Wissenschaften. Philos.-Histor. Classe, 66 Band, Heft 2 and 3; ditto, 67 Band, Heft 1, 2, and 3; ditto, 68 Band, Heft 1. Math.-Naturw., 1870, 1 Abth., Heft 8, 9, and 10; 2 Abth., Heft 9 and 10; 1871, 1 Abth., Heft 1, 2, 3, 4, and 5; 2 Abth., Heft 1, 2, 3, 4, and 5, Almanach 1871.

From the SOCIETY.—Proceedings of the Liverpool Architectural and Archæological Society, 1871.

From the ROYAL UNIVERSITY OF CHRISTIANIA.—Beretning om Sundhedstilstanden og Medicinalforholdene I Norge, 1867; Tabeller over de Spedalske I Norge, 1 Aaret, 1869; Bidrag til Lymphekjertlernes normale og pathologiske Anatomi, by G. Armauer Hansen; Generalberetning fra Gaustad Sindsspgeasyl for Aaret, 1869.

From the SOCIETY.—Bulletin de la Société Impériale des Naturalistes de Moscou, 1 and 2.

From the AUTHOR.—Man, contemplated Physically, Morally, Intellectually, and Spiritually. No. 1. By J. W. Jackson, Esq.

From the Rev. W. W. NEWBOULD.—Bibliotheca Psychologica. By Dr. Gräke.

From the AUTHOR.—La Race Prussienne. By M. L. A. de Quatrefages.

The following paper was read:

STRICTURES *on* DARWINISM. By H. H. HOWORTH. PART I.—ON FERTILITY AND STERILITY.

AMONG those who have advanced the cause of science by hard and indefatigable work there are few that can compare with Mr. Darwin; whether we consider the number of new facts he has collected, the bold and ingenious theory he has developed, or the scrupulous candour, and fairness, and sobriety of his arguments, we are all, I hope, agreed in honouring his name as a Nestor among naturalists. We are all also agreed, I hope, in the opinion that the discussion raised in Mr. Darwin's works on the "Origin of Species" is a purely scientific question in which we have nothing to do with religion, which is not to be decided by prejudices, nor by fanaticism, but which must stand or fall by its inherent truthfulness or error.

With perfect consistency and fairness Mr. Darwin has not shrunk from applying his theory to man as well as to the animal and vegetable kingdoms. If it be true of the latter, as Mr. Wallace and others hold that it is, I can see nothing but prejudice which can exclude its operation from the former, and this being so it becomes a question of vital interest to the students of our science, and not only so, but our science probably furnishes more valuable material for the solution of the problem than all the rest put together.

As I have been taken to task elsewhere for not stating the

theory of Mr. Darwin correctly, I must begin with an exposition of the opinions I mean to controvert.

I take the general theory of Evolution to be based on these propositions. No two individual objects in creation are alike, they all vary more or less from one another. If we arrange the whole in a series according to their affinity to one another we shall have a graduated series in which the variation between individuals, and the variation between classes, is one of degree, and not of kind, and if we give time and a variety of surrounding circumstances, the same causes which are competent to produce the slightest variation, may gradually produce the greatest. This law, when applied to the varieties of life, offers us the simple conclusion that all may have been derived from a common ancestor, and if we extend the analogy of individuals of one family to families of one class, and classes of one kingdom, we shall be driven to the conclusion that they not only might have been so descended, but that they actually were so. I say this may or may not be true; it underlies the whole Darwinian position, and is tacitly allowed and taken for granted by Mr. Darwin's philosophy.

Mr. Darwin's is a more particular and more limited form of this general law. In order that I may be saved from all formal questions I will put the issue as it has been put by Darwin himself in the preface to the last edition of his great book. He says then (page 4): "In the next chapter the struggle for Existence among all organic beings throughout the world which inevitably follows from the high geometrical ratio of their increase, will be treated of. This is the doctrine of Malthus applied to the whole animal and vegetable kingdoms. As many more individuals of each species are born than can possibly survive; and as consequently there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself under the complex, and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected."

In a few words, Mr. Darwin's theory is the old-fashioned theory of Malthus pressed to its utmost limits, and is shortly, that in the struggle for existence that is going on everywhere, the weak elements go to the wall, and are gradually eliminated while the strong prevail and survive. And the question of strength or weakness is not tested solely by physical vigour, but by all the circumstances which give any type a better or a worse chance of contending with the difficulties of the struggle for life.

If Mr. Darwin had been content with this general assertion his theory would have been well described by the phrase "Sur-

vival of the Fittest" to which some Darwinians are partial, which may mean much or little. *As it stands it is simply an identical expression.* That those forms of life survive which are best fitted to survive is a truism which the philosophy of the most opposite schools would willingly adopt, for it is equivalent to saying that white is white and grey is grey.

But Mr. Darwin deals with more than this mystical phraseology, and it is easy to find an issue with him.

Having laid down his abstract proposition he proceeds to apply it to a number of cases, and it is in this concrete form that I propose to examine it. To-day I shall be content to criticize one only of its factors—namely, that physical vigour, health and strength, in the struggle for existence, have a tendency to prevail to the exclusion and eradication of weakness and debility. The bold paradox I mean to prove is that the reverse is true of the majority of cases. It will be seen at once that this paradox is the same in substance as that maintained by Mr. Doubleday in his true "Law of Population," London, 1853, a work written in answer to Malthus.

The doctrine of Malthus, to which I shall confine myself, is that in which it is maintained that Population is stationary or decreasing where food is scarce and life precarious, and that it abounds where the opposite conditions prevail, or in other words that if you starve a people, pinch them in clothing, etc., they will not increase in numbers, but gradually decrease, while if you feed them well, and house them well, your census returns will be very creditable.

We will begin by examining the general law, which is not limited in its application to man.

To begin with the vegetable world, the gardener is a good empirical philosopher. In his experience of cultivated plants he has learnt many laws which escape the field naturalist, and as one of the main objects of his profession is to make his plants bear as many flowers, and as much fruit as possible, he has probably accumulated many facts which illustrate our position. The gardener then tells us that when a tree is barren in nine cases out of ten it is so because its growth is too vigorous, and it is making too much wood, and that the surest way of making it bear more fruit is to stint it in food or water, or to injure its health, etc., and the methods adopted are very various. One way is by pruning the roots very hard, a method especially efficacious with the pear and the fig, another is to prune the branches very hard, which is generally adopted with all kinds of plants which are wanted to bloom. Another, which is a proverbial remedy in the orchard, is to ring the trees, that is, to cut a ring out of the bark so as to stop the flow of sap. Another,

chiefly in vogue in vineries, and with wall fruit, is to bend and twist the branches into as many contortions as possible with the same object. Another, again, is to turn the plants when the wood is ripe into the frost, and to keep them there a long time. All these plans are more or less efficacious. The rationale of everyone of them is the mutilation, or starving, or weakening of the tree, in order to make it fruitful. If we adopt the opposite course what is the result? Our camellias, which have set hundreds of bloom buds in the autumn, will discard them rapidly if we stimulate the plant by feeding it, or giving it heat sufficient to induce a winter growth. The buds will fall off in myriads, and leaves and branches sprout out everywhere. The same is notoriously the case with peaches; the fruit that best tests the gardener's skill and patience. Orchids refuse to bloom if supplied with food and moisture, while if allowed to dry and shrivel away to the point of death they will throw out spikes of bloom; the same is true of cacti, and in fact of all kinds of plants, I know, in a greater or less degree. But we may go further. The double flower is a distorted form produced by cultivation, *i.e.*, by abundant food and decent conditions. In the double flower the reproductive organs are altered, and often absent, and no seed is produced. Now it is curious that one of the first effects of taking our wild flowers into the green-house is to make them grow double, and cease to bear seed. Thus it is that our double garden daisy grew out of the wild daisy, and the chrysanthemum out of the ox-eye; and where the effect is not great enough to affect the flower it often affects the fruit. The coarse little shrivelled melons, cucumbers, and oranges, growing on wounded, dried up, and paralyzed branches, are full of seed; while the fleshy giants that have been well tended and fed have hardly any seed at all in them. The same is the case with grapes, and the small grape that forms the domestic currant. The green-house is notoriously a bad place to ripen seed in, and so is the highly cultivated garden. The wild kale that grows on wild exposed rocks has a few ragged hard leaves, and a thick panacle of seed; while the cabbages in our gardens hardly bear any at all.

Mr. Darwin has cited one or two cases on the other side, of which the most striking is the case of the cereals which are notoriously heavily weighted with grain, and this chiefly due, he contends, to the heavy manuring and careful cultivation they have been subject to. But the cereals are cases that I should quote to prove my own position; with highly cultivated, thickly planted wheat, there must be a terrible struggle going on for light and air with the leaves, and for food with the interlaced and thickly tangled roots of a myriad of neighbours which press

upon each individual on every side, and cause the stubble to become very matted, a very different condition from that of the wild wheat of Thibet. The same argument applies to rice, and to other crops which are planted thickly, and which, in the phraseology of farmers, exhaust the land. So far as my experience goes, the evidence of cultivated plants is decidedly overwhelming against Mr. Darwin, and in favour of my position that the weak, the ill-fed, and the pinched, are the most fertile. Our means of testing wild plants is not so great. A correspondent of *Nature* calls attention to a fact which strongly corroborates me. He refers to the notorious fact that the money worts (he might have quoted the strawberry, the ivy, or any other creeping plant equally well) will hardly bloom at all if allowed to sprawl in all directions, taking root, and therefore nourishment at every joint, while if the suckers are spread out on slabs of stone so that the whole plant has to be nourished from the mother root, it will bear abundantly. Among weeds like groundsel and dandelion, the most abundant and fertile seed is scattered by those living on the edges of the common, weakly plants rooted among stones, and in a poor soil. Beech trees growing in rich pastures ripen little mast, the husks having no kernels. Oaks and firs bear the most fruit on rugged exposed situations, or where the subsoil is poor and gravelly. So that we may infer that what is true of cultivated plants is equally true of wild ones.

Mr. Doubleday in the postscript to his second edition quotes two facts which have an analogous bearing with the preceding, namely, that grafts from a dying tree strike with far more certainty than those from a tree in full vigour, and that seeds which have been kept some time germinate in the majority of cases far more surely than those that are recent. He also says that pear and apple trees bear most profusely just before they die, and that after severe winters, of which that of 1836 and 1837 was a notorious example, grass and other vegetables grow at an immensely increased rate. All these facts point in one direction only.

Let us now turn from the vegetable world to the animal. Stockkeepers and breeders have accumulated much sound experience on the subject, which corroborates that of gardeners in regard to plants. It is a golden rule with them to keep their animals weak, and in a state of depletion, if they wish them to breed freely. Pure breeds are seldom very fruitful; they are notoriously pampered and highly fed, and when prize shorthorns and southdowns are turned into coarse pastures where kyloes and mountain sheep might feel it a luxury to live, but where their round sides are speedily denuded of flesh, they breed

much more readily; the same is true of horses. Mr. Doubleday quotes the case of a highly bred blood mare, which for a length of time appeared to be incurably barren, and from which the owner naturally desired to obtain a breed, rendered fertile, and ultimately the dam of a numerous progeny, by being literally put to the plough and cart, fed sparingly, and worked down to a state of extreme leanness and temporary exhaustion. He goes on to say in the sheep, however, this principle of increase or decrease is most nicely developed. It is invariably found that if over-fed sterility is the consequence. On the other hand, in accordance with the leanness of the animal a produce of one, two, or three lambs takes place. Upon their knowledge of this fact the improvers of the breed of this animal are accustomed to act. In order to afford the best chance of a perfect animal it is believed that a produce of one lamb at a birth is desirable, and this the breeders of sheep contrive to secure by apportioning the food of the ewe to such a nicety that, avoiding sterility on the one hand, and a double or triple birth on the other, a single lamb is almost invariably the offspring of the animal so limited. It is also a fact known to stock-farmers that during severe seasons, when food is scarce, most lambs are on the average produced. Mild open winters are not favourable to the increase of sheep, because during such winters grass is plentiful. Farriers, I am told, very often bleed horses and cattle which are stubbornly sterile to induce fertility.

If we turn from domestic animals to semi-wild and only partially reclaimed ones we find that the same rule applies. I prefer to quote directly from Mr. Darwin, who has on this branch of the inquiry furnished us, as he so often does, with the best materials for an answer to himself. In this case he also completely answers an opponent of mine in *Nature*, Dr. Tait, who accuses me of misreading the rationale of the evidence. "The most remarkable cases, however, are afforded by animals kept in their native country, which, although perfectly tamed, quite healthy, and allowed some freedom, are absolutely incapable of breeding." "Rengger, who in Paraguay particularly attended to this subject, specifies six quadrupeds in this condition, and he mentions two or three others which most rarely breed. Mr. Bates, in his admirable work on the Amazons, strongly insists on similar cases, and he remarks that the fact of thoroughly tamed wild animals and birds not breeding when kept by the Indians cannot be wholly accounted for by their negligence or indifference, for the turkey is valued by them, and the fowl has been adopted by the remotest tribes. In almost every part of the world, for instance, in the interior of Africa, and in several of the Polynesian islands, the natives are extremely fond of

taming the indigenous quadrupeds and birds, but they rarely or never succeed in getting them to breed." Mr. Darwin continues his illustrations of this fact through many closely packed pages, after which he adds the following commentary (see "Variation of Animals and Plants under Domestication"), vol. ii, p. 158: "We feel at first naturally inclined to attribute the result to loss of health, or at least to loss of vigour; but this view can hardly be admitted, when we reflect how healthy, long-lived and vigorous, many animals are under captivity, such as parrots, and hawks when used for hawking, chetahs when used for hunting, and elephants. The reproductive organs themselves are not diseased, and the diseases from which animals in menageries usually perish, are not those which in any way affect their fertility. *No domestic animal is more subject to disease than the sheep, yet it is remarkably fertile.*" Mr. Darwin, with equal clearness and conclusiveness, decides that this sterility cannot be due to a failure of sexual instincts, change of climate, or want of food, and he concludes that certain changes of habits and of life affect in *an inexplicable manner* the powers of reproduction. However inexplicable the manner of its operation may be, it seems to me to be impossible to evade the conclusion that the *causa causans* of the sterility is that I am arguing for in this paper—namely, a more luxurious habit, a more vigorous health, a less precarious existence, induced by the care and attention of domesticators. If we turn from domestic and semi-domestic animals to wild ones, our facts are, of course, less numerous. Lovers of birds have remarked that after certain severe winters, in which almost all the small birds have been killed off, they have been replaced in a season or two at an astonishing rate by the recuperative vigour of the survivors who have meanwhile been reduced to the verge of death by starvation. Fish that visit the sea, like salmon, do not breed when in high condition, strong with the good living they have enjoyed in salt water, but spawn when they have become meagre and thin after a long sojourn and comparative fast in fresh water. Hibernating animals breed at a season when they are reduced by their long sleep and fast to a very thin and weak condition, and we explain in the same way the much wider fact that it is immediately after the frost has gone, and before the animal world has had time to recover from its hardships that the breeding seasons begins, and so we might continue our examples. Mr. Wallace met my arguments on this point in a very Johnsonian way. I will quote his expression, and the answer I gave him, which will do equally for others who take the same view. He said that when I produced an area in which all the animals were diseased and decrepit, and the strong and healthy ones had disappeared, then he

would credit my theory. I replied that this was no fair statement of my position. That I never maintained that the toothless tiger which cannot seize its prey will be the mother of a numerous progeny. She can do nothing but die, but that as a general law the more weak and ill-fed individuals are more prolific than the strong and well fed.

Mr. Darwin met the arguments of Doubleday and others in a very different manner. He quotes a few instances which seem to tell against them, but he, too, ignores the vastly greater number he had himself quoted on the other side, a portion of which I have given you to-night. The cases he quotes are very few, and they seem to be very unfortunate. The ferret breeds well in confinement, no doubt, but then the ferret is kept in a state of extreme depletion, in order that it may be always hungry and ready to hunt. The domestic fowl, we are told, lays much more abundantly in confinement when it is well cared for than in the wild state. There is an easy answer to this—the eggs of the domestic fowl are abstracted as fast as laid, and every bird-nesting boy knows that if the same plan is adopted with wild birds that they also will continue to lay. In fact, the wilder kinds of fowl, like game, will often make a nest in a wood, or under a hedge, and it is then found that, very like the wild fowl, they lay enough eggs to form a sitting, and no more. The case of the rabbit seems a strong one, but even here it is an undoubted fact that rabbits which breed at a prodigious rate are not those which are found near rich feeding grounds, there they are comparatively sterile. It is on the most barren sand hills near the sea, where food is poor and scarce, that they teem in myriads. The case of the sheep may be met in Mr. Darwin's own words previously quoted, "No domestic animal is more subject to disease than the sheep, yet it is remarkably fertile."

I take it, therefore, that the animal world in general fully corroborates the vegetable world in its evidence on the question at issue. We will now turn to the most conclusive and unanswerable case of man himself. I cannot, *in such a question*, put man in a kingdom separate to himself, believing as I do that he is influenced by very much the same laws as the vegetable and animal kingdoms, but I detach him in this paper from the rest, simply because our evidence about him is so much more abundant. To begin with individuals. Medical men, upon whose judgment I can thoroughly rely, tell me in confirmation of the dicta of Mr. Doubleday, that it is a recognised law of life with them that semi-convalescent people, and those only just recovering from prostrating diseases like fever plague, etc., are very fertile. It is proverbial with midwives that the same is true of consumptive people.

If we compare as classes the rich and well-to-do around us, especially those where the condition of prosperity has lasted for two or three generations, with the pauper population of our alleys we shall find that the rate of increase of the latter is much greater than that of the former. That in the houses where the word want is absurdly unknown, we have few olive branches round the table, while in the cellar dwellings near the drains they so abound that they may with great propriety be rather styled holly branches, and this, notwithstanding two important elements which ought theoretically to tell so much in favour of the well-to-do. One of these is the economical one that prudential restraint (a favourite doctrine of some philosophers) if feasible, may be expected to be put in force, not by the rich, who often wish for children, but by the poor who have too many. The other a physiological reason. It is well known that with rare exceptions a woman does not become pregnant so long as she continues to suckle her last child. Now, among the poor almost every mother suckles her children, while among the rich the number of mothers that do so is limited. Not as is often supposed because of mere fastidiousness, but because they secrete little or no milk, so that the condition favourable to pregnancy occurs at a much earlier date after childbirth among the rich than among the poor. The fact of poor fare inducing fertility is an old enough fragment of philosophy. The following extract from one of Marston's plays, written in the seventeenth century, which was pointed out to me by a friend whom I have previously named here, puts the problem rather humorously: "If Sir Amorous would have children, let him lie on a mattrass, plough, or thresh, eat onions, garlic, and leek porridge. Pharaoh and his council were mistaken in their device to hinder the increase of procreation of the Israelites by enforcing them to much labour of body, and to feed hard with beets, garlic, onions (meats that make the original man most sharp and taking). He should have given barley-bread, lettuce, melons, cucumbers, huge store of veal and fresh beef, blown up their flesh, held them from exercise, addled them in feathers, and most severely seen them drunk once a day, then would they at their best have begotten but wenches, and in a short time their generation would have enfeebled to nothing" ("The Parasitaster, or the Fawn," a comedy by John Marston. Collection of old English plays. London, 1814, vol. ii).

Sir Thomas Brown tells us, in his "Hydriotaphia," old families last not three oaks. I find the following passage in a work written by M. Muret so long ago as 1766, quoted in the article on population in the "Encyclopædia Britannica;" speaking of the extreme healthiness of the Pays de Vaud, he says, "Whence

comes it that the country, where children escape the best from the dangers of infancy, and where the mean life, whatever way the calculation is made, is higher than in any other, should be precisely that in which the fecundity is the smallest .... I will hazard a conjecture, which however I give only as such. Is it not that in order to maintain in all places a proper equilibrium of population God has wisely ordered things in such a manner *that the force of life in each country should be in the inverse ratio of its fecundity*," etc., etc. This seems to forestall Mr. Doubleday by nearly a century.

I will now proceed with the proof, trusting in the main to Mr. Doubleday for my facts.

He repeats the well known remark that our peerage and baronetage are not old, and that but few of the old Tudor nobility, and almost as few of the representatives of the original creation of baronets survive. Out of 394 peers in Parliament in 1837, 272 had been created during the previous eighty years. Between the year 1611, when baronetcies were first created, and 1837, 753 became extinct, and counting all the baronets living at the latter date, together with those who had been made peers, they only exceeded the number of extinct ones by twenty-three. Of the original creation only thirteen remained, while of the vast numbers James I made during his lifetime only thirty-nine remained. So that unless there had been perpetual fresh creations both orders must have been all but extinct. As it may be said that this was caused by laws of primogeniture (although no title becomes extinct as long as any descendant of the original holder of it in the male line survives) it will be well to quote other cases. Amelot, writing of Venice, reckoned that there were 2,500 nobles who had voices in the council. Addison adds that in his day there were only 1,500, notwithstanding the addition of many new families since that time. He says it is very strange that with this advantage they are not able to keep up their numbers, considering that the nobility spreads equally through all the brothers, and that so very few are destroyed by the wars of the republic. Malthus, in his "Essay on Population," p. 278, says the same in regard to the rich bourgeoisie of Berne, quoting statistics in his own support. But the same thing was known long before this. Tacitus mentions how in the days of Claudius not only had the old patricians of the earlier monarchy and republic decayed away and become nearly extinct, but that even the newer creations of Julius Cæsar and Augustus had gone the same way. Dr. Wallace has many pages of illustration from ancient writers to show how the luxurious and well-to-do classes rapidly disappeared in the great centres of Greek and Roman culture. The Mamelooks in

Egypt, the dominant caste of Turks in Europe, and of Manchu Tartars in China, all prove the same great fact. The result, then, of the general experience of the highest ranks in different nations, living under various conditions of life, among whom plenty and ease abound, who ought, according to the Malthusian doctrine, to be stocking the waste places of the earth, is that they are only kept alive by a constant recruiting and infusion of fresh blood from below. It may be urged that these are not fair examples—these are luxurious people whose big dinners and deep draughts have made them decrepit. It is well, therefore, that we should extend our survey somewhat further. Mr. Doubleday, fortunately, has dug much deeper.

The free burghers of Newcastle were a privileged and rich body of tradesfolk and artizans. They formed a close trades-union to which admission was to be had by outsiders by servitude as apprentices only. Doubleday has collected evidence to show that they were constantly diminishing in numbers, a decrease, be it remarked, accompanied by a more than corresponding increase among the people of Newcastle outside the burgess element. A curious pendent to this statement is the fact that since the loss of their privileges the burgesses have begun to increase at a much more rapid rate.

At Berwick, an adjoining town to Newcastle, with similar burgesses, differing only in not being wealthy and privileged, there is a marked contrast in the rate of increase, while in other privileged boroughs, such as Durham, Carlisle, and many more (see Doubleday, *op. cit.* 62) there has been a stationary or decreasing number of freemen.

If we take communities of men like the Quakers, among whom poverty is hardly known, who nearly all marry, and marry early, and who until lately seldom abandoned their sect, we shall find a general agreement among those best able to judge that they have not increased in numbers.

In America, before the civil war, while the slaves were increasing rapidly, the free blacks were decreasing. I am told by millowners and others that the vast increase of population that has occurred in Lancashire of late years has not been among the indigenous stock of the country, who are a comparatively stationary element, but among the Irish and semi-Irish inhabitants of the lower quarters of the large towns. It is notorious how crowded with children these low and miserable neighbourhoods are compared with the richer quarters, and how few of the women there are barren. If we extend our view to isolated portions of the community, we shall be forced to admit that this fertility is due entirely to the poor food and miserable living of these increasing elements.

One of the poorest and most destitute portions of the earth's surface is that comprised in the Scottish Hebrides. A miserable climate is supplemented by a scarcity of food and a want of clothing. Formerly the population maintained a decent existence by the manufacture of kelp, but the introduction of barilla and of free trade ruined the kelp trade, and a busy population was gradually reduced to the abject condition now existing at Skye, Lewes, etc. The conditions are those that in Mr. Malthus' view ought to militate against an increase of population, and yet we find that they have doubled their numbers in 60 years. See the observations in "Anderson's Highlands," p. 262.

From Sir John McNeill's Report on the state of the Western Highlands and Islands of Scotland, published in 1851, it would seem that the average of each family in Ulva and Tiree is a little over six, that is, father and mother and four children. The births in Rasay and Rona for the three years before the report were three times as many as the deaths. For many years, he says, the condition of the people in this district has become worse and worse, and Sir John makes an elaborate comparison between twenty-seven of the most miserable of the West Highland parishes with twenty-seven prosperous and well-to-do parishes in the Eastern Highlands, and found, to use Doubleday's words, that in the former, where the population was in constant danger of dying out for want of nutriment, and barely continued to exist, where the failure of the potatoe crop or the decline of the market for kyloes brought famine to their doors, the wretched population had increased between 1755 and 1841 at the astounding rate of 126 per cent., while in the eastern parishes there was a decrease during the same period of 29 per cent.

In Ireland we have a country whose circumstances are very similar. In 1837, out of a population of 8,000,000, no less than 2,000,000 were wandering and houseless mendicants, subsisting on charity. Dwelling for the most part in mud cabins, without window or chimney save a hole in the wall or roof, and shivering over a peat fire, they lived almost wholly on potatoes. Every edible besides—including wheat, barley, peas, beans, butter, beef, and bacon—was exported from the country, and under such conditions what do we find to be the rate of increase of the inhabitants? Between 1695, when the population was estimated by Captain Smith at 1,034,102, and 1831, when the census returns made it 7,734,365, there was an increase of 750 per cent., an astounding result, and more astounding still if we consult the table given by Doubleday, page 120, showing the intermediate years and how it grew with an accelerated speed as the poverty increased. In the decade between the census of 1821 and that of 1831 there was an increase of 930,000 in a total population of 7,000,000.

In Sadler's answer to Malthus there are some interesting tables about the number of children born in years of scarcity and those of plenty, from which it appears that, notwithstanding that the *latter are marked by a greater number of marriages, the former are marked by a greater number of births.* In 1846, a very prosperous and cheap year, there was an increase of 3,500 in the number of marriages and a decrease of 300 in the births the following year. In 1847 came the potatoe disease and famine and bank crisis, so that in the next six quarters there was a decrease of 2,000 in the number of marriages, while in the last three quarters of 1848 and the first three of 1849, when this decrease in the marriages ought to have begun to tell, there was an increase of 2,650 in the births.

Again, from 1488 to 1650 there cannot be much doubt that the population of England was rapidly diminishing. The contemporary writers and the Statute Book are full of proofs of the fact. During the same period there can be as little doubt that wealth was more generally diffused in England than at any other time. Acts of Parliament to limit wages and luxury, acts whose preambles set out the exceeding plenty then prevailing, are not to be mistaken. Fortescue mentions that the land was full of rich men. Many yeomen could spend £100 a year, equivalent to at least £600 a-year now. He says they were rich in gold and silver, drank no water, eat plenty of all kinds of flesh and fish, wore fine woollen apparel, etc., etc., and he especially compares the wealth of the English with the poverty of the French. An artisan earned in three or four days what would buy a sheep, a calf, or a quarter of barley or malt. Wine and beer were then common drinks of the people. An Act of the 24th of Henry VIII declares beef, mutton, pork, and veal to be the ordinary food of the poorer sort, and so we might go on for pages quoting facts that show that at this period of English history, when the population was rapidly diminishing, wealth and plenty were generally diffused.

Leaving these realms and crossing the channel, let us return with Mr. Doubleday to the north of Germany. We there find the land barren and the people poor, but crowded. In Bohemia, with its cold climate and its inhabitants feeding sparingly on poor diet of barley, oatmeal, potatoes, and milk, we have a population of 3,885 to a square German mile. In Silesia, where the climate is much milder and the crops better, but the people are very poor and badly fed, 4,090 in the same area; while in Bavaria, which is rich and prosperous, the population is only 1,980 to a square mile. In France, whence Doubleday has collected much valuable information, I will only quote one remark taken from a work of Mr. Thornton's on over-population.

In the Département du Nord, which contains most of the seats both of the French cotton manufacturers and of French destitution, population increases at a rate considerably more than double the average rate of the whole kingdom, or about 13 per cent. in ten years.

In Italy (excluding Naples, the most marked example, perhaps, of all, but about which statistics are wanting), Italy, where the country population is so well-to-do and has a climate which favours man in many respects, the average number of births to a marriage is three only, a proportion below that of any other European country, perhaps, except the equally well favoured Provence.

In Holland and Belgium, where we have a very rich soil very highly cultivated, where the law favours the division of property, and where we are so often told by travellers that population abounds, it is only 1,800 to the square English league, while in Ireland, one-fourth of which was bog, it amounted in 1837 to 2,391 persons to the square league.

America has sometimes been cited on the other side, but with very great perversity. In America the population has increased immensely from emigration and at an immense rate among the newer inhabitants, those whose first years of American life are those of hard toil and harassing struggle with Nature. It is notorious that in Kentucky and in the older parts of New England the rate of increase of the population is very moderate; indeed, while the great cities, which are even more crowded with abject poverty than those of Europe, notwithstanding the Utopian latitudes in which they are situated, are increasing rapidly and chiefly among the Irish inhabitants.

The increase of the black population of the States is at a remarkable rate, if we are to be guided by the notions of Malthus; and this increase has continued since emancipation, as the recent census shows, so that it cannot be due to the interested motives of the slave-owners, as some would urge.

In China and Japan cattle and sheep are almost unknown, in India the Brahmins forbid the eating of flesh, so that we have in these areas populations living on vegetable food, and chiefly on rice. However travellers may otherwise differ, they are all agreed in describing the miserably poor and wretched condition of the inhabitants of these areas; they agree also in describing their wonderful fecundity and numbers; they are packed most closely on the rivers, and where a poor fish diet is their ordinary fare. If it were not for wholesale infanticide it would be hard to see how the Chinese householder could live. In India, in the old province of Bengal, where the universal food is rice, the average of population reaches the immense total of 2,166 persons to each square league of land.

If we compare these areas with similarly situated areas elsewhere, where animal food is generally eaten, with South America, or Russia, or Turkestan, beyond the Oxus, we shall find a marvellous contrast. In the latter the population is very sparse, and the rate of increase very slow. And where we have any facts about semi-savage tribes who have changed their mode of living from a pastoral to a settled state, and have discarded the crook for the plough, such as the Tchuvashes, Bashkirs, etc., we shall find that synchronous with this change there was also a sudden increase in the census returns. These subjects of the Czar, who are now very fertile, were until about a hundred years ago very much the reverse.

We have now taken a rapid survey of civilised and uncivilised communities, and we ought to complete it by a similar survey of savage tribes, but unfortunately our facts are not so easy to find among these. What facts we have tend to corroborate our position entirely. Thus Lieutenant Musters, in a paper read before our society not long ago on the Patagonians, told us that it was the custom for the women among them, when they had been with the men, to get bled, as they believed it made them fertile. Mr. Price told us the same of the Quissama tribe in Madagascar. Neither of these races have been sophisticated with the philosophy that is popular in Europe, and their evidence is a most valuable empirical support to our position. It agrees so completely with the theories put in practice by both gardeners and stock-keepers, and to which I have already alluded.

I shall deal more in detail with the several causes that have extinguished races in my next paper of this series. There is one of them which comes opportunely here. Mr. Wallace was sarcastic in his observations upon me because I attributed the extinction of the Hottentots to the greater luxury of their lives having induced sterility among them. I believe this position, notwithstanding the unphilosophical sneers about it, to be most reasonable. We have parallel cases in Tasmania and New Zealand, where the race has undoubtedly diminished, and very fast, chiefly because of the barrenness of the women. In New Zealand the facts have been collected by Mr. Fenton in a most interesting paper entitled "Observations on the State of the Aboriginal Inhabitants of New Zealand, Auckland, 1859." From this I quote: "The usual number of barren to productive females is 20 in 487, or 1 in 24·35. Among the Maoris the numbers are 155 in 444, or 1 in 2·86, manifesting that the general presence of the procreative power among the Maori females is slightly more than one-ninth of that among females belonging to communities of which the population is increasing" (*op. cit.* 28). Again, "The unfruitfulness of women is likewise a recent characteristic, if the

Maories are to be believed when speaking on this subject. And this must be so, otherwise it is impossible to account for the great increase of the population during the twenty generations which the Maoris have passed through in this country, an increase which has taken place notwithstanding the considerable expenditure of life caused by perpetual wars and in spite of the constant operations of numerous other influences calculated to check the increase of numbers and shorten the duration of life. 'The rude forefathers of the hamlet' were, according to the universal consent of their existing representatives, blessed with prolific wives, and not seldom with several all producing simultaneously. Absence of issue from a union was not indeed unknown in former times, but the desire of children was always strong in the breast of the Maori female, and she was usually held in respect according to the number of children with which she had strengthened the tribe."

The only cause I can assign for this increased sterility is that made fun of by Mr. Wallace, namely, the contact of European civilization. The same was true also in Tasmania, where the greatest perseverance was used to induce the few surviving natives to breed, and without avail, and those who believe that man physically is only a member of the great animal kingdom will have no difficulty surely in accepting that as true of him that is true of all other forms of life, namely, that luxury makes him sterile and want fertile.

I must now briefly consider some remarks made by Mr. Herbert Spencer on this question, to which a correspondent of *Nature* has called my attention.

If I understand Mr. Spencer's argument rightly, it amounts to this, that Doubleday's facts are correct, but that his inferences are not so, and that the true explanation of them is found in the general law that animals propagate in the inverse ratio of their nervous and mental development, that in fact the simplest structures are the most prolific. Doubleday has himself considered this theory in the postscript to his third edition, and made some apposite remarks about it. He says with some reason that it may be perfectly true that the simpler structures *are* more prolific than the more elaborately organised structures, but it by no means follows that the simplicity of the structure is *the cause* of the fecundity." In the economy of nature a million blades of grass are wanted for one tree, and hundreds of herrings only make a mouthful for a porpoise, and as there is a greater need there is some law which supplies that need.

It is not difficult to test Mr. Spencer's position. Are the prolific Irish, Chinese, and Hindoos inferior mentally and in nervous development to the New Zealanders, the American Indians,

or the Hottentots? Are the English and Americans inferior mentally to the Spaniards or the Turks, or are their brains less in bulk? Is the shorthorn or southdown more gifted with nervous and mental attributes than the Kyloe and the mountain sheep? Do the semi-domesticated animals mentioned in such profusion by Mr. Darwin gain so much in mental and nervous development as to check their powers of reproduction altogether, as compared with their wild relatives *who have to exercise all their ingenuity and skill in catching their food*? Is the deer more intellectual than the greyhound or the rhinoceros than the shepherd's dog? Does ringing a tree or cutting its roots increase its complexity of structure? Does removing it to the greenhouse do so? *Do not battling with difficulties and struggling for existence tend to increase rather than decrease the nervous development and structural complexity of an organism?* I take it that there can only be one answer to these queries, and that answer adverse to Mr. Spencer.

In conclusion, I must state the result of the evidence I have collected in this paper, in which I have not knowingly shirked or evaded one difficulty, and in doing so I cannot but conclude that sterility is induced by vigorous health and by a plentiful supply of the necessaries of life, while fertility is induced by want and debility, and that this law acts directly against Mr. Darwin's theory, in that it is constantly recruiting the weak and the decrepit at the expense of the hearty and vigorous, and is constantly working against the favourite scheme of Mr. Darwin, that in the struggle for existence the weak are always being eliminated by the strong. I am aware that I only meet one factor in Mr. Darwin's argument. I hope, with your permission, to traverse the whole field he has occupied in future papers. The next one will be on "The Substitution of Types."

DISCUSSION.

Mr. HUGHES thought that the subject brought forward by Mr. Howorth offered interesting matter for discussion, and was fairly put, but protested against the proposition which the author combated being in any way identified with the views of Mr. Darwin. Mr. Darwin did not hold that the races which prevailed were necessarily larger or stronger, but simply that they had the greatest total of advantages for holding their own under the conditions in which they were placed. It was not always necessary for the survival of a race that they should have a very numerous progeny; for instance, the passenger pigeon produced very few young in its whole life, while the salmon, which had so many enemies from the time it was spawned that the race would stand a poor chance of surviving if it had not an almost innumerable offspring, produced its tens of thousands every year. The plant that needs a special combination of soil and weather

to sow itself, or forms the food of many animals, must produce many seeds. The proposition laid down by the author he understood to be, that conditions which *weakened* the individuals tended to make those individuals more fertile; and in reply to that, Mr. Hughes went on to show that the cases adduced by the author did not bear out this view. The gardener who prunes and gashes his plants, or removes them to other soils does so, not to *weaken* the plant, but to cut off the undue development of that part which would interfere with the production of what he requires. In the cauliflower and wheat, he wants more flower and seed; in cabbage and grass, more leaf. Fat and heavy cattle are produced by artificial means, and would not survive in a state of nature. In the case of fowls, man has selected certain breeds for laying, &c., and of course, knowing that over-feeding is injurious, does not feed his laying-hens in the same way as those he wishes to fatten; but no amount of cutting down their food would make a Brahmapootra lay like a spangled Hamburgh. He did not believe that any race actually stinted for food was more prolific than the same race under healthy conditions with enough food. In the case of man, many artificial circumstances had to be considered. Among those who had a hard, rough life, the sickly young received no care, died off, and so those who were left were the most vigorous and grew up to propagate a vigorous race. Other cases adduced might be explained by the hereditary habit of the disuse of certain organs; and others, such as that of the Maories and the wild cattle of England, by the too close breeding in and in, when, from various causes, the race had become too small to allow of greater choice.

Mr. Lewis, while thinking with the author of the paper that the theories commonly called Darwinian had been pushed by some people to unreasonable conclusions, could not but agree with the President that the author appeared to be confounding various conditions which were not necessarily the same. The principal thing proved by the paper appeared to him to be that an artificial state was less favourable to propagation either of man or beast than a natural state.

Dr. Charnock said, according to the author of the paper, the poorly-fed are the most fertile. Did he also mean that there was greater longevity among them? He (Dr. Charnock) thought that the term "poorly-fed" was sometimes applied to those who lived upon a vegetable diet; but if an Irishman consumed eight pounds of potatoes daily, it might perhaps be equal to a pound of flesh consumed by anybody else.

Mr. Quaritch said that Mr. Howorth had endeavoured to maintain the bold assumption that species of the animal and vegetable kingdoms are multiplied by their weakest and most delicate individuals, in opposition to Mr. Darwin, who refers to the strongest and fittest that power of reproduction. Mr. Quaritch considered that the theories of those two gentlemen would not be found upon close inspection to differ very materially, although Mr. Howorth had exaggerated his case by selecting the plant grown on poor soil, and the under-fed, delicate man, or other animal. It is really the hardy plant, as dis-

tinguished alike from the finest and showiest and the puniest and weakest, which best propagates its kind. And it is also the hardy human pair, in most cases underfed—that is, subsisting upon a minimum of food—which reproduces our own species. The fact is such, not because the hardy individuals are in a condition of so-called semi-starvation, but because the struggle for existence has steeled their frame, and a rigorous abstemiousness precludes any of those unnecessary outgrowths—the result of a more generous diet—which weaken the body and require to be fed. Nature will most readily propagate species under conditions in which its laws are most closely followed; and it cannot be doubted that the reproductive power lies in the healthiest and strongest individuals of every kind—not in the finest-looking, nor in the weakest. Over-feeding and starvation are punished by disease and death. Rich living induces an imposing show of health; but it is extreme frugality which bestows a maximum of procreative power. Mr. Quaritch repeated his opinion that Mr. Howorth and Mr. Darwin differed in little more than words, their facts and real conclusions being similar.

After a few remarks by the President, Dr. King, Mr. Charlesworth, and Captain Burton,

Mr. Howorth replied. He said the discussion has been chiefly one about terms, and has not met the points raised by the paper. The author does not contend against the notion that the fittest forms of life for surviving survive. This is a truism which every natural philosopher from Aristotle downwards would willingly admit; and the grave fault of most Darwinians is to mistake this identical expression for Mr. Darwin's position. Mr. Darwin's concrete examples of this law furnish grounds for criticism; and it is these concrete examples that were chiefly attacked in the paper. Mr. Darwin contends that among a number of individuals struggling for existence the strongest, or the most crafty, or the most enduring, elbow out the weakest, etc., by monopolising the food and other resources which are necessary to life. The object of this paper is to show that those individuals who succeed in obtaining more food, and in monopolising those resources, are condemned by some higher law to comparative sterility, while those that are weakly and sickly and ill-fed are endowed with a corresponding degree of fertility. So that there is a constant fight going on against the increase of the well-fed and the prosperous, instanced by such examples as the wild cattle at Lyme Hall, in Lancashire, which have gradually decayed and become sterile under conditions of plentiful food, etc., etc., while the kyloes in the Highlands are just as fertile. In this we have only a generalisation of the fact pointed out by Mr. Doubleday in answer to Malthus, and which I take to be a most complete answer to that philosopher. Mr. Darwin, as he himself says in his work, merely extended and amplified the conclusions of Malthus until they included the whole animal and vegetable creation, and the author of the paper similarly extended the conclusions of Mr. Doubleday. Sir John Lubbock said that the author had mistaken fat for vigour, and over-feeding for good health; but this is hardly a fair way of describing the ex-

amples quoted in the paper. It can hardly be said that the population of Ireland during the famine, that of the Western Highlands now, the condition of consumptive and sickly people, of sickly and decrepit animals like sheep, etc., etc., all of which were cited as typical instances of fertility, are also instances of animals in a normal state of health. That ringing a pear-tree, and reducing cacti, orchids, etc., to the point of death to induce them to bloom and bear fruit, is to mitigate the effects of over-feeding. The very essence of Mr. Darwin's argument is that those individuals which get more food by any means, or struggle into stronger and more vigorous life by any means, have an advantage in the struggle for life which ends in their elbowing the others out of existence, and that it is these forms that survive. The paper endeavoured to prove, and in the author's opinion succeeded in doing so, that these forms fail to reproduce themselves in the manner that less favoured forms do, and have a tendency to die out. In regard to particular objections, the reference to seeds that have been kept some time was not meant to apply to those mythical examples of the Egyptian wheat, etc., which have been long ago exploded, but to the common-place experience of gardeners, who find the seeds of melons, cucumbers, etc., which have been kept a year or two, germinate more certainly than freshly-gathered seed. Reference was made by one speaker to hereditary habit inducing a more fertile breed, and also producing the cases so common in the upper classes of mothers who cannot suckle their offspring; but this cannot apply to the Maories and Red Indians, with whom the delicate notions of our philosophers are not received. The author could not see any analogy between blind people hearing and smelling more acutely than others (no doubt due to the necessity of exercising those senses more freely) and the fertility induced by deprivation of food or harsh circumstances. Nor could he allow with the same speaker that the poor are very thankful for many children, the children being a source of profit rather than otherwise. This fallacy has been exposed by the recent Royal Commission upon infanticide. One gentleman asked if the poorly-fed were long-lived as well as fertile; the test that the author urged was not the longevity of individuals, but the increasing numbers in each generation in different areas. Thus Ireland and China were increasing their populations at a very rapid rate under conditions very adverse, according to Mr. Darwin's extended reading of Malthus, while Sweden, South America, and Turkestan, were remarkable examples on the other side.

The meeting then separated.