, cylindrical, mostly aquatic worms, with red blood, covered with a soft and more or less segmented and annulated skin, destitute of articulated organs of motion; the head commonly provided with antennæ and numerous simple eyes, and the mouth with lateral maxillæ; the organs of motion in form of setæ or cirrhi extending from the sides of the trunk, in single or double longitudinal rows. The sanguiferous system consists of arteries and veins, without distinct auricle or venticle, and generally of a dorsal vessel directed forwards and two lateral inferior veins directed backward, conveying red blood. The respiratory organs are generally in form of external branchiæ, sometimes of internal air-sacs. The alimentary canal passes straight through the body, with two terminal openings, and with numerous lateral hepatic cœca developed in its course. They subsist chiefly on animal food which some seize and devour entire, and others obtain by conveying the moist sands of coasts or the soil of continents through their alimentary cavity. Many are tubicolous, secreting calcareous sheaths on their surface, or constructing arenaceous or other tubes around their body, and many are free with a naked cutaneous surface. This class is termed *annulida* from the *annuli* surrounding the trunk, and is divided into orders by the differences of the respiratory organs. Those which have no perceptible respiratory organs form the order APNEUMATA, as the *nais*; those which present distinct branchiæ at the cephalic extremity of body, are termed CEPHALOBRANCHIA, as the *serpula* and *sabella*; those which have external or internal branchiæ disposed along the back of the trunk are called DORSIBRANCHIA, as the *arenicola*, the *nereis* (Fig. 11), and the *halithea*; and those which breathe by pulmonary sacs, as the *lumbricus*, compose the order PULMONATA.

FIG. 11.

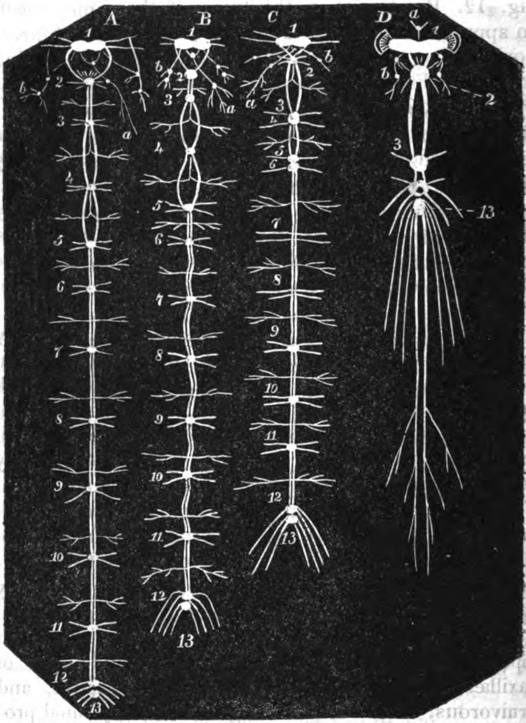


THIRD SUB-KINGDOM.

DIPLO-GANGLIATA OR ENTOMOIDA.

This sub-kingdom is chiefly composed of articulated animals with articulated members, the *insects* of Linnæus, which have an elongated, segmented form of the trunk, with tubular jointed organs of motion symmetrically disposed along its sides. Their organs of sense and of motion are more developed than in the helminthoid classes, and also their organs of nutrition. Their exterior covering is more consolidated, and generally contains phosphate of lime, and their masticating organs are more numerous and more complex. Some respire by branchiæ, others by ramified tracheæ, and others by pulmonary sacs. Most are active, carnivorous, and predaceous, with a short straight alimentary canal, a small stomach, simple follicular chylopoietic glands, and a pulsating ventricle, more or less divided, on the dorsal vessel. The moto-sensitive columns, forming the symmetrical axis of the nervous system, are extended along the ventral surface of the body, in the same relative position as in the helminthoid classes, with the ganglia increased in magnitude, and corresponding with the increased development of the segments and of their lateral appendages. The typical form of the nervous axis and the high development of its ganglia are expressed by the term DIPLO-GANGLIATA applied to this sub-kingdom, and the annexed Fig. 12. represents this system as it occurs in different conditions and forms of insects. Fig. 12. A. represents

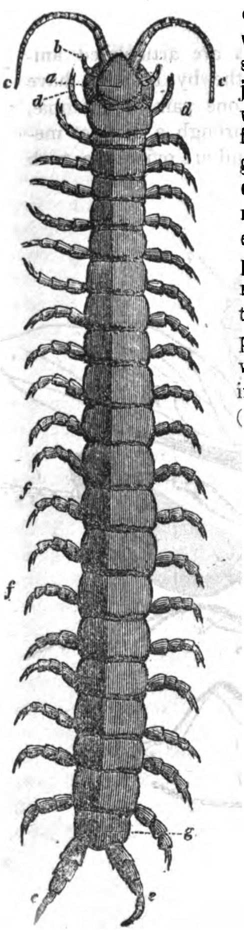
FIG. 12.



the pairs of transversely approximated ganglia disposed along the nervous columns of the larva of *papilio brassicæ*, Fig. 12. B. shows, in the pupa of the same insect, an approximation of the ganglia in a longitudinal direction, and a consequent bending of the intervening columns; Fig. 12. C. exhibits the shortened columns and concentrated ganglia of the same *lepidopterous* insect in its imago state; and Fig. 12. D. represents a more concentrated condition of the nervous axis exhibited by the adult *melolontha vulgaris* one of the *coleopterous* insects. The classes of *entomoida* are founded chiefly on differences of the respiratory and locomotive organs and of the general form of the body. Four of these are established, viz. *Myriapoda, Insecta, Arachnida,* and *Crustacea.*

Class X. Myriapoda.—Body elongated, distinctly articulated, and equal throughout; without distinction of thorax or abdomen; all the segments of the trunk freely moveable, and provided each with one or two pairs of jointed ambulatory feet; the head provided with a pair of antennæ, and with simple eyes. They respire by tracheæ which open along the whole extent of the body, and ramify from their commencement without forming continuous lateral air-tubes as in insects. The myriapoda present the nearest approach to the helminthoid form of the trunk and its appendages. They do not undergo metamorphosis, nor possess compound eyes, nor wings. The mouth is furnished with an upper and lower lip, a pair of mandibles, and a pair of maxillæ. These animals are muscular, active, and carnivorous, with a short straight alimentary canal provided with simple salivary and biliary follicles. They are divided into two orders by the differences of their jaws

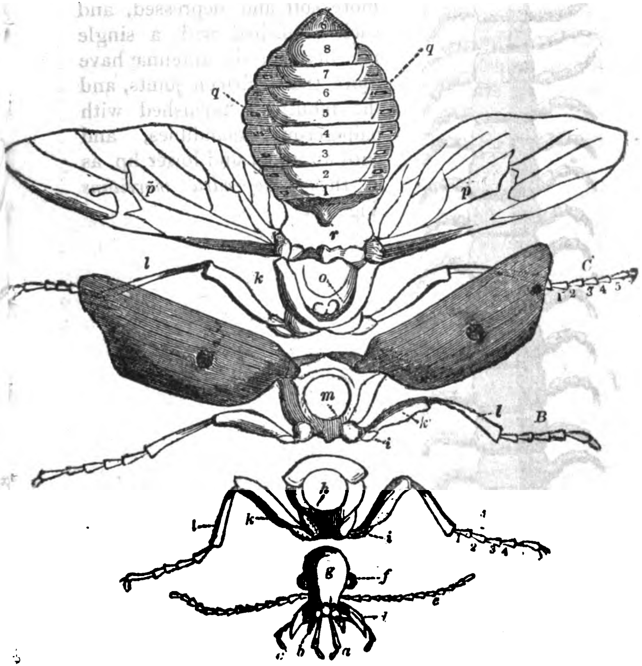
FIG. 13.



and feet. The order CHILOGNATHA is composed of those which have solid cylindrical segments, antennæ with seven joints, two strong mandibles without palpi, and very short feet terminated by simple ungues, as in the *iulus*. In the CHILOPODA the segments are more soft and depressed, and each furnished with a single pair of feet; the antennæ have more than thirteen joints, and the mouth is furnished with palpigerous mandibles, and with an upper and lower lip, as in the *scolopendra morsitans* (Fig. 13.)

Class XI. Insecta.—Insects are articulated animals with six feet, which breathe by tracheæ, have a dorsal vessel for circulation, one pair of antennæ, compound eyes, generally pass through a distinct metamorphosis and acquire wings, and are oviparous with

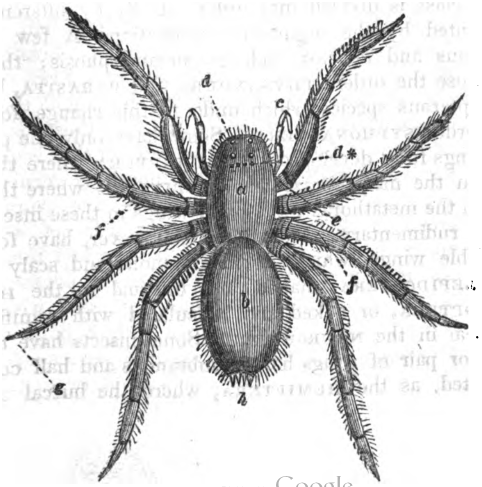
FIG. 14.



the sexes distinct. The trunk of insects, as seen in the annexed (Fig. 14.) of the *calosoma sycophanta*, is divided into the head (14 *g*.) which supports the brain, the organs of the senses and those of mastication or suction, the *thorax* (14. *h. m. o.*) composed of three segments which support the legs and the wings, and the *abdomen* (14 *q. q.*) generally consisting of nine segments which embrace the principal viscera of nutrition and generation. The mouth is furnished with a pair of mandibles, a pair of maxillæ, a labium and labrum, with maxillary and labial palpi, and the alimentary canal with salivary, biliary and often pancreatic follicles. The dorsal vessel is divided by valves into several distinct pulsating cavities, and the tracheæ, commencing by lateral stigmata, form continuous longitudinal trunks along the sides before they ramify through the body. This class is divided into orders chiefly by differences presented by the organs of locomotion. A few are apterous and do not undergo metamorphosis; these compose the orders THYSANOURA and PARASITA, but the apterous species, which undergo this change, form the order SYPHONAPTERA. Some have only one pair of wings fully developed, as the DIPTERA where they are on the mesothorax, and RHIPIPTERA where they are on the metathorax; the other wings in these insects being rudimentary. Most insects, however, have four available wings, which are membranous and scaly in the LEPIDOPTERA, naked and unequal in the HYMENOPTERA, or naked and reticulated with ramified tracheæ in the NEUROPTERA. Some insects have the anterior pair of wings half membranous and half consolidated, as the HEMIPTERA, where the buccal apparatus is constructed for sucking. In many which have the mandibles and maxillæ adapted for masticating hard substances, the anterior pair of wings form complete solid elytra which cover and protect the posterior membranous pair, as in the ORTHOPTERA, the DERMAPTERA, and the immense order COLEOPTERA where the various systems of the body have attained their most concentrated and developed form.

CLASS XII. ARACHNIDA.—Articulated animals breathing by tracheæ or by air-sacs, without antennæ, or compound eyes, or wings, or metamorphosis; generally with four pairs of legs; the segments of the head and thorax are united, so that the trunk consists of only a cephalo-thorax and abdomen, as seen in the *lycosa tarentula* (Fig. 15.) Their mouth is provided with a

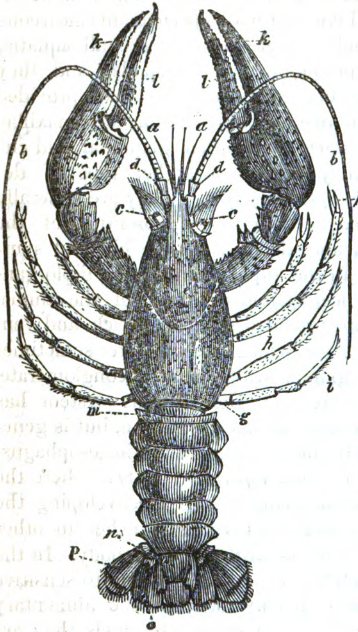
FIG. 15.



pair of mandibles and maxillæ, a labium and labrum and a pair of jointed palpi often extended like short feet. The organs of vision are simple ocelli, and the stigmata, confined to the abdomen, are only from two to eight in number. They are cunning, powerful, active, carnivorous animals, often provided with poison-instruments to overcome their prey, or with secretions adapted to form nets to entangle them; they are oviparous, with the sexes separate and often remarkably distinct in external form. They are divided by their respiratory organs, into TRACHEATA which breathe by ramified tracheæ, as the phalangium, where there are only two abdominal stigmata; and PULMONATA which breathe by pulmonary sacs opening by 2—8 transverse abdominal stigmata, as in the scorpions and spiders. In many parasitic and microscopic species the respiratory organs have not been detected.

CLASS XIII. CRUSTACEA.—Articulated animals with five or more pairs of articulated members, breathing by branchiæ, with two pairs of antennæ, and two compound eyes. The segments of the head and thorax and pro-abdomen are generally united; those of the post-abdomen are moveable, and the exterior shell is generally hard and calcareous. The mouth is furnished with a pair of palpigerous mandibles five pairs of palpigerous maxillæ, the two exterior pairs of which are sometimes in form of feet, a labrum and tongue. They are mostly aquatic, carnivorous, and predaceous animals, with a short and straight intestine, without salivary or pancreatic glands, and with a large conglomerate liver. The circulation is aided by a muscular ventricle, and the branchiæ are sometimes external, attached to the false feet under the post-abdomen, sometimes concealed under the sides of the carapace. The sexes are separate, and the organs of generation are double and symmetrical in both sexes. They are divided into orders chiefly by characters derived from the feet and the respiratory organs. The lowest forms of *crustacea* are generally small, jawless, parasitic, suctorial, binoculous species, with prehensile antennæ, and termed POECILOPODA from the anisopodous character of their segments, the feet of different segments being prehensile, or natatory, or branchial, or ambulatory. The BRANCHIOPODA have the branchiæ attached to numerous pairs of similar feet, they possess mandibles and maxillæ, and are generally small, monoculous or binoculous animals, with a large carapace enveloping the whole body. The numerous extinct family of *trilobites*, where the carapace and segments are generally trilobate above, appear to have belonged chiefly to this order. In the ISOPODA there are seven pairs of similar unguiculated feet attached to seven moveable segments behind the cephalic. The LÆMODIPODA have the anterior pair of feet attached to the cephalic segment; they have no post-abdominal branchiæ, the eyes are sessile and the mandibles without palpi. In the AMPHIPODA the mandibles are palpigerous, the branchiæ are attached to the post-abdominal feet, the eyes are sessile, and the first pair of feet are attached to the first thoracic segment. The cephalic segment is free, and supports large pediform maxillæ in the STOMAPODA, where the branchiæ are attached to natatory post-abdominal feet. The highest order consists of the DECAPODA which have ten ambulatory feet, the cephalic

FIG. 16.



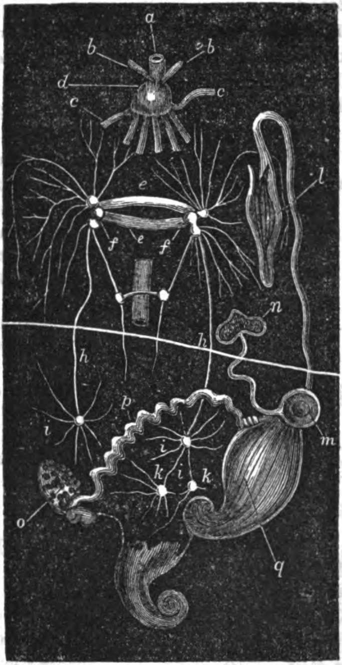
thoracic and pro-abdominal segments united, and the branchiæ concealed under the sides of the carapace, as seen in the *astacus fluviatilis* (Fig. 16.) In the highest brachyourous decapods the nervous system, corresponding with the increased lateral development and the longitudinal shortening of the trunk, has already almost assumed the concentrated and cyclo-gangliated form which characterises the next sub-kingdom.

FOURTH SUB-KINGDOM.

CYCLO-GANGLIATA OR MOLLUSCA.

In the molluscous classes of animals, the trunk of the body is not articulated nor possessed of articulated members; it is generally short and broad, without internal skeleton, and covered with a permanent calcareous or cartilaginous shell. These animals are all aquatic, excepting a few pulmonated gasteropods, and they breathe by distinct branchiæ; they are not provided with articulated antennæ, or palpi, or transverse maxillæ, but in their alimentary canal, their glandular and circulating organs, they present a higher type of development than the *diplo-gangliata*. They are generally slow-moving or fixed, with a low condition of the organs of relation, and deficient in the bilateral symmetry so marked in the diplo-neurose, the diplo-gangliated and the encephalated divisions of the animal kingdom. They are provided with an auricle and ventricle, one or both of which cavities are sometimes divided, and their glands are generally conglomerate. The moto-sensitive axis of the nervous system has seldom a rectilineal longitudinal disposition, but is generally concentrated around the entrance of the œsophagus, as seen in that of the *bulla lignaria* (Fig. 17.) where the great cephalic gangliated ring (*e. e. f. f.*) enveloping the œsophagus, sends numerous nervous branches to other ganglia irregularly distributed through the body. In the tunicated and conchiferous animals, the moto-sensitive columns are disposed chiefly beneath the alimentary canal; in the gasteropods and the pteropods they are more concentrated around the œsophagus; and in the more elevated forms of cephalopods they at length mount to that supra-œsophageal position which they preserve in all the vetebrata where they cease to surround the alimentary canal. From the high development of the

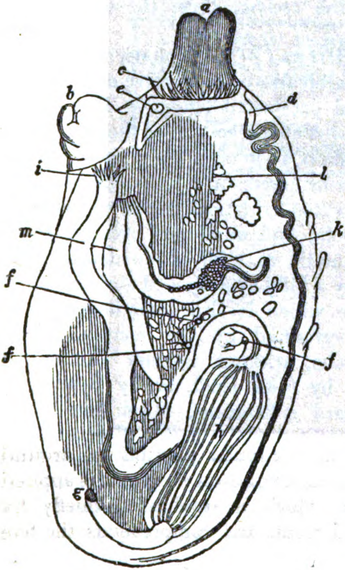
FIG. 17.



cerebral ganglia and their circular distribution around the œsophagus, the term CYCLO-GANGLIATA is applied to this sub-kingdom, which is subdivided chiefly by differences of outward form, and comprehends the five classes, *Tunicata*, *Conchifera*, *Gasteropoda*, *Pteropoda* and *Cephalopoda*.

CLASS 14. TUNICATA.—The tunicated animals are soft, aquatic, acephalous mollusca, destitute of external or internal calcareous shell, breathing by reticulate branchiæ lining an internal sac, and having the body enveloped in an elastic tunic furnished with at least two apertures. The exterior close cartilaginous tunic is lined with a muscular mantle, the respiratory orifice is frequently surrounded with sensitive tentacula, as seen in the *cynthia dione* (Fig. 18. *a. c.*), and sometimes with coloured ocular points, and the mouth or entrance of the œsophagus (18 *g.*) is placed at the bottom of the respiratory cavity, as in conchifera. The respiratory currents, by which food is brought to the mouth, are produced by vibratile cilia disposed on the branchiæ and on the lining mantle, as in other mollusca. The mouth is destitute of masticating, salivary, and sensitive

FIG. 18.



organs, the stomach is always furnished with a liver (18. *h*.), and the rectum (18. *i*.) opens near the respiratory vent (18. *b*.) These animals are entirely marine, and feed on the minute organic particles suspended in the ocean. They often unite organically with each other to form compound animals, and are divided into two orders founded on this difference of condition. Those more simple forms which are organically united, as the *salpa*, constitute the order SALPARIA ; and those of a higher internal development, which continue isolated by their external tunic, as the *ascidia*, form the order ASCIDIARIA.

CLASS XV. CONCHIFERA.—Acephalous, aquatic mollusca, covered with a bivalve or multivalve shell breathing by four internal pectinated laminæ. The mouth, as in the *tunicata*, opens at the bottom of the respiratory sac, and leads by a short œsophagus to a gastric cavity perforated by numerous ducts of a large conglomerate liver. The lips are extended laterally to form two pairs of pectinated tentacula, and numerous eyes are sometimes developed around the margins of the mantle. The circulation is aided by a bifid or a divided auricle, and by a muscular ventricle which is also sometimes divided and is generally perforated by the rectum. These animals are oviparous, without mutual excitement, and are often fixed by their shell, or by byssus, or by burrowing in hard substances. Their shells are permanent, solid, laminated, connected by ligament, and moved by one or more adductor muscles which leave impressions on their inner surface. Those which are narrow longitudinally, and have but one muscular impression on the valves, as the *spondylus* (Fig. 19. 1.) and the *anomia* (19. 2.) form the order MONOMYARIA. In

FIG. 20.

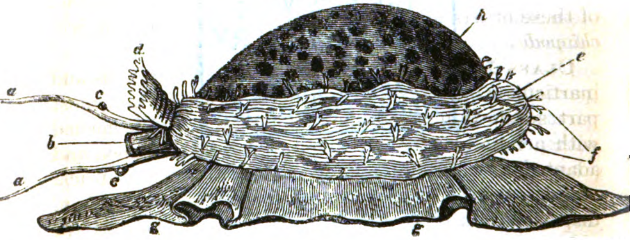


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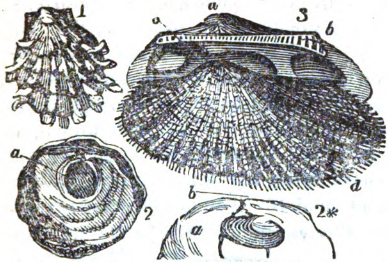
FIG. 19.



the order DIMYARIA the shell is extended longitudinally, and there are two impressions on the valves from adductor muscles, as seen in the *arca barbata* (19. 3.) To the former of these orders may be referred the *rudista* and the *brachiopoda*.

CLASS XVI. GASTEROPODA.—Body invertebrate and inarticulate, provided with a head which for the most part supports tentacula and simple eyes, and furnished with a muscular foot extended under the abdomen and adapted for creeping. They possess a systemic auricle and ventricle; the respiration is generally by branchiæ, disposed on the exterior surface or in an open cavity; a few respire by a pulmonary sac; and the body is for the most part covered with a univalve unilocular solid shell. Most of these animals are marine, several inhabit fresh waters, and a few reside on land; some are entirely naked, some possess an internal dorsal shell, in some the external shell is without operculum, but most have a turbinated and operculated shell. The form of one of the testaceous gasteropods, the *cypræa tigris*, is seen in (Fig. 20.) where the foot (*g. g.*), the head (*b.*), and the tentacula (*a. a.*) are extended, and the shell (*h.*) is partly enveloped by the sides of the mantle (c.) In the nervous system they present a greater concentration of the moto-sensitive axis around the œsophagus, and a greater development of the sympathetic ganglia in the abdomen than the acephalous classes. The carnivorous species are generally provided with a muscular proboscis embracing the buccal teeth, and have often the sexes distinct. The phytophagous forms have most generally the teeth placed on the tongue or lips, and have often the sexes united, with or without mutual impregnation. The gasteropods may be divided into three *orders* by the forms of their respiratory organs and of their external covering. Those which breathe by branchiæ unprotected by an external or internal shell form the order NUDIBRANCHIA; those branchiated species which have these organs protected by an external or internal calcareous covering may be grouped under the term TECTIBRANCHIA; and those are called PULMONATA which respire by means of a pulmonary sac. The position and forms of the branchiæ and of the shell are too numerous and diversified to render a further multiplication of *orders*, founded on such characters, of any practical utility in this class.

CLASS XVII. PTEROPODA.—Body organized for swimming, mantle closed above, branchiæ external, no muscular foot for creeping; shell, when present, always thin, pellucid, unilocular and inoperculate. These small soft floating animals are entirely marine, and swim by the contractions of two lateral musculo-cutaneous fins which support the branchiæ or vascular plexuses for respiration. The fins, as in cephalopods, are without rays, and the head is generally provided with retractile or sheathed tentacula, and sometimes with

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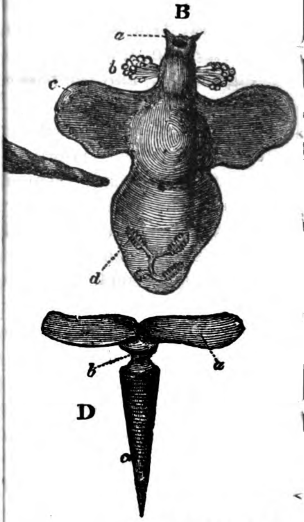

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eyes. They are provided with salivary glands, and a conglomerate liver which surrounds the stomach; the heart consists of an auricle and ventricle; the moto-sensitive axis embraces the œsophagus; and the sexes are united. Those which have a testaceous covering, as the *cleodora* (Fig. 21. C.) and the *Cuvieria* (Fig. 21. D.), form the order thence called THECOSOMATA; and those which are destitute of shell, as the *clio* (Fig. 21. A.) and the *pneumodermon* (Fig. 21. B.) compose the order GYMNOSOMATA.

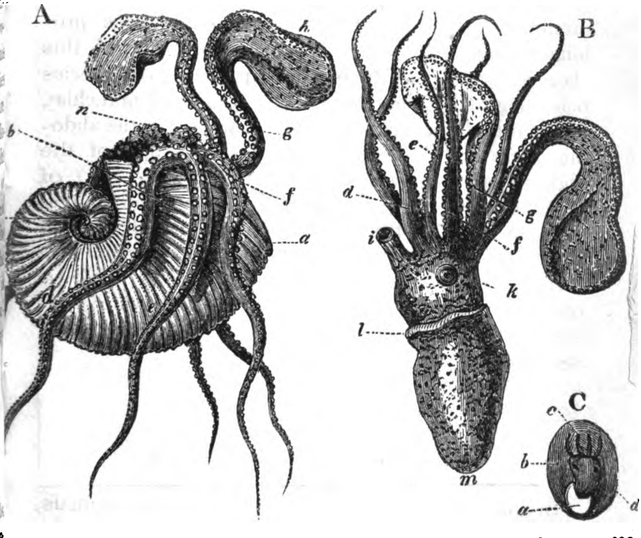
CLASS XVIII. CEPHALOPODA.—Free, aquatic, molluscous or cyclo-gangliated animals, with feet disposed around the head, respiring by internal branchiæ, and having the abdominal cavity enveloped by a muscular mantle open anteriorly. They are entirely marine, predaceous in their habits, provided with twò powerful mandibles which move vertically and with salivary, pancreatic, and biliary glands. They swim by musculo-cutaneous expansions placed along the sides of the trunk or between the feet, and which are not supported by rays. The body is generally naked, sometimes covered with a polythalamous or monothalamous and inoperculate shell, sometimes furnished with an internal dorsal or calcareous shell, and is supported with an internal organized cartilaginous skeleton. The brain surrounds the œsophagus, and generally sends back two symmetrical dorsal moto-sensitive columns. The sympathetic ganglia are contained in the abdominal cavity as in other molluscous classes; there are two eyes, and generally two tentacula. There are commonly three distinct gastric cavities. There are two pairs of conglomerate salivary glands; the liver is of great size and pours its secretion, with that of the pancreatic follicles, into the stomach, as in other mollusca; there is always a strong muscular systemic ventricle, and the auricle is cleft, and placed at the commencement of the branchial arteries; the sexes are separate, excepting in the lowest foraminiferous forms; and the naked cephalopods are provided with an excretory anal ink-gland as a means of protection. Those testaceous cephalopods in which the septa of the shell are perforated by a simple foramen, compose the order FORAMINIFERA. In the SYPHONIFERA the chambres of the shell communicate by means of one or more syphons prolonged from the septa. The highest order of this class is termed CRYPTODIBRANCHIA from the species belonging to it having two lateral symmetrical branchiæ, like most of the pteropods, but concealed in the abdominal cavity. An example of this class and of the highest order is seen in the annexed (Fig. 22.) of the *argonauta argo*, where A represents the animal swimming with its two posterior feet (*h.*) raised, and the other six feet (*n. f.*) extended over the margin of the shell. The same animal, removed from its shell, is represented at B; and C represents the ovum containing the developing embryo and its rudimentary shell (*a.*)

FIFTH SUB-KINGDOM.

ENCEPHALATA OR VERTEBRATA.

In the red-blooded or vertebrated classes of animals, forming the highest sub-kingdom, the great moto-sen-

FIG. 22.



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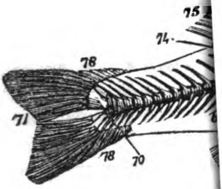
sitive nervous axis no longer surrounds the œsophagus, nor is perforated by the alimentary canal, but occupies entirely a dorsal position with relation to the digestive organs. It consists of four parallel approximated fibrous columns which always develope anteriorly a medulla oblongata, optic lobes, and cerebral hemispheres, as seen in the annexed Fig. 23. of the spino-cerebral axis of man. There is always an internal organised skeleton, and the body of these animals is most extended longitudinally, and presents great bilateral symmetry in all the organs of relation, as in the articulated classes. This primary division of the animal kingdom is termed ENCEPHALATA, from the brain being here enclosed in an osseous cavity, distinct from that which contains the nutritive organs and the great axis of the sympathetic. The sensitive columns are peripheral or external, and the motor columns are placed centrad or next the alimentary canal, as in the articulata, and there are double organs of five distinct senses. The lateral organs of motion never exceed two pairs. The alimentary canal is always provided with a distinct gastric cavity, a buccal and anal orifice, and pancreatic and hepatic glands. The heart consists of two or more cavities, the blood is red coloured, there are distinct chyliferous vessels, two kidneys, and a spleen, and there are always organs appropriated to respiration. The primary divisions of this sub-kingdom are founded chiefly on differences of the generative, the sanguiferous and the tegumentary organs, and five classes are established; viz. PISCES, AMPHIBIA, REPTILIA, AVES and MAMMALIA.

CLASS XIX. PISCES.—Fishes are cold- and red-blooded, oviparous, vertebrated animals, with one auricle and one ventricle of the heart, breathing by permanent branchiæ, and with fins for progressive motion. The vertebral column and cranium are cartilaginous or imperfectly ossified, continued in the same straight line, and enclose a lengthened moto-sensitive spinal cord, a large lobed medulla oblongata, large undivided optic lobes, small smooth cerebral hemispheres, and distinct olfactory tubercles, extended also on the same plain, and almost always a small median lobe of the cerebellum. The hands and feet are formed like fins for swimming, and progressive motion is effected chiefly by the lateral movements of the posterior coccygeal vertebræ, which have their spinous processes directed backwards to support a caudal fin, as seen in the annexed Fig. 24. of the skeleton of the *perch*. The bodies of the vertebræ are concavo-concave; there is no sacrum, the pelvic arch is not attached to the vertebral column, the fins are supported by rays prolonged from the skeleton, and the skin is generally covered with laminated calcareous scales. The mouth destitute of salivary glands and furnished generally with several rows of irregular fangless teeth, leads by a short and wide œsophagus to a capacious gastric cavity, from which a short and equal alimentary canal, without cœcum-coli, extends to the cloaca where the genital organs of both sexes also terminate. A large conglomerate liver opens generally by a single duct immediately beyond the pyloric valve, where also a pancreas, conglomerate in the cartilaginous species and follicular in the osseous fishes, opens into the beginning of the duodenum. The bilocular heart of fishes is generally



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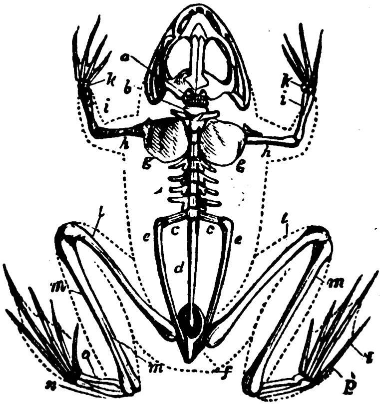
preceded by a distinct *sinus venosus*; it is always succeeded by a *bulbus arteriosus*; it transmits the venous blood of the system entirely through the branchiæ, and the trunks of the branchial arteries and veins do not communicate by anastomosing canals. The lungs are generally present in form of a simple air-sac communicating by a *ductus pneumaticus* with the anterior part of the alimentary canal, and seldom assist in respiration. The sexes are separate, and impregnation sometimes takes place internally, but most commonly when the ova are separated from the body of the female. The class of fishes is divided into orders by characters taken from the structure of the fins, the gills, the jaws, the general condition of the skeleton, and the following six orders have been established, viz. CYCLOSTOMI, PLECTOGNATHI, LOPHOBRANCHII, MALACOPTERYGII, ACANTHOPTERYGII, and PLAGIOSTOMI.

CLASS XX. AMPHIBIA.—The amphibious animals are cold- and red-blooded, oviparous pulmonated vertebrata with three cavities of the heart, with a naked skin, and breathing in the young state by branchiæ. Like fishes, they are destitute of claws on the feet, and like them they possess, in their larva state, a bilocular heart which transmits the entire venous blood of the system through the gills, and vertebræ with concavo-concave bodies. They commence their larva state as fishes, and undergo various degrees of metamorphosis in advancing towards the condition of reptiles; hence the designation *amphibia* applied to this most mutable class of vertebrated animals. The bones of these animals are still imperfectly ossified, the ribs are

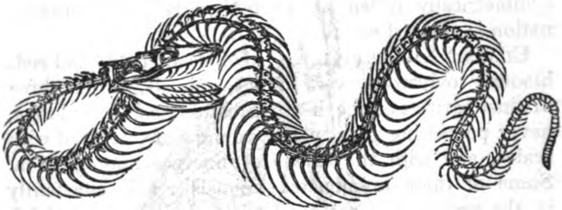
FIG. 25.



either entirely wanting, as in the *frog*, Fig. 25. or are very short, as in the *salamander;* the pelvic arch is nearly or entirely free, and the atlantal and sacral members are often imperfectly developed or wanting. They are predaceous animals, subsisting generally on worms, larvæ of insects, or naked mollusca, which they swallow entire from the imperfect condition of their masticating organs. The respiration effected through their naked secreting and sensitive skin compensates for the imperfect development or the limited use of the lungs, especially during submersion or hybernation. Many retain the gills through the whole of life, along with effective pulmonic cavities, and these aquatic species compose the order PERENNIBRANCHIA. Those which lose the branchiæ by their metamorphosis, form the higher order CADUCIBRANCHIA, some of which reside constantly in the water, others occasionally, and others continue on land. The genital organs are double and symmetrically developed in both sexes, and impregnation is effected externally, as in fishes.

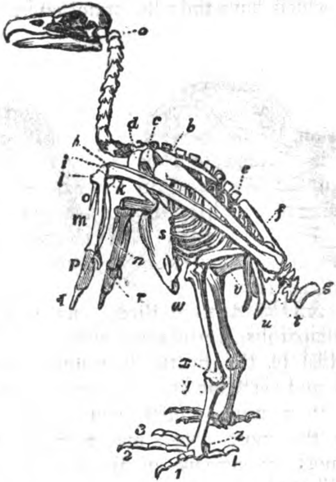
CLASS XXI. REPTILIA.—Reptiles are cold- and red-blooded oviparous vertebrated animals, with three distinct cavities of the heart, breathing solely by lungs, never possessing gills in the young state, covered with scales, and with the means of internal impregnation. Some of these pulmonated animals reside constantly in the water, most are terrestrial; their lungs and left auricle are larger than in the amphibia, and the toes are almost always provided with claws. The skeleton is more consolidated by ossification; the bodies of the vertebræ are concavo-convex, the long bones are filled with cancelli, the cranial sutures are more firm; the sacrum is composed of more than one vertebra, and the extremities, when present, are more firmly connected with the vertebral column than in the amphibia. They have a small cerebellum, languid muscular irritability, great tenacity of life, a muscular septum dividing more or less the cavity of the ventricle, and an undivided abdomino-thoracic cavity. The generative organs are double and symmetrical in both sexes; impregnation takes place internally, the ova are hatched on land, and the instincts of the parent generally extend to the protection of the young. Those which have no atlantal or sacral extremities perceptible externally, as the *serpents* Fig. 26. compose the order OPHIDIA. In the order SAURIA, the ribs are moveable, and there are one or two pairs of external members. The CHELONIA are those which have the ribs immoveable.

FIG. 26.



CLASS XXII. AVES.—Birds are warm- and red blooded, oviparous, vertebrated animals, with four distinct cavities of the heart, breathing both by their pulmonary and systemic vessels, covered with feathers, and with their arms constructed for flight. Their bones are the most dense and compact in texture, and the most extensively anchylosed, of all the vertebrata; instead of marrow they are generally filled with air admitted from the cells of the lungs. The coracoid bone reaches the sternum, the tympanic bone is moveable, the tarsal bones are generally deficient as seen in the annexed Fig. 27 of the *vultur fulvus*, and in place of teeth the jaws are covered with horny mandibles, as in chelonian reptiles. The thoracic and abdominal cavities are not separated by a muscular diaphragm, and the lungs, forming an undivided lobe on each side, are fixed by the pleura to the ribs and vertebræ. The tracheal rings are complete and ossified, the bronchi traverse the lungs and terminate in the

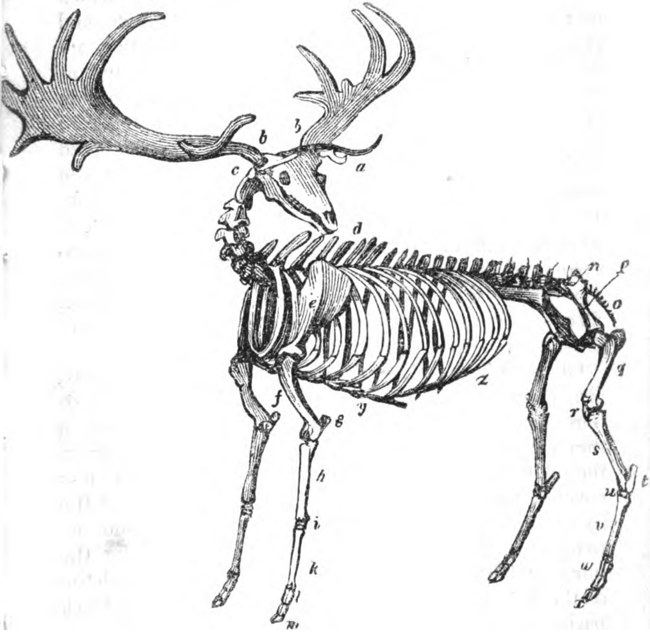
FIG. 27



abdominal air cells, and the last rings of the trachea form an inferior larynx. The cerebral hemispheres are destitute of convolutions, the optic lobes are of great size, hollow internally and undivided externally, and the cerebellum is large and sulcated. The alimentary canal is generally furnished with a crop, a glandular infundibulum, a muscular gizzard, two cœca-coli, and with salivary, pancreatic and hepatic organs. The right ventricle is furnished with a thick muscular tricuspid valve, and the aorta descends on the right side. The sexes are separate, with internal impregnation, and the genetal organs terminate, with the intestine, in a cloaca, which is not extended outwards to form an allantois and placenta in the embryo. The organs of generation are double and symmetrical in the male and generally unsymmetrical and sinistral in the female. The chorion of the ovum is calcified, and development is effected by incubation. This great natural family of feathered vertebrata is divided into orders by characters taken chiefly from the organs of prehension and locomotion. The following have been, thus established, viz. PALMIPEDES, PINNATIPEDES GRALLATORES, ALECTORIDES, RAPACES, OMNIVORÆ, INSECTIVORÆ, GRANIVORÆ, CHELIDONES, ALCYONES, ANISODACTYLI, ZYGODACTYLI, GALLINÆ, and CURSORES which approach the nearest to mammalia.

CLASS XXIII. MAMMALIA.—Mammiferous animals, are warm- and red-blooded, viviparous vertebrata, with four distinct cavities of the heart, free lungs in a thoracic cavity separated by a muscular diaphragm from the abdomen, the surface of the skin more or less covered with hair, and with mammary glands for the lactation of the young after birth. The form and articulations of the bones are generally adapted for the horizontal position of the trunk, as seen in the skeleton of the *fossit Elk*, Fig. 28. The long bones have thick parietes, and distinct internal cavities filled with marrow The bodies of the vertebræ unite by flat surfaces, the tympanic bone is fixed, the jaws are generally furnished with teeth lodged in deep alveoli, the coracoid bone rarely reaches the sternum, and the sternum separates the clavicles on the median plain. The brain presents large lateral ventricles, a corpus callosum, tuber an-

FIG. 28.



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nulare, numerous superficial convolutions, and covered optic lobes divided each by a transverse sulcus. The alimentary canal is long, the colon distinct and with a single cœcum, and the anal opening is generally distinct from the urinary and genital passages. The tricuspid valve is thin and membranous, the aorta descends on the left side, there is no inferior larynx, the epiglottis is distinct, and the bronchi continue cartilaginous into the lungs and terminate in these organs. There is always a urinary bladder, and the urethra in the male passes through a tabular penis. The organs of generation are double in both sexes, symmetrical in the male and very rarely unsymmetrical in the female. The oviducts commonly unite at their lower part for a greater or less extent to form a uterus, in which the ovum resumes its attachment to the parent by a placenta developed from the allantois, and is hatched. The orders of mammalia are generally founded on trivial differences of outward form, and they are classified, as in birds, according to their supposed degrees of development, thus: Cetacea, Ruminantia, Pachyderma, Monotrema, Edentata, Rodentia, Marsupialia, Carnivora, Insectivora, Chiroptera, Quadrumana, Bimana.

TABULAR VIEW

OF THE

CLASSIFICATION

OF THE

ANIMAL KINGDOM.

REGNUM. ANIMALIA.

1. SUBREGNUM. CYCLONEURA VEL RADIATA.

1. CLASSIS. PORIPHERA.

Ordo 1. *Halinida*	*Ordo* 3. *Keratosa.*
2. *Leuconida*	

2. CLASSIS. POLYPIPHERA.

Ordo 1. *Carnosa*	*Ordo* 4. *Lamellifera*
2. *Vaginata*	5. *Corticifera.*
3. *Retiformia*	

3. CLASSIS. MALACTINIA.

Ordo 1. *Ciliograda*	*Ordo* 3. *Palliograda*
2. *Physograda*	

4. CLASSIS. ECHINODERMA.

Ordo 1. *Crinoida*	*Ordo* 3. *Echinida*
2. *Asterida*	4. *Holothurida.*

2. SUBREGNUM. DIPLONEURA VEL HELMINTHOIDA

5. CLASSIS. POLYGASTRICA.

Ordo 1. *Anentera*	*Ordo* 3. *Diacœla.*
2 *Cyclocœla*	

6. CLASSIS. ROTIFERA.

Ordo 1. *Loricata*	*Ordo* 2. *Nuda.*

7 CLASSIS. SUCTORIA.

Ordo 1. *Cystica*	Ordo 4. *Acanthocephala*
2. *Cestoidea*	5. *Nematoidea*
3. *Trematoda*	6. *Epizoa.*

8. CLASSIS. CIRRHOPODA.

Ordo 1. *Balanida*	Ordo 2. *Anatifida.*

9. CLASSIS. ANNULIDA.

Ordo 1. *Apneumata*	Ordo 3. *Dorsibranchia*
2 *Cephalobranchia*	4. *Pulmonata.*

3.SUBREGNUM.DIPLOGANGLIATA VEL ENTOMOIDA

10. CLASSIS. MYRIAPODA.

Ordo 1. *Chilognatha*	Ordo 2. *Chilopoda*

11. CLASSIS. INSECTA.

Ordo 1. *Thysanoura*	Ordo 7. *Hymenoptera*
2. *Parasita*	8. *Neuroptera*
3. *Syphonaptera*	9. *Hemiptera*
4. *Diptera*	10. *Orthoptera*
5. *Rhipiptera*	11. *Dermaptera*
6. *Lepidoptera*	12. *Coleoptera.*

12. CLASSIS. ARACHNIDA.

Ordo 1. *Tracheata*	Ordo 2. *Pulmonata.*

13. CLASSIS. CRUSTACEA.

Ordo 1. *Pœcilopoda*	Ordo 5. *Amphipoda*
2. *Branchiopoda*	6. *Stomapoda*
3. *Isopoda*	7. *Decapoda*
4. *Læmodipoda*	

4. SUBREGNUM. CYCLOGANGLIATA VEL MOLLUSCA.

14. CLASSIS. TUNICATA.

Ordo 1. *Salparia*	Ordo 2. *Ascidiaria*

15. CLASSIS. CONCHIFERA.

Ordo 1. *Monomyaria*	Ordo 2. *Dimyaria.*

16. CLASSIS. GASTEROPODA.

Ordo 1. *Nudibranchia*	Ordo 3. *Pulmonata.*
2. *Tectibranchia*	

17. CLASSIS. PTEROPODA.

Ordo 1. *Thecosomata*	Ordo 2. *Gymnosomata.*

18. CLASSIS. CEPHALOPODA.

Ordo 1. *Foraminifera*	Ordo 3. *Cryptodibranchia*
2. *Syphonifera*	

5. SUBREGNUM. ENCEPHALATA VEL VERTEBRATA

19. CLASSIS. PISCES.

Ordo 1. *Cyclostomi*	Ordo 4 *Malacopterygii*
2. *Plectognathi*	5. *Acanthopterygii*
3. *Lophobranchii*	6. *Plagiostomi.*

20. CLASSIS. AMPHIBIA.

Ordo 1. *Perennibranchia*	Ordo 2. *Caducibranchia.*

21. CLASSIS. REPTILA.

Ordo 1. *Ophidia*	Ordo 3. *Chelonia*
2. *Sauria*	

22. CLASSIS. AVES.

Ordo 1. *Palmipedes*	Ordo 8. *Granivoræ*
2. *Pinnatipedes*	9. *Chelidones*
3 *Grallatores*	10. *Alcyones*
4. *Alectorides*	11. *Anisodactyli*
5. *Rapaces*	12. *Zygodactyli*
6. *Omnivoræ*	13. *Gallinæ*
7. *Insectivoræ*	14. *Cursores*

23. CLASSIS. MAMMALIA.

Ordo 1. *Cetacea*	Ordo 7. *Marsupialia*
2. *Ruminantia*	8. *Carnivora*
3. *Pachyderma*	9. *Insectivora*
4. *Monotrema*	10. *Chiroptera*
5. *Edentata*	11. *Quadrumana*
6. *Rodentata*	12. *Bimana.*

NOTICE

OF

NEW CHEMICAL SUBSTANCES,

DISCOVERED DURING THE PAST YEAR

BY ROBERT D. THOMSON, M.D.

THE progress of chemistry, during the past year, has perhaps been more considerable than during that which preceded it. In a notice like the present, it is only possible to describe cursorily the more simple new compounds which have been obtained by chemists. The compounds formed by combinations of these substances, as well as the discovery of new salts of acids and bases already known, with important facts resulting from the experience of chemists, would occupy a volume instead of a sheet—and the present state of chemistry, in this country, would not warrant the publication of such a work. The *Jahresbericht* of Berzelius is of this description; but its appearance in this country, generally two years after the period of which it treats, renders it comparatively of little utility either to the scientific or practical chemist. In the absence of such sources of information perhaps the present notice may not be destitute of its advantages, and, at least, it will afford facilities to those who wish for further knowledge by referring them to the original periodicals from which the facts here described have been derived.

In presenting an account of foreign chemical discoveries to English readers, there are several points to which the person who undertakes the task must direct either his own attention or that of his readers in order that no misunderstanding may arise from confounding various theories. In the present paper, the formulæ have been given as stated by their authors, so that under every substance, the peculiar theory which each author embraces is embodied. In all the continental formulæ, two atoms of hydrogen represent one English atom of hydrogen, all the continental chemists considering water to be a compound of one atom oxygen and two atoms hydrogen. This is not the place to enter into a discussion of this point further than to state that there are two arguments which would appear to favour the continental view of the question. 1. That in all cases of gaseous combination, a volume of the combining gases is equivalent to an atom. Water consists of 1 vol. oxygen + 2 volumes hydrogen; unless therefore it constitutes an anomaly, it does not appear why the composition should not be 1 atom oxygen + 2 atoms hydrogen. 2. According to the law of Dulong and Petit, the specific heats, of all bodies when multiplied by their atomic weight give the constant quantity ·375. This number is very curiously attached to all atoms, and would almost tempt us to consider it as the atomic weight of heat, for it enables us to determine the number of atoms in a compound. The atomic weight of water is 1·125, and its specific heat is 1·. The two terms multiplied together, give us 1·125 as the product. If we divide this result by 2, the number of atoms in water, according to English views, the quotient is ·5625, an unsatisfatory result. But if the divisor be 3, the number of atoms of which water consists according to continental chemists, then we have 1·125 ÷ 3 = ·375 the very number which we obtain in simple bodies. There is every reason to believe that when the analogy which hydrogen bears to the metals is further investigated, this subject will be fully elucidated. Besides these arguments there are several other reasons in favour of the continental theory. The principal object in retaining the English views, is the greater simplicity thrown over the composition of otherwise intricate compounds. However, in the present paper, the formulæ of the respective authors have been retained with the per centage in analysis when it is given in order that the reader may calculate for himself, and consider the propriety of adopting or rejecting the views given. In the table at page 115, the British and continental atomic weights are stated in parallel columns, which will facilitate the calculation.

ACIDS.

1. *Sulpho-glyceric acid,* was obtained by Pelouze, by acting upon glycerine, the sweet principle of oils with sulphuric acid. Concentrated sulphuric acid was brought in contact with half its weight of glycerine; the mixture was cooled, diluted with water, saturated with lime and filtered; a syrupy mass was obtained, from which, on cooling, crystals of a peculiar salt of lime separated, which were very soluble in water, and in which re-agents

exhibit the presence of sulphuric acid. Pelouze terms the acid of this new salt, sulpho-glyceric acid. Sulpho-glycerate of lime, when dried at 233° consists of 2 atoms sulphuric acid, 1 atom of lime, and 1 atom of glycerine, (C_6 H_{16} O_6) which has lost an atom of water; its formula being CaO C_6 H_{14} O_5, forming an analogous case to that of the production of sulphovinic acid, where the alcohol loses an atom of water in order to combine with 2 atoms sulphuric acid. When sulpho-glycerate of lime is dissolved in water and treated with oxalic acid, the acid remains in the form of a colourless liquid. It readily decomposes the carbonates and produces with bases a series of remarkable salts, which are easily decomposed. Sulpho-glycerate of lime crystallizes in needles, has a bitter taste, and is soluble in less than its weight of water. It begins to decompose at 284° and gives out a vapor which affects the eyes strongly. It leaves a residue of sulphate of lime. The sulpho-glycerates of lime, barytes and lead have been analysed, and consist of 1 atom oxide and 1 acid.*

2. *Citricic acid.*† In preparing pyro-citric acid, Baup has ascertained that besides a spirituous liquid and a bituminous oil, pyro-citric acid is not the only substance which is formed, but that there is another acid produced. To obtain it, the liquid product of the distillation of citric acid is to be evaporated and crystallized several times, until small needles make their appearance. This is the new acid which Baup terms *citricic*, reserving that of *citribic* for the pyro-citric acid of Lassaigne. Citricic acid has no smell; it crystallizes in rhomboidal octahe-

* L'Institut, July, 1836. † Ibid.

drons; its primitive form is a right rhomboidal prism; it is soluble in water, alcohol and ether. When heated to 212° it does not lose its water of crystallization, at 322° it passes into a colourless liquid, which crystallizes in plates on cooling. Its composition is $C_{10}\ H_6\ O_4$. When it combines with bases, it loses an atom of water and becomes $C_{10}\ H_4\ O_3$. It is isomeric with citribic acid; it precipitates the acetates and subacetates of lead, and turns the salts of iron red; citricates of potash and soda are deliquescent; bicitricate of ammonia crystallizes with different quantities of water, and forms two distinct hydrates.

3. *Compound of sulphuric and sulphurous acids.* Rose has ascertained that when these two acids are brought in contact in an anhydrous state, a colourless liquid is formed which evaporates when exposed to the air, giving out thick fumes and a smell of sulphurous acid; it is decomposed with great facility even by the smallest traces of vapour of water; with a greater quantity of water, sulphurous acid gas is disengaged with considerable effervescence. Ammoniacal gas when dry gives with this liquid a mixture of sulphite of ammonia and anhydrous sulphuric acid; the formula is $2SO_3 + SO_2$, the percentage being: sulphuric acid 71·42, sulphurous acid 28·58*.

4. *Sulphotartaric acid.* According to Fremy, when tartaric acid pounded, is added to concentrated sulphuric acid, the mass becomes syrupy. On saturating this mass with chalk, a liquid is obtained which contains a salt of lime, the sulpho-tartrate of lime very pure. The salt is very soluble in water, but is decomposed by it, even

* Poggendorff's Annalen, No. 9, 1836.

at the ordinary temperature. This new acid may be isolated by heating a solution of the salt of lime with oxalic acid; when evaporated it forms brilliant crystals; it forms soluble salts with lime, barytes, strontian, potash, soda and ammonia which all crystallize readily. When treated with nitric acid, they give origin to sulphuric and tartaric acids.*

5. *Sulpho-cholesteric acid.* Discovered by Köninck has some analogy with malic acid, forms crystallizable salts with bases.†

6. *Amygdalic acid.* Amygdaline a substance examined by Liebig and described under neutral bodies, dissolves in a cold solution of barytes water without decomposition; when heated, pure ammonia and nothing else is given out; if this is performed in the open air, some carbonate of barytes falls; the decomposition is completely effected after boiling for a quarter of an hour. If a current of carbonic acid be passed through the liquid still hot, the free barytes is completely precipitated, and the liquid after filtration, contains a neutral and fine solution of amygdalate of barytes; when evaporated, it is obtained as a gummy mass. Its atomic weight is 67·38; the formula of the acid is $C_{40}\,H_{52}\,O_{24}$, and its atomic weight 57·81. It contains 2 atoms of oxygen more than amygdaline, and 2 atoms of hydrogen less. Amygdalic acid may be viewed as a compound of formic acid $C_2\,H_2\,O_3$, and of a substance $C_{38}\,H_{52}\,O_{12}$, a combination from which the bases separate 1 atom of water; the acid is isolated by means of sulphuric acid.‡

* L'institut, Sept. 1836. † Ibid.
‡ Journ. de Pharm., Aug. 1837.

7 *Catechuic acid.* This acid was obtained by Buchner from catechu; Svanberg has lately examined it accurately, under the direction of Berzelius. The acid obtained by Buchner's process is to be dissolved in water and precipitated by a solution of sugar of lead; the catechuate of lead thus obtained is then to be decomposed by sulphohydric acid. The precipitate is washed with water of the temperature 194°; the liquid on cooling deposits the acid in a pure white state; it is a very feeble acid, it does not precipitate gelatin; it forms a precipitate with acetate of lead, but none with acetate of barytes and acetate of copper. Its atomic weight is 16·83, the formula of the acid is $C_{15} H_{10} O_5$, or carbon 62·94, hydrogen 4·11, oxygen 32·95.*

8. *Japonic acid.* When catechuic acid is treated in contact with air, with caustic potash, the solution changes colour, becoming pink, red and then black. The acid solution when rendered caustic by an excess of potash, being treated with acetic acid, equally in excess, then evaporated to dryness, and the residue treated with alcohol in order to dissolve the acetate of potash, japonate of potash is obtained. The japonate is to be dissolved in water; chloro-hydric acid is to be added in such excess as to separate the acid. Japonic acid is black and dissolves in very small quantity in cold water, and not at all when dry; it dissolves when fresh readily in hot water, and on cooling is precipitated in the form of black grains. The solution reddens turnsol; the acid is insoluble in alcohol, and is not precipitated from its solutions by acetic acid; its salts do not crystallize. The

* Köngl. Vetensk. Acad. Handl. 1836.

neutral japonate of potash gives copious black precipitates with chlorides of barium, calcium, aluminum, glucinum and yttrium It gives a green precipitate with sulphate of copper, a black with nitrate of silver. The atomic weight is 13·67, its formula $C_{12}\ H_8\ O_4 + HO$, its composition carbon 67·09, hydrogen 3·65, oxygen 29·26.*

9. *Rubinic acid.* When catechuic acid is dissolved in carbonate of potash, and the liquid is exposed to the air without applying heat, it becomes red and dries into an amorphous mass which redissolves very readily in water. This substance is rubinate of potash mixed with an excess of carbonate of potash ; the rubinate is dissolved in water and filtered ; acetic acid is added and the rubinate precipitated by alcohol. It precipitates, when thus obtained, the earthy and metallic salts red. Its atomic weight is 23·51, and its formula $C_{18}\ H_{12}\ O_9$; its composition in numbers, carbon 58·53, hydrogen 3·19, oxygen 38·28.

The composition of these acids is analogous to some others.

Anhydrous catechuic acid,	$5\ (C_3\ H_2) + 5O.$
„ japonic acid,	$4\ (C_3\ H_2) + 4O.$
Metagallic acid (Pelouze),	$2\ (C_3\ H_2) + 2O.$
Rubinic acid, . .	$6\ (C_3\ H_2) + 9O.$
Metameconic acid (Liebig),	$4\ (C_3\ H_2) + 10O.$

10. *Ampelic acid* was obtained by Laurent from the oils of bituminous schist ; the oils whose boiling points were between 176° and 302° were boiled with nitric acid. In evaporating the acid, white flocks of ampelic acid se-

* Köngl. Vetensk. Acad. Handl. 1836.

parate on cooling. It is white, without smell, very slightly soluble in boiling water; alcohol and ether dissolve it readily. It fuses at 440°, and it sublimes, giving a white powder composed of microscopic needles; it dissolves in concentrated sulphuric acid, from which water precipitates it. It forms very soluble salts with the alkalies.*

11. *Tartralic acid.* When tartaric acid is exposed to a temperature of about 342°, pyrogenous products are produced. The first modification is tartralic acid, consisting of $C_6\ H_6\ O_7\frac{1}{2}$, its atomic weight one and a half times that of tartaric acid.

12. *Tartrelic acid.* This is the second modification produced by exposing tartaric acid to a temperature of 342°. Its formula is, according to Fremy, $C_8\ H_8\ O_{10}$, or double that of tartaric acid.

13. *Paratartralic, paratartrelic, and anhydrous paratartaric acids*, are all modifications of paratartaric acid, produced by exposure to heat in the same way as occurs with tartaric acid.†

14. *Sulpho-cetic acid,* is formed by heating sulphuric acid in contact with ethal, in a water bath, and agitating the mixture. Sulphocetate of potash crystallizes in plates. The formula of the acid is $SO_3\ HO + SO_3,\ C_{64}\ H_{64} + HO$, according to Dumas and Peligot.‡

15. *Sulphindilic acid,* is the name applied by Dumas to the blue acid formed by the action of sulphuric acid upon indigo. Its formula, according to him, is $2\ SO_3 + C_3\ H_{10}\ Az_2\ O_2$. The purple substance which appears during this reaction, he terms sulpho-purpuric acid. It is

* L'Institut, 214, 1837. † Ibid, 219, 1837.
‡ Journ. de Pharm. June, 1836.

represented by two atoms of indigo, and two atoms of sulphuric acid or by sulphindilic acid, with an atom of indigo. The composition of indigo, he finds the same as former experimenters, viz.: carbon 73·, hydrogen 4, azote 10·8, oxygen 12·2.

16. *Anilic acid.* Dumas gives this name to the acid formed by the action of nitric acid upon indigo, formerly termed indigotic acid. It has not the same radical as indigo. Its formula is $C_{28}\ H_8\ Az_2\ O_9$.

17. *Picric acid.* This is the last product of the action of nitric acid upon indigo or Welter's bitter. Dumas has found its formula, $C_{24}\ H_2\ Az_6\ O_{13}$; the propriety of this alteration in nomenclature is very questionable.*

18. *Œnanthic acid.* This acid was obtained by Pelouze and Liebig from the lees of wine, or rather from œnanthic ether which had been prepared from the latter. When œnanthic ether (described under ethers) is boiled with caustic potash, alcohol is disengaged and œnanthate of potash remains behind. The acid readily separates from the potash on the addition of dilute sulphuric acid, and swims on the surface in the form of a colourless oil. When washed with hot water and with chloride of calcium in the cold or in vacuo over sulphuric acid, it is in the state of hydrate; when deprived of water it consists of carbon 74·71, hydrogen 11·33, oxygen 13·96; its formula being $C_{14}\ H_{26}\ O_2$, and its atomic weight 14·32. The hydrate at 13°2C has the consistence of butter; at a higher temperature it melts into an oil destitute of colour, it possesses no taste nor smell, is slightly solu-

* Journ. de Pharm. Jan. 1837.

ble in ether and alcohol, reddens litmus paper: it dissolves in alkalies and forms salts. *Biœnanthate of potash,* consists of fine silky crystals; œnanthate of potash is obtained in a gelatinous mass, when œnanthic acid is boiled in carbonate of soda, evaporated to dryness, digested with alcohol and allowed to cool. It forms salts also with lead, copper and silver.*

19 and 20. *Chlorophenisic and chlorophenesic acids.* The first products of the distillation of coal tar, were collected by Laurent; through the yellow oil thus obtained chlorine was passed for 24 hours; the crystalline naphthaline was separated, chlorine was again passed through the filtered oil for two days, by which it was thickened; it was then cooled with ice and decanted and distilled. The oily product was placed in a flask with concentrated sulphuric acid, with which it was shaken till muriatic acid fumes ceased to be emitted. The sulphuric acid was then removed by a sucker, and the oil well washed with water. The oil was then mixed with caustic ammonia in a large balloon; it became light and stiff by a slight increase of temperature. The mass was boiled with distilled water, the boiling solution decanted on a filter and the residual brown oil treated with ammonia and water; a somewhat brownish oil remained, which did not become stiff on the addition of ammonia. The first aqueous solution on cooling deposited a granular crystalline mass; this was dissolved in water. Dilute nitric acid was added in drops, a reddish coloring matter separated which was filtered, the solution was then treated with dilute nitric acid in slight excess, a gelatinous white

* Pharmaceutisches Central Blatt. No. 2, 1837.

mass resulted which was washed, dried and distilled; the product of the distillation was chlorophenisic and chlorophenesic acids; these were separated by boiling them with a slight excess of carbonate of soda, which dissolves the chlorophenisic acid, and leaves the chlorophenesic acid in the form of an oil. The chlorophenisate of soda is decomposed by nitric acid, the acid remains; it is white, firm; out of hot solutions, in dilute alcohol it crystallizes on cooling in long rhombic prisms; it melts at 44° and boils at 250° C, distilling over without decomposition. It forms crystalline salts with ammonia, barytes, etc. It consists of $C_{12}\ H_6\ Cl_6\ O_2 + HO$, or carbon 35·34, hydrogen 1·93, chlorine 51·17, oxygen 11·56, its atomic weight 25·95. *Chlorophenesic* acid is oily, very soluble in alcohol and ether; with caustic ammonia, it gives a crystalline mass, which becomes oily on exposure to the air. The composition of the acid is $C_{12}\ H_8\ Cl_4 + H_2O_2$, or carbon 42·35, hydrogen 2·88, chlorine 40.89, oxygen 13·88. But Laurent thinks his specimen may have been impure; he has drawn up the following suite of compounds.

Phen (Benzine),	$C_{12}\ H_{12}$.
Hydrate of phen (creosote),	$C_{12}\ H_{12} + H_4\ O_2$.
Phenase, . . .	$C_{12}\ H_{10}\ O$, unknown.
Nitrophenase, . .	$C_{12}\ H_{10}\ O + N_2\ O_3$, unknown.
Chlorophenase, . .	$C_{12}\ H_8\ Cl_4$, unknown.
Chlorophenesic acid, .	$C_{12}\ H_8\ Cl_4 + O_2$.
Chlorophenise, . .	$C_{12}\ H_6\ Cl_6$.
Muriate of chlorophenise (chloride of Benzine), .	$C_{12}\ H_6\ Cl_6 + H_6\ Cl_6$.
Chlorophenisic acid, .	$C_{12}\ H_6\ Cl_6 + O_2$.*

* Pharm. Central Blatt. No. 11, 1837.

21. *Phosphomesitic acid,* obtained by Dr. Kane, by causing chloride of phosphorus to act upon acetone; it forms salts with soda crystallizing in rhombs, consisting of $P_2 O_5$, $C_{12} H_{10} O$, Na O, $H_2 O + SH_2 O$.

22. *Hypo-phosphomesitic acid.* When iodohydrate of mesitylene is formed by acting on acetone with iodine and phosphorus, a mass of crystals remains in the retort which are soluble in water, are very acid and form salts capable of burning with a phosphorescent flame. It consists of $P_2 O$, $C_{12} H_{10} O$.*

23. *Carbomethylic acid.* This acid has been obtained by Dumas and Peligot by acting upon pyroxylic spirit with carbonic acid. It is obtained in combination with a new salt-carbomethylate of barytes. This salt consists of $BaOC_2O_2 + C_4 H_4 C_2 O_2 H_2, O$; it is white, pearly, soluble in water and quite permanent in air or in vacuo. When dissolved in water it soon decomposes spontaneously even at ordinary temperatures into carbonate of barytes, carbonic acid and pyroxylic spirit.†

24. *Bosopric acid.* The writer has proposed this name (βους and κοπρος, vaccæ fimus,) for the acid of cow-dung, which Runge has termed cow-dung acid. A cow-dung bath has been long employed to cleanse printed calico; its principal use is to remove the superfluous quantity of mordants and substances employed for thickening, which do not adhere to the cotton, and thus prevent them from precipitating upon those portions which are unprinted and are intended to remain white. To understand the action of cow-dung in this case, it is necessary to be acquainted with its composition. Let fresh cow-dung be agitated with 20 times its weight of water and filtered

* Journ. de Chim. Medic. June, 1837.
† L'Institut, No. 202.

through fine paper, let the clear dark brown solution which passes through be mixed with a solution of sulphate of copper; a dark brown precipitate results, which after washing is to be decomposed by sulphuretted hydrogen. This separates the copper contained in the precipitate in the form of sulphuret of copper, and a clear brown solution is obtained, which reddens litmus strongly, and when evaporated leaves a dry brown mass which tastes acid and astringent. This mass consists of a brown colouring matter and a very strong colourless acid, and is the efficient means of purifying the mordanted cotton in the cow-dung bath. If it be dissolved in water and mixed with solutions of alumina, iron, copper or tin mordants, brown precipitates are formed, which are combinations with *bosopric acid* and *bosoprine* and alumina, iron, &c. The same compounds are formed when calico printed with these mordants is boiled with it. The *bosopric acid* and *bosoprine* take the place of the acids which were united with the mordants on the calico. Hence, when calico printed with acetate of alumina is boiled in the mixture described of *bosopric acid* and *bosoprine* the acetic acid separates from the alumina, and both the constituents of cow-dung combine in its place and form *bosoprate* of alumina united with *bosoprine*, which are both insoluble in water, and remain therefore in combination with the calico which acquires a brown colour. The other mordants act in the same manner. When *bosopric acid* is boiled with chalk, *bosoprate* of lime is formed, which is insoluble in water and acts like cow-dung.*

* Runge's Farbenchemie. The English translation published in the Records of General Science, Vols. III and IV, and separately in a small pamphlet by Sherwood, 8vo. p. 30.

NEUTRAL COMPOUNDS.

1. *Heveene.* This name is given by Bouchardat to an oil obtained in the rectification of oil of caoutchouc. The dry products of the rectification of the oil of caoutchouc which no longer pass over in distillation with the assistance of water are submitted to dry distillation; the first products are set aside, and only the last products are collected, which are purified by a new distillation. During these processes the point of ebullition of the product obtained diminishes by the decomposition of the oil which furnishes lighter oils and particularly a great proportion of carburetted hydrogen gas. To avoid this, Bouchardat heated the retort in an oil or mercurial bath. He has given the name of heveene to this substance from the *hevea guianensis* one of the Euphorbiaceæ from which caoutchouc is extracted. It is a transparent oil, of a light amber colour; it boils at 315° C. It is not congealed by the coldest mixtures; its specific gravity is ·920; it is soluble in all proportions in ether and alcohol; it consists of carbon 86·82, hydrogen 13·18. By passing chlorine through it, it becomes like wax, if used in excess the oil is blackened. Sulphuric acid, when added to heveene, forms a brown mass from which in some days an oily transparent fluid separates. If the brown mass is treated with water, a resinous substance separates resembling the resin of aldehyd of Liebig. The fluid from the action of sulphuric acid boils at 228° C. is insoluble in water; it bears a great resemblance to eupione. Dr. Gregory obtained the same product by submitting the

light oil of caoutchouc to the action of sulphuric acid; he considers it to be isomeric with olefiant gas. It is remarkable that sulphuric acid, by its reaction on caoutchouc oil distilled between 25° and 30° C, and upon heveene, which boils at 315° C. gives the same product.*

2. *Amygdalin.* The discovery of this substance we owe to Robiquet and Charlard, and its investigation to Wöhler and Liebig. The process for obtaining it is as follows. Bitter almonds deprived of their fat oil by strong expression are treated twice with boiling alcohol of 94 to 95 per cent. The liquid is passed through a linen cloth and the residue expressed. Most frequently a little fat oil continues to separate from the liquid which is to be removed by filtration; the liquid is then re-heated and filtered. If left at rest for some days a portion of amygdalin separates in crystals, but the greater part remains dissolved. The mother liquors are to be distilled until about $\frac{1}{6}$ remains of their original volume; the residue is allowed to cool and mixed with half its volume of ether; by this means all the amygdalin is precipitated—the fluid is to be collected on a filter, and the small crystals which it contains are to be expressed as strongly as possible between leaves of blotting paper which is to be frequently repeated. The crystals always retain a certain quantity of oil; this is to be absorbed by paper—but in order to remove the whole of it, the amygdalin is to be agitated in a flask of ether, thrown on a filter and washed with the ether until a drop evaporated upon

* Journ. de Pharm. Sept. 1837.

a surface of water leaves no trace of oil. To remove all the fibres of paper, it is to be dissolved a second time in boiling alcohol, where it crystallizes on cooling in the form of white pearly scales. If common spirit is used, sugar is dissolved. The transparency of the solution is a good test of the purity of the amygdalin. From a pound of bitter almonds 10 to 13 grammes of amygdalin are obtained, which amounts to about 2½ per cent. An aqueous solution of amygdalin, gives by cooling a great number of transparent prismatic crystals, which proceeding from a common centre, form large groups. Amygdalin consists of 89·43 amygdalin and 10·57 water. When sulphuric acid is added to amygdalin, volatile oil of bitter almonds distils over, the weight of which amounts to less than ¾ of the amygdalin; carbonic acid is also given out, and in the neck of the retort, benzoic acid soon makes its appearance in crystals. The supernatant liquor contains formic acid in solution. The residue in the retort when treated with lime gives out ammonia; when heated with permanganate of potash hydrate of the peroxide of manganese is formed, but no gas escapes; a feeble odour of oxalic ether is, however, perceptible. Amygdalin when boiled with caustic alkalies disengages ammonia and amygdalic acid is formed. Amygdalin consists of $Az_2\ C_{40}\ H_{54}\ O_{22}$; its atomic weight is 57·71 or in numbers, azote 3·069, carbon 52·810, hydrogen 5·942, oxygen 38·179. If crystallized amygdalin be left for 18 hours in contact with sulphuric acid, it loses two atoms of water. Amygdalin may be considered a compound of hydrocyanic acid ($N_2\ H_2\ C_2$), with another body (C_{38}

H_{52} O_{22}), which by the action of an alkali is decomposed into ammonia and formic acid.

Action of emulsin upon amygdalin. When amygdalin is brought in contact with the emulsion of sweet almonds, hydrocyanic acid is formed; the quantity of water present is an important condition in this decomposition; the quantity of oil formed, varies with that of the water; when bitter almonds are treated with boiling alcohol, the residue does not possess the property of decomposing amygdalin; pulverized bitter almonds may be deprived of all their amygdalin by treating them with cold alcohol, so that the residue moistened with water does not give out the least smell of hydrocyanic acid. Hence it would appear, that amygdalin is a constituent of bitter almonds; oil and hydrocyanic acid being products of the decomposition of this substance. These are not the only products; for if small portions of amygdalin be added gradually to an aqueous solution of emulsin until all smell of hydrocyanic acid has disappeared, the liquid will be found to contain sugar in the course of a few hours. If the liquid is allowed to evaporate spontaneously, small hard crystals make their appearance, which ferment on the addition of yeast: the fluid after the fermentation is acid and contains gum or altered emulsin. The small quantity of emulsin required to produce these decompositions shows that they have been produced by no ordinary chemical action. These facts are of very great importance, as they cannot fail to lead to important results in reference to fermentation. Liebig and Wöhler have ascertained that amygdalin exists in the leaves of the *prunus-laurocerasus*, but they have not been able to isolate it in consequence of its rapid decomposition into hydruret of benzoyle and hydrocyanic acid. They conceive it very probable that *asparagin*, *caffein*, and *urea* have similar bodies which act upon them as emulsin upon amygdalin. Their researches show that it is improper to say, that prussic acid exists in bitter almonds or laurel leaves; it is its basis which is contained in these vegetable productions.*

3. *Ampelin* was prepared by Laurent by taking the oil of bituminous schist which boils between 200° and 280° C. agitating it with concentrated sulphuric acid, decanting and then pouring upon it $\frac{1}{15}$ or $\frac{1}{20}$ of its volume of liquid caustic potash; the whole is then left at rest for twenty-four hours; two layers will then be found in the flask, of which the inferior one is more voluminous than that of the solution of potash employed; it is to be drawn off with a sucker, diluted with water and sulphuric acid poured on it; the ampeline separates and rises to the surface of the solution. The ampeline resembles a fluid fat oil; it is soluble in alcohol and ether: at —20 C. it does not solidify; it dissolves in all proportions in pure water; when submitted to distillation it gives water, a very limpid oil, and a residue of charcoal.†

4. *Retinaphtha.*—When resin falls in a cylinder heated to a cherry-red, as takes place in Mathieu's process for making gas, besides the gas, a number of new compounds of carbon and hydrogen make their appearance which Pelletier and Walter have isolated, examined and

* Annalen der Pharmacie, XXII, No. 1.

† L'Institut, 214.

termed *retinaphtha*, *retinile*, *retinole*, *metanaphthalin* ; *retinaphtha*, is a very light volatile liquid; its composition is C_{28} H_{16}.

5. *Retinile* is a new sesquicarburet of hydrogen represented by the formula C_{36} H_{34}; and by the action of chlorine, bromine, &c. is converted into a series of compounds which have not been examined.

6. *Retinole* is a new bi-carburet of hydrogen represented by C_{64} H_{32} differing from Faraday's bicarburet (C_{24} H_{12}) both in constitution and chemical properties.

7. *Metanaphthalin* was also obtained in the same process; it differs from naphthaline in chemical properties but is isomeric with it. It is remarkable for its beauty and lustre.*

8. *Alkarsin*. In the fluid called Cadet's obtained by the distillation of arsenic acid with acetate of potash which was considered to be a compound of arsenic with acetic acid, Dr. Bunsen of Kassel has discovered a compound of arsenic completely analogous to alcohol and mercaptan (arsenic instead of oxygen and sulphur) which he calls alkarsin. Equal parts of arsenic acid and acetate of potash are to be heated in a glass retort to a red heat on a sand bath. The product separates into three layers; below is reduced arsenic, then an oily compound consisting of alkarsin and another substance, and above a fluid containing water, acetone, acetic acid, alkarsin and some arsenic acid. The oily portion is to be placed in a flask for digestion. The glass retort is generally corroded into holes before the end of the operation by the carbonate of potash ; 500

* L'Inotitut, 214.

grains of arsenic acid give about 150 of Cadet's liquid. The product is to be agitated with water several times and then distilled over hydrate of potash in an apparatus filled with carbonic acid. After being deprived of arsenic acid, acetic acid and arsenic, it is to be distilled over lime or barytes away from the air. Alkarsin is colourless, specific gravity 1·462, smells like arseniětted hydrogen and irritates the nostrils and organs of respiration. It excites itching when placed on the skin. It is fluid at —25 C. and boils at 150°C. When heated, it smokes and breaks out into flame, carbonic acid, water and arsenic acid being formed; air readily acts upon it and forms arsenic acid; it is scarcely soluble in water; it dissolves in all proportions in ether and alcohol, it takes fire in chlorine forming carbon, muriatic acid and chloride of arsenic. It dissolves iodine, and a white flocky body separates; sulphur dissolves in it, crystals soon separate; phosphorus dissolves and separates on cooling; potassium remains for some time unchanged, but gradually gas is disengaged, and the fluid thickens into a white magma, which when heated explodes in the flame, carbon and arseniet of potassium being formed. Oxide of mercury and nitrate of mercury are reduced by alkarsin. It consists of carbon 23·15, hydrogen 5·67, arsenic 71·18, or C_2 H_6 As, the specific gravity of the vapour is 6·516.*

9. *Eblanin or pyroxanthin*, obtained by Mr. Scanlan of Dublin (now of London) from raw pyroxylic spirit. It is prepared by distilling pyroxylic spirit over hydrate of lime, the distilled liquid is colourless; the dry residue

* Pharm. Central Blatt., 19, 1837.

contains besides lime, acetate of lime and a brown resinous matter, eblanin. The lime is taken up by dilute muriatic acid, and the residue digested with spirit of wine. It crystallizes in long needles of the colour of carbazotate of potash; it sublimes at 134° C. at 144° it melts; concentrated sulphuric acid dissolves it, and forms a reddish blue colour; the solution, however, soon becomes brown, and brownish flocks precipitate; caustic potash and ammonia dissolve it. Pyroxanthin resembles Laurent's naphthalese in colour, and in the blue colour produced by sulphuric acid, but its composition is quite different. Its composition, according to Dr. Gregory, is carbon 75·79, hydrogen 5·30, oxygen 18·91, or $C_{21}H_{18}O_4$.*

10. *Mesitylene.* When pyro-acetic spirit (acetone) is distilled, according to Dr. Kane, with concentrated sulphuric acid, a very light liquid is produced, boiling at 135°, and consisting of $C_{12}\,H_8$, according to Dumas's formula, which appears to prove that acetone consists of $C_{12}\,H_8\,H_4\,O_2$, and that on losing its water it becomes mesitylene.

11. *Porphyroxin.* This substance was obtained by Merck, from Bengal opium sent by Dr. Julius of Hamburg; he found it to contain 8 p. c. of morphin, 3 narcotin, 1 thebain, 0·5 codein, traces of meconin, and 0·5 of a peculiar substance. 100 grains of finely powdered opium were treated with boiling ether and the solution was allowed to evaporate spontaneously; the meconin was taken up from the residue by boiling water, and the narcotin purified from fatty matter by solution

* Ann. der Pharm. XXI., p. 143.

in spirit. The opium exhausted by ether was digested with some warm water and carbonate of potash, after which it was again boiled with ether. By this process the codein, the thebain, and new matter were taken up. The cold ethereal extract was dissolved in very dilute muriatic acid which left a mass like caoutchouc; the thebain and new substance were precipitated by ammonia, the codein by caustic potash. The morphin was extracted from the opium which had been twice treated with ether; by boiling with spirit, evaporating the tincture, treating the residue with dilute acetic acid and precipitating the solution by ammonia. The precipitate consisting of thebain, and the new matter was dried, pounded, dissolved in boiling ether, and the tincture allowed to evaporate spontaneously, on which the thebain appears in crystals, the new substance as a resinous mass readily soluble in spirit; these were separated by careful washing with spirit; this new substance crystallizes in fine shining needles, is neutral, dissolves in spirit, ether and dilute acids. The acid solutions are precipitated by alkalies; Merck has not been able to obtain this body which he terms *porphyroxin*, in such a pure state as to submit it to analysis. It exists also in Smyrna opium.*

12. *Petrolene.* According to Boussingault, bitumens may be considered mixtures of two bodies, viz.: a liquid to which he has given the name of petrolene, and the other solid, which he terms *asphaltene.* Petrolene is an oily body, volatile, having a bituminous smell, colour pale yellow; it boils at 280°C; specific gravity 0·891;

* Ann. der Pharm. XXI., p. 201.

little soluble in alcohol; very soluble in ether; it is obtained by distilling with water the bitumen of Bechelborun. It consists of carbon 88·5, hydrogen 11·5 = C_{80} H_{64}. The density of its vapour is 9·415. It is isomeric with the essence of lemons, of turpentine and copaiba; the density of its vapour is very nearly double of that of turpentine.

13. *Asphaltene* is obtained by submitting the bitumen of Bechelborun, purified by ether, to a prolonged temperature of 240°C. to 250°C. It is solid, black. It softens at 300°C. but decomposes before fusing. It consists of carbon 75·3, hydrogen 9·9, oxygen 14·8 = C_{80} H_{64} O_6, shewing that it is an oxide of petrolene.*

14. *Xanthophylle.* Berzelius has given this name to the yellow colouring matter of leaves in autumn. He operated on the *pyrus communis*; the leaves were collected in a bottle and covered with alcohol of ·833 and allowed to remain 40 hours in contact; new portions of alcohol were added. The fluids were distilled to $\frac{1}{8}$, when on cooling a sort of crystalline substance separated; after the separation of this substance, the distillation was continued till nothing remained but the water of the leaves. On this yellowish brown fluid a soft, yellow fatty matter swam, which appeared similar to the yellow colouring matter of the foliage. It consisted of grains which with the fingers may be separated into a yellow fat and fat oil; the oil may be removed from the fat by digesting with a weak solution of caustic potash, which saponifies the oil and dissolves only a small portion of the yellow fat; the yellowish fatty acids are precipitated from the

* Buchner's Repert. VII., p. 381.

alkaline solution by chloro-hydric acid, and they may be obtained colourless by dissolving them in dilute caustic ammonia (5 drops to an ounce of water) and re-precipitating them. To deprive them of the solid fat it is necessary to treat them with cold alcohol. It is usually obtained in the form of a yellow fat, easily fusible, and becoming liquid at 42°C; then it concretes, becomes transparent and yellow brown; it cannot be volatilized without decomposition, but it gives by dry distillation a brownish fat and carbon; it is insoluble in water; it is slightly soluble in alcohol; water precipitates this solution; ether dissolves it in great abundance; concentrated sulphuric acid renders it brown; the solution is precipitated by water; caustic potash has little action on it. It appears to be intermediate between the fixed oils and resins.*

15. *Erythrophylle.* Berzelius has applied this term to the red colouring matter of fruits and leaves in autumn. He examined the colouring matter of the cherry and black currant. The juice of these fruits gives with acetate of lead a blue precipitate which is malate and citrate of lead combined with the colouring matter. To obtain the colouring matter pure, it is necessary to separate the acids; the best agent for this purpose is chalk in fine powder, which affords a deposit of malate and citrate of lime; small quantities of lime are then to be added to separate the neutral malate in the fluid; then the latter is to be filtered and mixed with a little acetate of lead; the blue precipitate formed at first is to be separated, because it may also contain malate of lead; every thing in solution is precipitated by the acetate.

* Journ. de Pharm. Nov. 1836.

The green precipitate is collected on a filter and washed with water, being always covered in order to prevent the access of air; it is then to be decomposed by sulpho-hydric acid; the filtered liquor is to be evaporated in vacuo over sulphuric acid; the residue is to be dissolved in anhydrous alcohol; this leaves undissolved the colouring matter, altered by the air and pectic acid. By distilling the alcohol and drying the residue in vacuo, a beautiful red colouring matter is procured. It forms with ammonia a neutral soluble compound. The same colouring matter exists both in leaves and fruits.*

16. *Melampyrin.* This substance has been obtained by Professor Hünefeld, of Greifswald, from the *melampyrum nemorosum.* The dried plant was digested in water, the infusion precipitated by acetate of lead and treated with charcoal, and the fluid allowed to crystallize, or the melampyrin was precipitated by spirit. It crystallizes in colourless four-sided rhomboidal prisms which are without taste and smell, easily soluble in water, insoluble in ether and spirit. Melampyrin is not precipitated by nitrate of mercury, acetate of lead, chloride of mercury, nitrate of silver. It appears to be somewhat analogous to gum and sugar.†

17. *New bicarburet of hydrogen.* This gas was obtained by Mr. Edmond Davy, of Dublin, by the action of carburet of potassium on water. It is highly inflammable, and when kindled in contact with air burns with a bright flame, apparently denser and of greater splendour than even olefiant gas. When this new gas is brought in contact with chlorine gas instant explosion takes place

* Annal. der Pharm. XXI, 257.
† Erdmann's Journal für prak. Chem. No. 17, 1836.

accompanied by a large red flame, and the deposition of much carbon, and these effects readily take place in the dark. It is altered by standing over mercury, but is slowly absorbed by water. Recently boiled water absorbs its own volume. It is absorbed by and blackens sulphuric acid. When mixed with $\frac{3}{4}$ of oxygen, it detonates violently. It requires for complete combustion, $2\frac{1}{2}$ vols. oxygen, two volumes of which are converted into carbonic acid, and the other half volume into water. It consists of 1 vol. of hydrogen, and 2 vols. vapour of carbon condensed into 1 vol., or is a bicarburet of hydrogen represented by the formula 2C + H.*

ALKALOIDS.

1. *Fagin.* A narcotic substance obtained from beech nuts, by Zanon. He made an emulsion with beech oil and filtered it. The solution had an acid reaction, and was precipitated white by chloride of barium, sulphate of iron, tincture of galls, nitrate of silver. Hydrate of potash separated a yellow substance; the whole was dried and treated with alcohol of 34° Baume; the orange tincture was filtered and distilled, a yellow substance was obtained possessing alkaline properties, tasting sweetish, precipitating by carbonate of soda, carbonate of potash, ammonia and magnesia, and by caustic ammonia. It crystallizes with sulphuric acid in small prisms.†

2. *Phillyrin.* Obtained by Carboncini from the bark

* Records of General Science, Vol. IV, 320.
† Annal. der Pharm. XXI, 262.

of the *phillyrea media and latifolia.* The dry powder of the bark was boiled for two hours with water, the residue was again boiled for half an hour with an additional quantity of water and expressed. This solution was cleared with albumen, and when cool supersaturated with lime water; it was then allowed to stand for a month in a vessel covered with linen; it was filtered and expressed. The residue being pounded was digested with alcohol in a small still, the clear solution was decanted and the residue again boiled with spirit. The solution was then agitated with animal charcoal for twenty-four hours, and filtered; the solution on cooling deposited phyllyrin in the form of scales. The bark contains from 2 to 2·5 per cent of phillyrin. Pure phillyrin crystallizes in scales having the lustre of silver; an ounce of hot water dissolves about 12 grains which on cooling separate; it is soluble in alcohol, less so in ether. In water acidulated with sulphuric, nitric, muriatic, acetic, citric, oxalic and tartaric acids, phillyrin dissolves with the assistance of heat, but crystallizes on cooling as from a solution in water; in the alkalies the same phenomenon is exhibited. The bark contains also an acid which has not been examined.*

3. *Thein.* This substance was obtained in 1827 by Oudry, but not in a pure state. Dr. Günther has lately procured it of greater purity. He took ¼ lb. of good Hyson tea, exposed it to the action of hot water, evaporated the liquid, took up the extract with alcohol of 85°, evaporated the tincture, dissolved the residue in water, boiled it with calcined magnesia, filtered, evapo-

* Gazetta Ecclett. Nov. 1836.

rated the filtered liquid to extract, on the surface of which in 24 hours crystals of thein made their appearance; the filtered magnesia fluid gave, by digestion with warm spirit, thein mixed with much green matter; 1 lb. of tea was then employed; it was treated with water and magnesia, the extract was digested with alcohol, then allowed to crystallize; the crystals were dissolved in water, and the tannic acid precipitated by the acetate of lead; the excess of lead thrown down by sulpho-hydric acid and the colourless filtered liquid evaporated. In 24 hours, yellowish needles of thein make their appearance, but still containing foreign matter. The finest product is, however, obtained by operating with alcohol upon the tea extract, and upon the resin which separates. The crystals resemble filaments of byssus. They are soluble in 100 parts of water at the temperature of 5°C. at 100°C. soluble in every proportion and at 20°C. in 25 parts alcohol of 36° per cent.; they are soluble also in ether, in oil of rosemary, but not in oil of turpentine. Thein dissolves readily in sulphuric, muriatic and nitric acids without colour; with sulphuric acid it gives a neutral and acid salt, both of which are more soluble in spirit than in water. The nitrate of thein crystallizes in the same way as thein itself.*

4. *Lepidin.* This name has been given by Leroux to a yellow substance which he procured from *lepidium iberis;* he boiled the dry and powdered seeds for half an hour in four times their weight of water acidulated with sulphuric acid; the fluid was saturated with carbonate of lime, filtered and evaporated. The extract was treated with

* Journ. für Prak. Chemie, X, 273.

alcohol; the latter was distilled off; the residue was the lepidin; it has a bitter taste, soluble in water, alcohol, but not in ether, and appears to be a neutral substance; but no inference can be drawn in this or any other respect with regard to it, as it is obviously as hitherto obtained a mechanical mixture.*

ETHERS.

The composition of ethers has, for some time, excited much discussion in the chemical world, in consequence of the light which such knowledge would throw upon organic compounds. Two rival theories have been ably supported in reference to this subject, one by Dumas of Paris, the other by Liebig of Giessen. I. According to Dumas, ether produced by the action of sulphuric acid upon alcohol, has for its basis olefiant gas. In favour of this view he adduces five reasons: 1. Oils of turpentine and lemons, &c., form compounds with chloro-hydric acid, phosphuretted hydrogen and iodo-hydric acid. 2. Naphthaline combines with sulphuric acid to form sulpho-vinic acid. 3. Ether has a similar composition to the ammoniacal salts. Four volumes of ammoniacal gas are replaced by four volumes of olefiant gas. 4. The simplicity of the formulæ. 5. Chlorine combines with olefiant gas; this compound forms the commencement of a suite. Liebig opposes eight objections to these arguments of Dumas. 1. Olefiant gas does not combine with chloro-hydric acid nor with any other acids. 2. Sul-

* Gazetta Eclett. April 18 .

pho-naphthalic acid contains no naphthaline. 3. Ammonia contains three atoms of hydrogen, and olefiant gas only two. The composition of both is therefore not analogous. 4. Faraday's bicarburet gives more simple formulæ. 5. The oil of olefiant gas contains no olefiant gas. 6. This oil affords neither by exposure to the light of the sun, nor by decomposition by alkalies, a compound of ether. By the decomposition of the compounds of ether three carbo-hydrogens are obtained of a similar composition. Which is the true basis of ether? 7. Oil of wine is probably this basis, as by the distillation of the sulpho-vinates with lime, one atom of ether is resolved into:

½ atom alcohol	$= C_2 H_6 O$
and oil of wine	$= C_2 H_4$
	$C_4 H_{10} O$

8. The theory of substitution affords a direct proof in opposition to the idea of the existence of water in ether.

Reason for considering ether not to be a hydrate. 1. Hydrous sulphuric acid takes up no water from it, but forms with it sulpho-vinic acid. 2. Anhydrous sulphuric acid removes no water from ether, but decomposes it and forms water at the expense of its hydrogen. 3. The voltaic pile does not decompose ether, but freely anhydrous alcohol. The decomposition depends on alcohol being a hydrate, the constituents of water appearing at the poles. 4. If ether were a hydrate, the water would be decomposed by another oxide, which is not the case.

II. Liebig holds that ether is an oxide. 1. It forms neutral and acid compounds. 2. In neutralising acids it obeys the usual laws of bases. 3. In the double salts for example, sulpho-vinic acid salts, the oxygen of both bases (ether and the metallic oxide) bears the proportion of 1 to 3. 4. In the phospho-vinic acid salts, the oxygen of the three bases (ether, metallic oxide and water,) are to the oxygen of the acid as 3 to 5. The phospho-vinate of barytes loses at 120°C. 1 atom water, (one of the bases,) and there remains a corresponding salt of pyro-phosphate in which the oxygen of both bases is to that of the acid as 2 to 5. 5. Chloro-hydric acid decomposes ether, the oxygen combining with the hydrogen of the acid to form water. 6. For this reason, the chloro-hydrate of ether cannot be formed of olefiant gas and chloro-hydric acid gas. 7. Acetal is a basic compound of ether containing 3 atoms of the base. 8. That ether is an oxide may be deduced from the theory of substitution.

Such are the principal arguments for the two theories; at one time the views of Dumas had many supporters, but at present the theory of Liebig seems to be gaining ground—at least in this country.

1. *Chloro-pyromucic ether.* When a current of dry chlorine is made to pass into a vessel containing pyromucic ether, the ether becomes yellow in proportion as the action of the chlorine is continued. When the temperature ceases to increase, the operation should be stopped; a current of dry air is then to be passed through to decolorize the fluid. The product thus obtained is double the weight of the original pyromucic ether; its specific gravity is 1·496; it is perfectly transparent, of the consistence of syrup, of a bitter taste; smell resembling *calicantus;* it has no reaction upon vegetable colours; when distilled, a considerable quantity of chlo-

ro-hydric acid is disengaged, the mass blackens and leaves charcoal; it dissolves easily in ether and alcohol. When exposed to the air it assumes a milky whiteness; hot potash produces a white deposit, alcohol is disengaged, and the liquid, which is very red, contains chlorine, but no pyromucic acid; ammonia produces muriate of ammonia and prussiate of ammonia; the composition of this ether is carbon 30·22, hydrogen 2·81, chlorine 50·00, oxygen 16·97, and according to Malaguti its formula is, new acid ($C_{20}\ H_6O_5Cl_3$,) and ether ($C_8\ H_{10}\ O$.)*

2. *Cyanmythelene ether.* Mr. Richardson obtained this ether by passing the vapour of cyanuric acid through pure hydrate of methylene (pyroxylic spirit,); a quantity of beautiful small crystals were formed after a short time; they were repeatedly washed with water to free them from the methylene ether, and afterwards dried at 100°C. They were soluble in alcohol, methylene ether and water, more so in warm than in cold. The aqueous solution does not re-act acid. When heated, part is volatilized without decomposition, while cyanuric acid remains behind, and hydrate of methylene ether and ammonia are evolved; it undergoes an analogous decomposition to the cyanic ether when heated with potash. Its composition is carbon 30·83, hydrogen 5·03, azote 23·80, oxygen 40·32, and may be considered as a compound of 2 atoms cyanic ether ($4C + 4N + 2O$), 1 atom methylene ether ($2C + O + 6H$) and 3 atoms water ($3O + 6H$) $= 6C + 4N + 6O + 12H$, from which it would appear that this cyanic methylene ether is quite analogous to the cyanic ether of Pelouze in its composition.†

* L'Institut, No. 209.
† British Annals of Medicine, Vol. II, 71.

3. *Mesitic ether.* By the action of perchloride of phosphorus and pyro-acetic spirit, a liquid is obtained which is heavier than water and whose formula is $C_{12}\ H_{10}\ Cl_2$ or $C_{12}\ H_8\ Cl_2\ H_2$. When this chloro-hydrate of mesitylene is decomposed by an alcoholic solution of potash, a fluid makes its appearance which is lighter than water, being represented by $C_{12}\ H_{10}\ O$; this, according to Dr. Kane is mesitic ether corresponding to common ether.*

4. *Œnanthic ether* was obtained from the oil of wine by Delechamps. The lees of wine were mixed with half their volume of water, and distilled cautiously over an open fire. The spirit thus obtained of the strength of 15° Cartier was again distilled. It came over first of the strength 22° Cartier, and latterly when it reached 15°, an oil appeared. For 10000 kilogrammes of distilled fluid, 1 kilogramme of oil was obtained, so that the oil amounted to $\frac{1}{10000}$ of the wine. The raw ether has a sharp taste, and forms a colourless fluid ; and at leas may be so obtained by rectification. It still contains some œnanthic acid which may be removed by agitating with a solution of carbonate of soda, and heating to ebullition the milky fluid. The ether separates, and may be rendered anhydrous with chloride of calcium.

Œnanthic ether is fluid, like peppermint oil, colourless, possessing a very strong taste of wine, boiling at 225°—230°C. When distilled 6 grammes of ether pass over with 1 lb of vapour. Fixed alkalies decompose it, but it is not altered by carbonic acid or ammonia. When boiled with a solution of caustic potash, alcohol passes over, and œnanthate of potash remains in solution in the water. Œnanthic ether is the cause of

* Journ. de Chim. Médicale, June, 1837.

the taste or gout of old wines. It presents the first instance of the formation of an ether without the intervention of the chemist. Its composition is C 72·39 H 11·82, O 15·79, or $C_{18} H_{36} O_3$; it is therefore composed of 1 atom œnanthic acid, and 1 atom of ether = $C_{14} H_{26} C_2 + C_4 H_{10} O$. The specific gravity of its vapour is 10·4769.*

5. *Pyromucic ether* was obtained by Malaguti by distilling alcohol of 40° with chloro-hydric acid and pyromucic acid. It precipitates from its solution in the form of an oil, and soon crystallizes in plates with a rhomboidal base; specific gravity = 1·3, fusible at 34°C. It distils without decomposing. Its smell resembles benzoate of methylene.†

6. *Pyrocitric ether* was obtained in the same way; it is fluid, yellowish, heavier than water.

7. *Camphoric ether.* Camphoric acid is obtained by boiling camphor with nitric acid, and consists of $C_{20} H_{16} O_4$ according to Malaguti. On boiling camphoric acid with sulphuric or muriatic acids and alcohol a bitter syrupy substance is obtained which is campho-vinic acid; it consists of $C_{48} H_{40} O_8$. If this syrup be distilled in a glass retort, a butter-like substance and charcoal are produced. If the former is treated with alcohol, long crystals separate on cooling. These have neither taste nor smell; they consist of $C_{20} H_{14} O_3$ being therefore camphoric acid with an atom of water less. The alcoholic mother liquors after the precipitation of the anhydrous camphoric acid, deposit on the addition of water a very

* Pharm. Central, No. 2, 1837.
† Journal de Pharm. Nov. 1836.

dense oily substance, which becomes fluid when boiled with a little potash. It has a peculiar odour, a disagreeable taste, and the property of volatilizing without decomposing; its composition is $C_{20}\,H_{14}\,O_8 + C\;\;H_{10}O$, that is a combination of ether and camphoric acid. It is therefore camphoric ether. It would appear, therefore, that the ether has taken the place of 1 atom of water, thus illustrating the law established by Mr. Graham.*

8. *Chlorocyanic ether*. When chlorine is passed through absolute alcohol which contains cyanide of mercury, and the product is collected in a cool tube, a quantity of alcohol is obtained along with an ethereal fluid which may be separated by means of water. This ether is heavier than water (1·12); boils below 50°C, burns with a purple flame (the smoke of which precipitates nitrate of silver: it dissolves in alcohol and ether as well as in pyroxylic spirit. The alcoholic solution decomposes in 24 hours, and a crystalline substance is formed, soluble in water according to Aimé; the formula of the ether is $CN\;Cl + C_4\;H_8\;+ H_2\;O$.†

8. *Carbonic ether*. This compound was obtained by Dr. Ettling by allowing sodium or potassium to re-act upon anhydrous oxalic ether; a mass is produced similar to resin, soluble in alcohol, ether, and water, and an ethereal fluid of little volatility, which is carbonic ether. At the same time carbonic acid and hydrogen are evolved. It is colourless and boils at 125°C; specific gravity 0·975; it burns with a blue flame; it consists of $C_5\,H_{10}\,O_3$ = 1 atom ether ($C_4\,H_{10}\,O$,) + 1 atom carbonic acid (CO_2.) The specific gravity of the vapour is 4·243.‡

* Journal de Pharm. Feb. 1837.
† Ann. de Chim. et de Phys. Feb. 1837.
‡ Ann. der Pharmacie, XIX, 17.

8. *Iodal.* A species of ether was obtained by Aimé from iodine and alcohol. He placed in a loosely stoppered flask absolute alcohol with about ¼ of its weight of iodine and added about as much concentrated nitric acid; in two days the alcohol began to be discoloured and in seven or eight days the reaction had terminated; during the whole time protoxide of azote had been evolved; the oil deposited at the bottom is to be removed with the sucker and purified from alcohol, and nitric acid by distillation over carbonate of lime and chloride of calcium, and from nitric ether by agitation with thirty times its weight of water. It begins to boil at 25° C. and continues up to 115° C. when it decomposes; with caustic potash it gives iodoform; when allowed to stand with water small crystals are produced. It dissolves chlorine, bromine and iodine, and is dissolved by alcohol and pyroxylic spirit. It is decomposed by sulphuric acid.

10. *Bromal* is obtained in the same way as the preceding with the substitution of bromine for iodine. Aimé has not analysed either of these compounds because he took it for granted that they are analogous to chloral.*

11. *Chloretherise.* M. Laurent obtained this substance by passing chlorine through Dutch liquor, in M. Liebig's apparatus. The operation was conducted slowly the first day, during which chloro-hydric acid was constantly disengaged; the second day the current was made to pass a little more quickly; at the commencement of the third day chloro-hydric acid was still disengaged, but having observed that some crystalline plates, which he considered chloride of carbon were formed, Laurent stopped the pro-

* Ann. de bim. Feb. 1837.

cess; he distilled the product several times in order to drive off the chlorine and chloro-hydric acid which it retained in solution and set aside the first and second portion which contained the crystals; the intermediate portion is colourless, denser than water; it possesses a peculiar aromatic odour, and burns with a green flame; water does not dissolve it; it strongly resembles the Dutch liquor; it is less volatile, however, and by the action of potash a new oil possessing a peculiar odour is formed. The first liquid gave by analysis $C_8\ H_4\ Cl_8$; Laurent terms it *chlorohydrate of chloretherise.* The new oil is colourless, heavier than water, soluble in alcohol and ether; it burns with a green flame. Its formula Laurent considers to be $C_8\ H_2\ Cl_6$. He terms it chloretherise.*

12. *Stearic ether.* This ether was obtained by Lassaigne while treating stearic acid with a mixture of alcohol and sulphuric acid, or with pyroxylic spirit instead of alcohol. Stearic ether is solid, white and semi-transparent like wax; it is lighter than water; its smell is peculiar and slightly ethereal; it has no taste and has no action on litmus paper. It melts by the heat of the hand; insoluble in water, but soluble in alcohol; with hot potash it gradually decomposes, stearic acid is re-formed, which remains in combination with the potash, and alcohol is disengaged with the vapour of water. Stearic ether consists of stearic acid, 87·91, ether 12.09.†

* L'institut. No. 200.
† L'institut. Aug. 1837.

ANIMAL CHEMISTRY.

The attention of chemists has hitherto been directed only at intervals to this most important of all the branches of chemistry; from what cause it is not easy to discover. Dr. Prout was the first chemist who laboured in this field with real success, and the benefit which resulted from his researches have occasioned universal regret that circumstances should have withdrawn him from such a promising career.

It is quite evident that in order to comprehend the animal economy in such a way as to be able to influence, in a truly scientific mode, any of its operations, we must first make ourselves acquainted with its structure, with the anatomy of the several parts, and then analyse the processes by which the animal machinery is sustained. This in fact constitutes the science of physiology which is, therefore, a combination of the sciences of anatomy and chemistry. Without the latter, the study is merely that of anatomy; in the absence of the former, the pretended student of physiology is a mere chemist. It is apparent then that the study of physiology would be best promoted by the united labours of an anatomist and a chemist. The study of anatomy is one of a peculiar kind requiring practical dexterity, so is that of chemistry; each requires a life time of labour—true physiology is therefore the result of these vast human efforts; hitherto physiology has made but little progress in consequence of the exertions of those who have prosecuted it having been directed in a wrong channel. How do philosophers proceed in the prosecution of other studies? Is it not usual to investigate the effects and thus to rise to the cause? In physiology the grand effort has been to speculate about life, irritability and the like;—Is life in the blood? it has been asked, just as if the whole machine, muscles, bones and nerves were not all equally animated by the same vital fire. But what this life is, no one can know, at least in the present state of our knowledge; we must be content with a knowledge of nature's works, instead of endeavouring to penetrate the recesses of the Creator's power,

Uric acid. The researches of Wöhler and Liebig on this subject have assisted in forming a new era in the history of chemical discovery. Hitherto the products of animal action had never been formed by artificial means, but Wöhler shewed that urea might be produced at will in the laboratory of the chemist. He found that urea is formed when cyanic acid is combined with ammonia. These two substances when first united form cyanate of ammonia, but in the course of a few minutes after the combination has taken place, the properties of the salt disappear; neither cyanic acid nor ammonia can any longer be detected, but urea has been produced, an important substance in the animal economy. Having ascertained this interesting fact, Wöhler in conjunction with Liebig, turned his attention with a similar object in view to uric acid; an investigation of the highest interest to medicine and chemistry; " for medicine," says Liebig, " inasmuch as we might anticipate from it the discovery of new methods of destroying calculi in the human bladder without the application of external force; and for chemistry inasmuch as there appears not the slightest doubt that urea, xanthic oxide, cystic oxide, oxalic acid (which last substance is also well known to form calculi) that all these bodies are produced by the alteration of one single substance, and that substance uric acid."* By heating uric acid with brown oxide of lead, the acid is decomposed into oxalic acid, urea and a new body which may be considered as a compound of cyanogen and water; the latter is identical with a body which was described by Vauquelin under the name of alantoic acid; it may be termed alantoin as it acts both as an acid and base; uric acid decomposed by two atoms of the oxide of lead with the aid of three atoms of water, affords two atoms oxalate of lead, one atom alantoin and one atom urea. The alantoin is the second body belonging to the animal organization which may be produced by artificial means; it may be readily formed from cyanogen and water. We see, therefore, from the experiment now detailed that the oxalic acid of the oxalate of lime, calculi is derived from the decomposition of uric acid, by the interposition of some body affording oxygen. Another fact illustrates this for which the writer is indebted to Dr Prout. When uric acid is boiled for some time in nitric acid and is set aside, beautiful pink crystals make their appearance, which were termed by Brugnatelli erythric acid. Their composition is however unknown; from a rapid inspection of the crystals they appear to consist of two differently formed crystals and to contain oxalic acid.

Liebig has endeavoured to prove that carbonic oxide is the radical of carbonic acid and of oxalic acid; he is inclined to apply the same view to uric acid, and to consi-

* British Annals of Medicine, Vol. II. No. II. 1837.

der uric acid as formed of urea and an acid so as to constitute a compound analogous to nitrate of urea. The composition of uric acid is $C_{10}\ H_4\ N_4\ O_6$. Let R represent carbonic oxide, then the acid which combines with urea to form uric acid will be R + Cy. If urea be indicated by Ur, then the composition of uric acid will be 4 (R + Cy) + Ur. We believe that the authors intend to prosecute the examination of the relations of uric acid which cannot fail to lead to the most important results to medicine, and to contribute to a knowledge of the causes of one of the most distressing diseases which affects the human frame, so as ultimately to supersede the performance of an operation so revolting to humanity.

Digestiou, Pepsin. In the *Annual* of last year, the progress which had been attained in the investigation of the nature of the process of digestion was briefly stated. Since our last publication, however, an interesting series of experiments has been made public, which have thrown a new view upon the subject, and promise the happiest results. We stated that chyme or that state which the food undergoes in the stomach might be produced by artificial means, or at least that a substance closely resembling it might be formed by digesting muscle in dilute muriatic acid at the temperature of the human body. But a still closer approximation may be attained by taking advantage of another fact which has been ascertained in Germany. Eberle in 1834 discovered that the mucous membranes, when digested in dilute muriatic acid, produce a fluid analogous to the gastric juice, which dissolved and modified most of the alimentary food which supports animals. Müller and Schwann had ascertained the same fact with regard to coagulated albumen, and that in the action no change was effected in the atmospheric air in contact with the mixture, nor was there any disengagement of gas. Schwann has endeavoured to investigate the nature and cause of this action. He procured a *digestive fluid*, by leaving the mucous membrane prepared from the third and fourth stomach of an ox, in contact with water containing 2·75 per cent. of muriatic acid for twenty-four hours. The fluid was filtered; in this state it contained 2·75 per cent. of solid matter in solution, and required a little more than 2 per cent. of carbonate of potash to neutralise it. It dissolved coagulated white of egg at a temperature of 99° 5 F; now it is well known that dilute acids do not dissolve coagulated albumen; hence an important change must have taken place in this acidulated fluid. Schwann observed also that when the acid was saturated, the digestive fluid lost the property of dissolving coagulated albumen; he found also that if the fluid was evaporated at a low temperature and the residue treated with alcohol, the digestive power was destroyed; that the same effect was produced by the influence of alcohol upon the solution, and that when heated to a boiling temperature, the fluid as well as the principle is decomposed. Acetate of lead gives a precipitate in the digestive fluid, and corrosive sublimate produces a similar precipitation — milk coagulates or caseum is formed, when treated by the digestive fluid. 1. The digestive fluid produces coagulation in milk with the assistance of heat, when its quantity does not exceed 0·42 per cent, while in a fluid containing acid diluted to the same degree 3·3 per cent is necessary. 2. The digestive fluid even when the acid which it contains is neutralized, coagulates milk. 3. An elevation of temperature destroys this power, leading therefore to the conclusion that the digestive principle is destroyed. 4. The digestive fluid, and caseum in solution may be employed as mutual reagents; a fluid which does not contain above 0·0625 per cent. of caseum still affords a precipitate with the neutralized digestive fluid; to the cause which affords the different reactions and occasions other phenomena, Schwann has given the name *Pepsin*. This must be only taken as an expression for a fact, as we are quite ignorant of any principle to which such a name should be applied. The mucus appears to be the substance at whose expense the *pepsin* is formed; acidulated water which contains only 0·25 per cent of digestive fluid, exhibits a distinct solvent power on albumen, and with ¼ oz. of acidulated water, to which 4·8 grs. of digestive fluid were added, 1 drachm of coagulated albumen was dissolved at the temperature of 100°; hence 1 part of *pepsin* must have acted upon 100 parts of albumen; in this action the digestive principle loses its properties in a great measure; it must therefore have undergone some change. Although solution may be affected at lower temperatures, it proceeds most efficiently between 100° and 120°. At a proper temperature albumen dissolves in from 6 to 24 hours, and fibrin from blood in from 3 to 12 hours; the presence of some salts, such as sulphate of soda which retards fermentation have a similar action on the solution of albumen. It would appear that albumen and fibrin are not only dissolved by the digestive fluid, but in some measure decomposed; the first substance furnishes by this action, 1. A substance resembling the coagulated white of eggs, which dissolves in acid, and is precipitated by neutralization. 2. Osmazome, and 3.

Mucus. The digestion of fibrin affords similar products, with the difference that the fluid in which the fibrin has been dissolved does not contain coagulable albumen which can be precipitated by an elevation of temperature. Muscular fibre boiled or roasted dissolves in a similar manner to fibrin, although with greater difficulty. *

* Poggendorff's Annalen, 1837. British Annals of Medicine, Vol. 1 1837.

NOTICE

OF

THE LIFE OF JAMES WATT.

The celebrity of some men may be compared to a meteor which appears for a little and then vanishes away; their memory is only found in their marble monuments. Others, again, like planets, have succeeded in attaining a more permanent distinction; they have conferred benefits upon their fellow men which remain after them; they require no busts—no empty gorgeous structures to tell that they have lived; their memory is in their works. Of the latter class was James Watt, the immortal discoverer of the steam engine. He was born in 1736 at Greenock, in Scotland, where his father was a merchant and magistrate. His grandfather and uncle both distinguished themselves as mathematicians and engineers. The subject of our memoir was educated in his native town, which has long been distinguished as a port of extensive commercial relations and for the elegance and substantiality of the works of its mechanics, especially in reference to navigation. Till the age of sixteen he continued at the grammar school, when he was apprenticed to a mathematical instrument maker.

At the age of eighteen he was sent to London, being bound to a distinguished mathematical instrument maker. Here, however, the delicacy of his health, from an attack of rheumatism, occasioned by working one winter's day in the open air, prevented him from deriving any advantage from his situation, and he was soon obliged to return to his native country. In 1757 he went to reside in the University of Glasgow, being appointed philosophical instrument maker to that seminary, with apartments in the building. In this situation he remained till 1764, when he married his cousin, Miss Miller. He then established himself in the town as an engineer. While in this capacity, he was consulted with regard to the great canal which traverses Scotland from east to west, termed the Caledonian Canal, and he is said to have projected the canal which unites the Clyde and Forth. An accidental circumstance, however had given a different bent to his pursuits. One of Newcomen's steam engines had been sent to him from the Natural Philosophy class for the purpose of being repaired, and this turned his attention to the power of steam, of which he was destined to make such splendid applications.

It has been usually admitted, that the first individual who ascertained the fact that steam was capable of raising weights or water, was the Marquis of Worcester. M. Arago, however, in the *Annuaire for* 1837, denies the accuracy of this conclusion, and claims the discovery for Salomon de Caus, a countryman of his own. A few extracts in the words of the respective authors will enable the reader to draw his own inferences. Hiero of Alexandria, 120 years before the christian era, was acquainted with the fact that steam, under certain circumstances, could give rise to motion. In 1543 Blasco de Garay, a sea captain proposed to the Emperor Charles V, to make embarkations even when there was a perfect calm, and without sails and oars. In June of the same year he is said to have made an experiment with a vessel of 200 tons, which he carried into Barcelona, according to some, at the rate of a league per hour; according to others at the rate of two leagues in three hours. The apparatus which he employed was a large cauldron of water attached to wheels connected with the sides of the vessel. This account is given by M. Gonzalez, in Zach's astronomical correspondence for 1826. It is altogether, however, so improbable that little importance can be attached to it; such is the Spanish claim to the discovery of the force of vapour. In 1615, Salomon de Caus wrote a work entitled "*Les Raisons des Forces Mouvantes, etc.*" In this he states that if water be introduced into a copper globe, with a tube passing vertically through the upper part of the globe, and dipping under the surface of the water, on the application of heat to the globe, the water will be driven up the tube; he observes "the force of the vapour (produced by the action of fire,) which causes the water to rise is produced from the said water, which vapour will depart after the water shall have passed out with great force." This is the French claim to the invention of the steam engine. In 1629, Branca of Rome described the eolipyle, or vapour blow-pipe. This, however, has little connection with the subject. In 1663, the Marquis of Worcester published his Century of Inventions. In his 68th invention he states that he has discovered an admirable and very powerful method of raising water by the assistance of fire, not by aspiration, for as the philosophers say, *intra sphæram activitatis*, the aspiration acting only at certain distances; "but my method has no limits if the vessel possesses sufficient strength." He took a cannon, filled it to three fourths, and shut up the open end; he then kept up a constant fire around it, and in the course of twenty-four hours the cannon burst with a great noise. "Having a way to make my vessels so that they are strengthened by the force within them, and that they are filled in succession, I have seen water run in a continuous manner, as from a fountain, to the height of forty feet. A vessel full of water rarified by the action of fire, raised forty vessels of cold water. The person who superintends this experiment has only two stop-cocks to open, so that at the instant when one of the two vessels is emptied, it is filled with cold water during the time that the other begins to act, and this in succession. The fire is kept in a constant degree of activity by the same person; he has sufficient time for this during the intervals which remains after turning the stopcocks." Such is the English claim to the discovery of the steam engine. Whatever opinion may be arrived at, one thing is certain, that if his predecessors were ignorant of the force of vapour and its moving power, the Marquis of Worcester was quite familiar with them. In 1683, Sir Samuel Moreland wrote his "Elevations of Water by all kinds of Machines &c.," a manuscript preserved in the British Museum. He observes that "water being evaporated by the force of fire, its vapours require a much greater space (about 2000 times,) than the water previously occupied, and rather than be confined will burst a piece of cannon. But being well regulated according to the rules of statics, and by science reduced to measure, to weight, and to balance, then they will carry their burdens peaceably (like good horses); and thus they will be of great use to the human race, particularly for raising water according to the following table, which expresses the number of pounds which may be raised 1800 times per hour to the height of six inches by cylinders half filled with water as well as the different diameters and depths of the said cylinders." In 1690, Denis Papin, a native of Blois, in France, first thought of placing a piston in a cylinder, and acting upon it by the force of steam. It is unnecessary to enter into the question of the priority of the discovery of the steam-engine from the preceding details, because they appear merely to demonstrate the force of steam, or its moving power—the alphabet of the steam engine.

In 1698, Captain Savery obtained a patent for an instrument in which the power of steam was applied to practical purposes. The water was placed in a boiler, the steam escaped by a tube at the upper part of the boiler into a large spherical vessel, where upon being condensed, a vacuum was formed, which enabled the atmosphere to act. It was therefore the atmosphere, and not the steam which was the moving power. In 1705 a patent was taken out for an improved engine on the same principle, in the names of Newcomen, Crawley and Savery. It was in 1764 that James Watt was employed to repair a model of one of these engines belonging to the natural philosophy class in Glasgow college. He was struck with the defects of the machine, and set about improving it. In 1768 he completed his first engine, which, as with those now in use, differed from that of Newcomen by the condensation of the steam taking place in a second vessel, so that the descent of the piston was produced by the force of the steam, and not by atmospheric pressure; the ascent of the piston was also produced by the power of the steam. The engine of Watt was therefore a true steam engine; those which preceded it can only be considered as machines which produced certain effects by the atmosphere acting on a vacuum produced by the condensation of steam.

Dr. Roebuck supplied Watt with the means of accomplishing this great work, and in 1769 he obtained his first patent. Watt had remarked that two thirds of the steam were condensed by the contact with cold water; hence there was a loss of two thirds of the fuel. He first attempted to substitute a wooden pipe for a tube of iron, considering that the wood is a worse conductor of heat, but he found that the wood had less resistance to the sudden alternations of temperature. He then thought of passing the steam into an iron tube without cooling the walls of the tube; this constituted the invention of the condenser. This vessel, free from air, and communicating with the water, being opened at the moment when the tube is filled with steam, draws the latter towards it, and when the vessel receives at the same time a jet of cold water, the steam which is passing to fill it is condensed; the remaining part of the steam in the pipe is removed into the vacuum caused by condensation, and thus the piston is allowed free play. To get rid of the water in the condenser, a small air-pump was applied which was worked by the piston. The invention of the condenser was then Watt's first great improvement. The second was the admission of steam above and below the piston according as it was to be depressed or raised. He surrounded the metal tubes with wood in order to keep in the heat. He calculated with precision the quantity of fuel necessary for producing a certain portion of steam and the volume of cold water required to condense it. Such were the inventions for which the new patent was obtained, but funds were wanted to extend the utility of the discovery. Fortunately in 1776, Dr. Roebuck, who had exhausted his means, met with a purchaser of his interests in the patent in the person of Matthew Bolton, of Birmingham. To him, therefore, it may with justice be said that the country owes the present diffusion and importance of the steam engine. The firm of Watt and Bolton commenced their manufactory at Birmingham by constructing a steam engine, which all those interested in mining were requested to inspect. The invention began gradually to be appreciated, especially in Cornwall, and Watt's engine very soon replaced that of Newcomen. One great encouragement to adopt the new engine was the terms upon which it was supplied. The agreement was, that one third of the saving of fuel over the old engine should be the price of the new engine The saving was carefully ascertained in this way; the quantity of fuel necessary for producing a certain number of strokes of the piston was ascertained by Newcomen's engine and by a new one of the same dimensions. The number of strokes was determined by means of a piece of clock-work, termed the *counter*, attached to the engine, and so arranged that every stroke advanced the hand one division. The instrument was placed in a box supplied with two keys, and was opened at the time for settling accounts in presence of the agent of Watt and Bolton, and of the director of the mine. To shew the amount of saving it is only necessary to state that the sum which the firm derived from three engines in one year at the Chacewater Mine, in Cornwall, amounted to £2,382, proving that the saving of fuel by the new plan was equal to upwards of £7000 per annum, being equivalent to £2,382 per annum on each engine.

The manufactory of Soho speedily extended its limits, and what was once a sterile hill, soon became a populous and fertile manufactory. The firm obtained an extension of their patent to 1800. To this period the engine had only been employed to raise water, but in 1800, Watt began to think of applying it to mills. This, he conceived, might be effected on the principle of the spinning-wheel, where the impulse which turns it one half, completes the revolution. While engaged with his models, he learned that a manufacturer of Birmingham, named Rickards, had constructed what he was in search of. He procured a plan of it, and found that it was precisely his own; he ascertained that his own plan had been sold by one of his faithless workmen to Rickards, who had procured a patent. It was too late to claim the invention, and he therefore sought for a new plan. He accordingly invented what is termed the sun and planet motion.

The intelligent and aspiring mind of Watt, however, was not content with directing its attention to one subject alone. He invented in 1779 a copying-press consisting of two cylinders, between which a sheet of moistened paper was passed and applied over a printed sheet; this contrivance was very successful. In March

1787 he introduced into Great Britain the method of bleaching cotton by means of chlorine which had been discovered in France by Berthollet. This claim was at one time disputed in favour of Professor Copland of Aberdeen, but it was quickly set at rest on the side of Mr. Watt (*Ann. of Phil.* viii, 2.) In 1800 Mr. Watt retired from the firm with a handsome fortune and was succeeded by his son, who continued along with the son of Mr. Bolton to carry on the manufactory. During his residence in Glasgow his first wife died. At Birmingham he married the daughter of Mr. Macgregor, a manufacturer in Scotland, with whom in the heart of his family, he happily spent the evening of his days. While engaged in business he was much troubled with headaches which, however, ceased to affect him when he was relieved from his labours. He was elected a fellow of the Royal Societies of London and Edinburgh, and the Institute of Paris in 1808 made him one of their eight foreign associates. In 1817 he visited Scotland for the last time. In the course of two years afterwards his health broke down, and he died on the 25th of August 1819, aged eighty-four years—beloved and respected by all. Mr. Watt was one of the most extraordinary men of any age. He was not only a mechanic, he was an accomplished scholar and yet in a great measure self-taught. He was familiar with the modern languages and had an excellent acquaintance with chemistry, physics, antiquities, architecture, music; in short he was generally well-informed. Possessing all these requisites and a splendid benefactor of his country—it is remarkable that government never conferred any honour upon him.

Immersed in expensive wars which deluged foreign lands with the blood of our fellow creatures and impoverished our own people, it sought only to bestow rewards on those who were foremost in the fight. It was perhaps well—the days of these men are past, but those of Watt will endure for ever. The visitor to the ancient relics of Westminster Abbey may have noticed many a gorgeous monument in memory of individuals who have left no record behind him save these heartless stones, or a notice perhaps in the history of battles of their having assisted in the premature death of some friend of freedom or unfortunate foe; he looks long in vain for the monuments of those who have succeeded in advancing the powers of the mind and at last espies an obscure tablet which tells that only a mere spot can be spared for the truly mighty dead. The memory of Watt was left to be established in peaceful times when a philosopher the hero of intellect, is valued above a hundred warriors the heroes of the passions; for Watt assisted in superseding the barbarism of war. A handsome statue of Watt was erected in 1824 at Birmingham. Glasgow possesses a similar tribute to his memory and Westminster Abbey can now boast of having deposited within its walls a marble statue of one who has conferred greater benefits on his country and on the world than perhaps any individual, commemorated by its gorgeous monuments. Where is the name of Watt unknown ?

To the reader an apology is due for this feeble notice of such a man, but it was impossible to abstain from even this trifling record when presenting the little memorial which faces the title page of this volume. It is executed by the *Numismatic process* in Paris, and constitutes an excellent specimen of the new invention, if not of the individual whom it is intended to commemorate.

TABLE

OF THE

ANALOGOUS PROPERTIES OF THE IMPONDERABLE AGENTS.

BY H. H. LEWIS Esq.

LIGHT.	HEAT.	ELECTRICITY.
Attraction and Repulsion of luminous bodies not known.	Attraction and Repulsion of heated bodies doubtful (Fresnel Mém. de l'Inst. t. viii. p. xxviii; v. also observations of Fusinieri Bib. Univ. April 1837, p. 421.	Attraction and Repulsion at a distance.
Dilatation by Light, (unknown)	Heat dilates all bodies.	Dilatation by Elecricity alone (unknown).
Chemical Decomposition (doubtful).	Chemical decomposition varies, some substances being decomposed at very low temperatures, whilst others are unalterable by the greatest heat of the blast fur-	Decomposition of all known compound substances into their so called elements; in the luminous arc of the voltaic pile or by discharge of powerful batteries.

LIGHT.	HEAT.	ELECTRICITY.
	naces.	the most refractory substances are fused and volatilized, but whether with, or without decomposition is not precisely known.
A luminous body radiates light however supported, and an opaque exposed to the action of a luminous body, becomes itself uminous, or light is developed by induction.	A heated body radiates heat whatever be its connection with the Earth, but the calorific effects are inappreciable at distances vastly inferior to the luminous; and a body exposed to the action of another at a higher temperature has its own calorific action increased, or heat is developed by induction.	Electrified bodies radiate electricity; but insulation is necessary for conductors; the sphere of electric action is also immeasurably inferior to that of light, but electricity is developed by induction.
A body, one part of which is immersed in a source of light, does not become luminous throughout.	A body partly immersed in a source of heat becomes heated throughout.	A non-conductor in contact with an electrified source is electrified only at the surface of contact; but if the electric action be very high, a greater or less portion of the surface surrounding that of contact becomes electric, an insulated conductor becomes

LIGHT.	HEAT.	ELECTRICITY.
		wholly electrified at the instant of contact.
A body radiating light is luminous internally.	A body radiating heat is heated throughout.	A body radiating electricity manifests the electric action at the surface only.
Two rays of light at a distance do not act on each other, but they may be made to cross so as to produce obscurity; and this result appears only to depend on the difference of the distances passed over by the rays.	Whether or not two rays of heat can produce a diminution of temperature is not known.	No action of two rays of electricity of same kind known, but electricities of opposite kinds dissimulate each other at a distance; and two equal and similar rays of opposite electricities acting on a body wholly neutralize each other.
		It is said alternate appearances of light and darkness have been observed in a platina wire connecting the poles of a pile (experiment of Dr. Barker Lond. and Edin. Phil. Mag, t. viii. p. 550-1).
A ray of light incident on a body is partly reflected and refracted with polarization and partly ab-	Rays of heat are capable of reflexion, refraction, polarization and absorption; by the latter	Reflexion, refraction &c. not known, but free electric action is a surface action.

LIGHT	HEAT.	ELECTRICITY.
sorbed; this absorption is not accompanied by a corresponding luminous appearance which alone is caused by the surface action of reflection.	phenomena a body becomes heated throughout, hence calorific phenomena are not surface actions.	
Certain substances are opaque to light, others on the contrary diaphanous, and light after traversing one transparent medium more readily passes through another.	Certain bodies are as Melloni expresses it Athermanous, or will not allow of the passage of heat; others are diathermanous, but a body diaphanous for light may be very athermanous for heat, and conversely, also heat after traversing one diathermanous medium more readily traverses another. It is by these properties that heat and light are separable, and it is now desirable the fundamental properties should be again verified for each after the separation.	Electric action takes place through non-conductors or this class of bodies are transparent for electricity, and according to Augustus de la Rive Voltaic, electricity having passed one medium more readily traverses another. (quoted from memory).
A ray of light is decomposed	A ray of heat is decomposable	Not known whether species of

LIGHT.	HEAT.	ELECTRICITY.
by the action of a diaphanous prism into an infinite number of others wholly distinct from each other, and the spectrum thus formed is traversed by dark bands varying with the source of the light.	into an infinity of others, quite distinct from each other, by the action of diathermanous prisms;	electricity will give an electric spectrum, but de la Rive suspects electric currents are not homogeneous, and that they have specific differences similar to those of heat and light, Ann. de Ch. et de Phy. t. lxi. p 50.
White light alone gives the omplete spectrum.	Bodies burning with flame alone emit every species of calorific rays, other sources of heat being deficient in some; but it is not known whether the complete calorific spectrum be traversed by bands of diminution of temperature	
Intensity of light varies inersely as the square of the distance.	Same Law.	Same Law.
Light is not known to develope electricity directly, but indirectly; there is a doubtful experiment as to the magnetization of a needle by the violet-rays. Light is not known to develope heat, as until the experiments of Melloni we had no means of separating	Calorific and luminous rays according to Melloni appear distinct from each other, but calorific rays of high temperature always emanate from luminous sources, and high temperatures are always accompanied by the emission of light: however the	The two electricities by their neutralization evolve always heat, and when of any intensity, light also.

LIGHT.	HEAT.	ELECTRICITY.
ıe luminous and calorific rays.	intensity of the heat is not proportional to that of light, which latter varies with the nature of the ponderable matter present; every thing else remaining the same. Heat cannot as yet be proved to evolve electricity in every case; but in many cases it does; yet it does not appear according to Becquerel to have any action on free or dissimulated electricity.	

QUERIES RESPECTING UNIVERSITIES AND SEMINARIES OF EDUCATION.

The following queries are respectfully submitted to the professors and teachers at universities and schools with a view of comparing the present methods of education. Answers to these queries may be directed to the Editor —care of the Publisher.

INSTITUTIONS.

1. When was the college or university founded—by whom and for what purpose?
2. What are the funds of the institution, specifying their source?
3. Are there any fellowships, scholarships, or bursaries belonging to the institution—specifying the number and value of each, their original destination and how they are bestowed; by competition or otherwise?
4. Are there any private annual subscriptions for the purpose of educating poor stndents? How many?
5. Has the institution any patronage—specifying its nature and value?
6. Is there any hospital or medical institution connected with the Uuiversity—specifying fees?

PROFESSORS.

1. How are the professors elected?

2. The number of professors—specifying their names and the subjects they teach, the years of their election or appointment?

3. The salaries of each professor, with their source and original destination?

4. The sum derived by each professor from lecture fees?

5. The perquisites of each professor, or pecuniary advantages which may accrue from the nature of his situation.

6. The public situations with their value which each professor holds in addition to his chair?

7. The number of lectures delivered by each professor—specifying the commencement of the lecture season, the number of lectures delivered per week, the number of days vacation and the termination of the lecturing season?

8. Do any of the professors teach privately or act as tutors — specifying their emolnments from this source?

9. Do any of the professors hold stated examinations weekly?

10. Do the professors derive any emolument from degrees and how much?

11. The opportunities which the professors afford to the students of obtaining practical knowledge?

TUTORS.

1. The number of tutors attached to the university or colleges?

2. The mode in which they are chosen and the origin of the system of tuition?

3. The source of their income?

4. How does the system of tuition work? Does it assist or deteriorate the usefulness of the professors?

5. What is the method which the tutors adopt in teaching?

6.—What number of hours is a student engaged in being taught? How long is he engaged with tutors?

STUDENTS.

1. Do the students require to pass through any system or course of education before presenting themselves at the institution?

2. If they do, what is the age at which they enter the institution or college?

3. What steps must be taken by the student to become a member of the college or university? The matriculation fee and other fees to be paid at entry?

4. Do the students reside within the building of the university? If so, what may be the average expenses per annum—specifying the items of expenditure? If they do not reside in the university, what may be the average necessary expenses of a student's residence at college exclusive of fees—specifying the items of expenditure?

6. The number of students attending the universitie or colleges of the university?

7. The number of students who derive fellowships, scholarships, stipendia or bursaries from the university, and the mode of the election to these emoluments?

8. Do the students usually continue to attend the universities for some years regularly, or are they frequently obliged to desist for a time in consequence of poverty?

9. Are there any distinctions in the rank of students, from their birth or wealth—specifying the numbers in each rank?

10. Is there any prejudicial or advantageous influence produced by auch distinctions?

11. Are there any abuses of funds or fellowships, &c. by which the students are deprived of these advantages?

12. What may be the number of students who study at the university without any intention of taking degrees, and the objects for which they study?

DEGREES.

1. What are the designations of the degrees granted?

2. Is there any curriculum or prescribed order of classes before the student can become a candidate for a degree—specifying the curriculum?

3. What is the expense of obtaining a degree—specifying the fees to the university and servants?

4. Is there any ceremony prescribed on granting a degree?

5. What has been the annual number of graduates for

the different degrees for the last five years—specifying the number under each degree?

6. What is the nature of the examination for each degree. In what language? How long does it last? Is it a practical, oral or written description?

7. Supposing a student about to enter a university, what sum of money must he calculate on spending before he can attain a degree in arts, philosophy, medicine and law—specifying the items of expenditure for each degree?

THE END.

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ERRATA,

IN THE ANNUAL FOR 1837.

page 3 line 13 for $\frac{62236}{32808}$ read $\frac{62391}{10000}$

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