note any traces of vegetable impressions in the rocks, and preserve them carefully.

Seek with the microscope for infusorial animals, both in a fossil and recent state.

On the Use of the Microscope on board Ship.

The following remarks embody the experience of Mr. Charles Darwin, F.R.S., on this subject, the importance of which increases as the science of zoology advances.

The facility in examining the smaller invertebrate animals, either alive or dead, depends much more on the form of the microscope used than would be at first expected. The chief requisite of a simple microscope for this purpose is strength, firmness, and especially a large stage; the instruments generally sold in this country are much too small and weak. The stage ought to be firmly soldered to the upright column and have no movement; besides the strength thus gained, the stage is always at exactly the same height, which aids practice in the delicate movements of the hand. The stage should be able to receive saucers, three inches in internal diameter. A disc of blackened wood, with a piece of cork inlaid in the centre, made to drop into the same rim which receives the saucers, is useful for opaque and dry objects: there should also be a disc of metal of the same size, with a hole and rim in the centre to receive plates of glass, both flat and concave, in diameter one inch and a half, for dissecting minute objects; a plate of glass of three inches diameter lets in too much light and is otherwise inconvenient. Close under the stage there should be a blackened diaphragm, to slip easily in and out, in order to shut off the light

completely; in this diaphragm there may be a small orifice with a slide, to let in a pencil of light for small objects. The whole microscope should be screwed into a solid block of oak, and not into the lid of the box as is usual.

The mirror should be capable of movement in every direction, and of sliding up and down the column; on one side there must be a large concave mirror, and on the other a *small* flat one; these mirrors ought to be fitted water tight in caps, made to screw off and on; and two or three spare mirrors ought undoubtedly to be taken on a long voyage, as salt water spilt on the mirror easily deadens the quicksilver. A small cap is very convenient to cover the mirror when not in use, and often saves it from being wet. The vertical shaft by which the lenses are moved up and down should be triangular (as these work much better than those of a cylindrical form), and there should be on both sides *large* milled heads; with such, there is no occasion for fine movements of adjustment, which always tend to weaken the instrument. The horizontal shaft should be capable of revolving, and should be moved to and fro by two milled heads (for the right and left hands), but the left milled head must be quite small, to allow of the cheek and eye approaching close to the lenses of high power. The horizontal shaft must come down to the stage.

The most useful lenses are doublets of 1 inch and 6-10ths of an inch (measured from the lower glass of the doublet) in focal distance; a simple lens of 4 or 5-10ths of an inch is a very valuable power; and, lastly, Codrington lenses (of the kind sold by Adie of Edinburgh),

of 1-10th, 1-15th, and 1-20th focal distances, have been found most useful by two of the most eminent naturalists in England. With a little practice it is not difficult to dissect under the 1-10th lens, and some succeed under the 1-20th. A person not having a compound microscope might procure a 1-30th of an inch Codrington lens. All the lenses (except the largest doublet) should be made to drop, *not screw*, into the same ring; the large doublet may slip off and on the opposite end of the horizontal shaft. The best saucers have a flat glass bottom, with thin upright metal sides (silvered within); there should be at least four of them, being in depth (inside measure) 3-10ths, 5-10ths, 7-10ths, and a whole inch. Circular discs of fine-textured cork, of the size of the saucers (with one or two circular springs of steel-wire to keep the cork at the bottom of the water), serve for fixing objects to be dissected by direct instead of transmitted light. For this end short fine pins and lace-needles should be procured; wherever it is possible, the animal ought to be fixed to the cork under water. Of the smaller plates of glass of an inch and a half in diameter, some should be flat and some slightly concave; the latter are very useful—saucers of this small diameter are inconvenient.

The simplest and most useful instruments for minute dissection are the triangular glove-needles, which with a little cotton-wool and sealing-wax can be easily fixed into pieces of large-bored thermometer tubes; a stock of tubes and needles should be taken on a voyage. With these needles (by keeping the object only just immersed in a drop of water, which can be regulated by the suction

of blotting-paper), wonderfully minute objects can be dissected; needles bent at their tips are convenient for some purposes. Arm supports are useful in minute dissections; two blocks of wood with inclined surfaces, coming up a little below the level of the stage, and resting partly on the stand of the microscope, can be made by a common carpenter. As it is often rather dark in the cabins of ships, a large bull's-eye glass on a stand (such as are sold with most compound microscopes) would be most useful to condense the light from a lamp on an opaque object, or to increase it when transmitted. Besides the needles, fine pointed forceps, pointed scissors, and eye scalpels are requisite. The French use an instrument called a microtome, and consider it most useful; others prefer finely pointed scissors, with one leg long and thick, to be held like a pen, and the other quite short, to be pressed by the fore-finger, and kept open by a spring. A live-box to act as a compressor, or still better a proper compressor closed by a screw, and both made to drop into the rim of the stage, are valuable aids for making out the structure of transparent animals or organs. The observer should be provided with three slips of glass, or still better with three circular plates, made to drop into the stage of his microscope, and graduated into tenths, hundredths, and thousandths of an inch, to serve as micrometers, on which to place and measure any object he is examining. Some watch-glasses are very useful as temporary receptacles for small sea-animals. Minute parts after dissection can be preserved for years in very *weak* spirits of wine, by covering them, when placed on slips of glass, by small portions of very thin

glass (both sold for this purpose), and cementing the edges with gold-size.*

When time and opportunity concur for the anatomical examination of an animal, the following notes or heads of observation will guide the dissector to the facts which it is most desirable to determine and note down.

No. Date 18

Notes of Dissections performed at

Animal's Name

Sex Age Weight

Length of body, from extremity of jaws to root of tail

——— of head of tail

Situation of testes

——— of preputial orifice

——— of vaginal orifice

——— of anus

——— and number of mammæ

Abdominal muscles

——— ring

Stomach { simple { length greatest circumference
Observations.
complex { number of sacs relative size
Obs.

Omentum

Mesentery

Intestines { length greatest circumference
——— of small ——— of small
——— of cæcum ——— of cæcum
——— of large ——— of large
Observations

Anus glands

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* A microscope such as here described, and most of the apparatus, can be seen at Messrs. Smith and Beck's, opticians, of Colman Street, London.

Cloaca

Liver { situation / number of lobes / weight / *Observations*

Gall-bladder, size situation

——— structure

Bile, enters intestine

Pancreas { form / situation / its secretion, enters intestine

Spleen { situation / form / weight

Lungs { situation / length breadth, right left / weight / number of lobes, right left / structure, air cells, &c.

Branchiæ

Heart { situation / weight / length breadth / shape and structure

Venæ cavæ

Aorta, primary branches

Trachea, number of rings structure

Larynx

Pharynx

Epiglottis

Thyroid Glands

Salivary glands

Tongue, length papillæ

Nostrils

Eye-lids

Eye

Pupil, form

Lachrymal gland

Ear

Brain, weight form, &c.

Spinal cord, length

Supra-renal glands

Kidneys { situation; form; length; breadth; weight of both; papillæ, number and form

Ureters terminate

Urinary bladder { situation; size; shape

Testes { size; structure

Vasa deferentia terminate

Vesiculæ seminales { size; structure; terminate

Prostate { size; structure; terminate

Cowper's glands { size; structure; terminate

Penis length muscle

Urethra

Ovaries { situation; size; shape; *Observations*

Uterus { length of cornua; —— of Fallopian tubes; —— of body; position

Vagina

Oviduct { length; form; termination

Peculiarities of muscles

———— air-sacs

———— glandular organs

Morbid appearances

Calculi

Entozoa

Epizoa