ORATION

ON

HARVEY'S "EXERCISES ON GENERATION".

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It had been a cherished view up to a comparatively recent date, that the number of Graafian follicles contained in each human ovary, and representing so many ova, was ordinarily from twelve to twenty, and that, if these became exhausted by frequent abortion or child-bearing, the limit of human fecundity would be reached. But this notion, doubtless, arose from the circumstance that only the more developed follicles had been observed. It required the microscope to demonstrate the fact that, so far from the number being thus limited, the difficulty consists rather in estimating them, especially in young subjects, where a single section of an ovary serves to display a hundred or more ovicapsules and ova: and it matters little at how early a period of life we commence the investigation, for occasionally in the ovarium even* of the foetus some traces of commencing formation of ova may be found. At first, nothing is distinguishable in the mammalian ovary but an uniform mass of primary cells and cell-nuclei; then, when the follicle or ovisac is about to form, little round or ovoidal aggregations of primary cells may be observed, constituting groups that are distributed in considerable numbers throughout the ovary. Within each of these little groups is soon perceived the germinal vesicle. This we may regard as the essential portion of every ovum; and from this little nucleated germ-cell man, in common with the rest of the vertebrata, takes his origin.

By the gradual evolution and multiplication of granular cells and oil-globules, much greater in amount in some classes than in others, the yolk is formed, sometimes obscuring the germinal vesicle; while at the same time, surrounding each of these little groups of cells, is perceived a delicate transparent tunic, the ovisac in its first stage of formation; the yolk receiving its limitation by the addition of a fine vitelline membrane. In animals that produce and emit vast numbers of ova at one time, these become ripened simultaneously, and when the spawning season arrives they are expelled in quick succession, or in one or more masses; but when the number of the progeny is smaller, a corresponding number of ova becomes ripened in succession, and these are gradually found approaching the margin of the ovary or projecting above its surface.

The formation of the ovarian ovum being completed, the next most important step in the process of reproduction is about to take place—viz., its escape from the ovary. If now the ovum be examined, it will be found to present certain differences in its constitution, according to the class to which it belongs. In the mammalian ovum, the yolk or vitellus containing the element which is to supply the germinal portion with additional materials for growth and development during the interval which elapses between its detachment from the ovary and its arrival at the uterus, is comparatively small; for the passage is rapid, occupying generally no more than a few days, and the ovum, having once reached the uterus, draws its nutrition from this latter source. But in birds, for example, where the embryo is entirely dependent for its materials of growth upon what it carries with it from the ovary, together with such additional matter as the oviduct supplies, a very large portion of food-substance must necessarily be provided. And it is to this element of the ovum in birds and some reptiles that its great bulk as well as brilliant colouring are due. Hence the division in such cases into a smaller or germinal portion—the germ-yolk and a larger food-yolk, destined for the supply of materials for subsequent nutrition. And here we are reminded of that excellent definition of an ovum which Aristotle has given, and which appears applicable to it, more or less, in all stages; namely, that "an ovum is that from part of which an animal is engendered, and the remainder of which is food for the thing engendered".

* Concluded from page 4 of last number.

In thus reviewing these initial steps in the process of reproduction, we cannot fail to be struck by one leading circumstance common to them all—namely, the profusion in which the reproductive material, under the form of these separate fragments, each of which we term an ovum, is provided in every class. Only in those animals possessing soft and distensible bodies, can the whole or greater part of this material become ripened and brought to perfection; and even here, where the ripened ova amount sometimes to millions, the process must be gradual; for, after the oviposit has taken place, there may still be seen, within the ovisacs, the preparations for those which are to follow in the next breeding season. But as we ascend higher in the scale, and come to animals producing a smaller progeny at one time, or even to those that are commonly uniparient, the difference consists not so much in a proportionate diminution of the number of germs or ova originally formed as of those that ultimately come to perfection; for, in some of the Mammalia at least, it is probably calculating below the mark if we say that many hundred original germs are provided to meet the contingency of a single act of birth. Of these, therefore, the greater part can never be ripened at all, but must perish in the seat of their original formation; and, further, if those which are ripened and emitted do not become fertilised shortly after that event, these equally perish.

In order to trace out this matter further, we must now turn our attention in another direction, and inquire what provision has been made to meet this latter contingency. The essential part of every ovum appears to be the germinal vesicle; but, unless the contents of another elementary cell be brought into contact with, and possibly mingle its contents with, those of the ovum, and, as it is now supposed, of the germinal vesicle itself, no further important stage in the process of reproduction can be reached.

We have, therefore, to consider the nature of the process by which the ovum becomes fertilised. Until very lately, the efforts of all the observers who had closely examined the ovum, with a view to ascertain whether the spermatozoon actually gained entrance within the ovum, had been defeated. That they did so enter was the opinion of Leeuwenhoek, who also imagined that, having arrived there, they became by metamorphosis the future embryo; and this opinion was entertained, to a certain extent, by Prevost and Dumas. By Dr. Barry the nearest approximation was made to the actual discovery of the penetration of these bodies within the ovum; but, although he saw them frequently upon, and even within, the soft zona pellucida, by which the ovum is surrounded, he still was not able to trace them with any certainty further. So also was Mr. Newport baffled in all those first experiments, of which he gave an interesting account to the Royal Society in 1850. Not until these observations had been extended, was he able to announce that he had actually witnessed the passage of the spermatozoon through the membrana vitelli. The fact thus established has since been confirmed by Dr. Ransom in regard to fishes, where the passage of the spermatozoon takes place through a special pore or micropyle.

These observations, therefore, have for ever set at rest this question, so long debated, as regards the vertebrate ovum; and although, on account of the highly refracting nature of the material by which the spermatozoon becomes surrounded, immediately on reaching the interior of the ovum, it is generally lost to view, so that its conditions can no longer be traced, still they serve to show in what way the material, of whatever nature it may be, which the body of the spermatozoon contains, may be brought into direct contact with that which constitutes the essential part of the female product or ovum.

The most important changes immediately following fertilisation are these. Already in the ripe ova, previous to impregnation, and as a preparation for it, it is noticed that the germinal vesicle has disappeared. This disappearance has been accounted for upon the supposition that a process of cell-development takes place in its interior, and that, the cell-wall being thus ruptured or dissolved, the contents become equally dispersed through the yolk. Now, if this be the real explanation of the disappearance of the germinal vesicle, which all observers agree in stating is not the result of impregnation, but takes place prior to that event, then it goes far to discredit those views which have been sometimes entertained with regard to the immediate agency of the spermatozoa in effecting the fertilisation of the ovum—namely, that it is in the nature of a mere catalytic action; while they add force to the belief that the contents of the spermatozoon become equally diffused through the yolk, together with those of the germinal vesicle, and by their combination initiate those further changes in it which serve to announce that impregnation of the ovum has been already effected.

The phenomena which next ensue, when occurring in the Mammalia, are all observable in the Fallopian tube, the general if not the constant seat of impregnation throughout this class. The first distinct evidence that the power of the spermatozoon has been efficiently ex-

erted upon the ovum, is afforded by the occurrence of a small interspace between the yolk and its outer covering, the so-called zona pellucida, occasioned by the shrinking or contraction of the yolk within the latter, which interspace is filled by a transparent fluid, while one or two small granular bodies, the appearance of which about this time has given rise to much speculation regarding their use, are frequently observed between the yolk and the zona pellucida. As soon as these changes have taken place, the yolk, volvox-like, begins to rotate—the rotation being supposed to be effected by the aid of cilia clothing its surface. I am not aware that any explanation has yet been offered of the purpose of the rotation in this instance, and yet so commonly has it been observed that it doubtless has a meaning; and this account of it offers itself to my mind. The rotation being the first important event that ensues, after the spermatozoon has gained entrance within the ovum, its occurrence would be coincident with the time at which the breaking up of the spermatozoon and the dispersion of its contents among those of the germinal vesicle is supposed to occur. Now, if the purpose be an equal distribution and admixture of these two throughout the yolk, then no means can be well imagined better suited for effecting this object than the rotatory movement of which I am now speaking. And now, following out the changes which the ovum further undergoes, consequent on impregnation, the “segmentation” of the yolk commences. This consists in a spontaneous cleavage of it—at first into two, then four, equal parts, each exhibiting a nucleus, and so on in a kind of geometrical progression, until it is broken up into a mass of finely divided nucleated particles, between which it is probable that the original sperm-force, or sperm-material, becomes equally divided. This process of complete disintegration of the yolk affects, apparently, the whole or greater portion of the mammalian ovum; but in others, as in birds, a part only becomes so affected, the larger portion remaining for nutrition.

A few questions of the greatest interest may now be considered. We have now arrived at two ultimate facts: ultimate, at least, as far as our present knowledge is concerned, and so far as our present means of investigation have enabled us to go. And these are the sperm-cell and the germ-cell, as constituting the essential elements which by their combination give origin to the future being. And whatever may result from further investigation respecting the structure and offices of these two elementary organisms, they must apparently be regarded as the cardinal points around which should be gathered all the information that subsequent research may develop.

This, then, must appear to be the proper moment for considering some important particulars which seem to have a direct bearing upon this subject. But, in endeavouring to arrive at the truth, it is important that we should eliminate from the investigation of certain now well-ascertained facts all external sources of fallacy; such, for example, as appear to have no better foundation than that of popular prejudice or fancy. I am tempted, therefore, to say a word here regarding that supposed influence of the imagination, which, from time immemorial down almost to the present day, has been generally believed to be exercised by one or other parent, but chiefly by the mother, upon the development of the offspring. Nor, as far as I can judge, has this belief yet altogether died out. But “which of us by taking thought can add one cubit to his stature”? or how, supposing that such power existed, could it be exercised, let us say, in the first place, by the male, seeing that we now know how the spermatozoa are formed in developmental cells that go through a gradual process of ripening and completion, not apparently much under the dominion of the mind? Nor can we get more satisfaction out of the opposite case, and show how maternal influence can be supposed to operate. Is it while the ovum is encased in the Graafian follicle, surrounded by the little bed of granules in which it then lies? Or next, while passing down the Fallopian tube, when it may be compared to a rolling stone, having scarcely even contact with the structures of the mother? Or lastly, when, arrived in the uterus, it draws its supply of nutriment through the placenta? But the placenta has no nerves, and he would be a bold physiologist to declare that nervous impressions could be conveyed by means of the general current of the blood. Nor do we get more satisfaction when we come to examine the several classes of cases in which this unscientific “use of the imagination” is supposed to be operative. Emotion, as well as accident, may undoubtedly cause premature expulsion of the ovum, but that is not a true exercise of the imagination. The broken bones occasionally observed in the fetus, and formerly connected with the witnessing of painful sights during pregnancy, are now known to be caused by spasmodic action of the uterus. The various malformations that depend upon arrest of development, erratic as these may appear, are obedient to certain laws, for even in deformity a certain order is preserved. And so, also, of the “marks”, “moles”, and other defects that are alleged as giving evidence of this remarkable power.

None seem to be connected in any way with mental force, which, even if it could be so exercised, seems to be employed in the manner here represented chiefly to produce evil results. In whatever way we view the matter, it seems to elude our grasp. It is like the rainbow, which often appears so near, and yet, when we endeavour to approach it, baffles pursuit—a pretty particoloured play of light, as unsubstantial as the mist upon which it depends for its existence.

Passing on, therefore, from these speculations, I proceed to subjects of a more practical kind.

The natural law of parentage is sufficiently represented in the popular notion that “like begets like;” that the child at its birth is only so far dissimilar from the parent as to need but a certain amount of growth and development to make the resemblance more or less perfect, at least as regards the general characteristics of the individual. And this seems to extend to special peculiarities, which may be handed down from one generation to another, and appear in the form of certain characteristic or other natural endowments; or they may be exhibited in the shape of various diseases, defects, or malformations, which may have affected the parents possibly for several generations. But in these cases it does not follow that like *always* begets like—at least, not apparently. The malformations, defects, or special characteristics may die out, or the course of transmission may be interrupted. The disease or peculiarity may not appear again for one or more generations; or it may be limited to certain lines of transmission, as through the males only, or through the females only, of the family; and in these again, according to certain restrictions.

It is probably little known how much Harvey had thought upon this subject of hereditary transmission, and how very clearly and concisely he expresses his own views upon several matters which, under new names, are at this moment exciting the greatest attention. “In reference to the subject of family likeness,” says Harvey, “we may be permitted to inquire as to the reason why the offspring should at one time bear a stronger resemblance to the father, at another to the mother, and at a third to progenitors, both maternal and paternal, further removed; particularly in cases where at one bout, and at the same moment, several ova are fecundated. And this, too, is a remarkable fact, that virtues and vices, marks and moles, and even particular dispositions to disease are transmitted by parents to their offspring; and that, while some inherit in this way, all do not. Among our poultry, some are courageous and pugnaciously inclined, and will sooner die than yield and flee from an adversary; their descendants once or twice removed, however, unless they have come of equally well-bred parents, gradually lose this quality; according to the adage, ‘the brave are begotten by the brave.’ In various other species of animals, and particularly in the human family, a certain nobility of race is observed; numerous qualities, in fact, both of mind and body, are derived by hereditary descent. ‘Every fourth birth,’ says Pliny, ‘the mark of the Dacian family is repeated on the arm.’ Why may not the thoughts, opinions, and manners now prevalent, many years hence return again after an intermediate period of neglect?” This disposition to *atavism*, or the reverting to an ancestral type or pattern after it has been lost or kept in abeyance through one or more successive generations, of which Harvey gives so clear a statement, has of late received great attention; and its study, more particularly in the hands of Dr. Prosper Lucas, has brought to light many most interesting examples.

Mr. F. Galton has attempted a farther development of it, in a paper read before the Royal Society so recently, that no report has yet appeared of it in their *Proceedings*. As far as I can ascertain, however, the object of the author is the discussion of the question, whether it be impossible to define the connection between relatives in a way that should do justice to the *latent* elements, which every creature inherits and may bequeath, but which give no sign of their existence in its own person. This difficulty, he considers, may be avoided by tracing the intervals of descent from the origin of life in each generation, and not from one adult to another. He recognises three well-defined stages in each of these intervals. First, the ovum, in which all the elements are confounded and no structure exists; then the embryo and the adult, in both of which they are separated into personal and latent. Then, by tracing out the process by which each stage in either of the lines was derived from its predecessor, he discovers the true relation of a man to either of his parents, and this he shows to have a twofold character—one part passing by the *latent*, the other by the *personal* line. The first of these Mr. Galton regards as the most important, though only collateral, because it descends through five steps to the parental *ovum*, and thence descends through three other steps to the parental *person*. The other—the *personal* line—though of minor importance, is nearer and quite direct, and it descends through three steps. As an example, he takes brothers and sisters, whose descent passes only through *three* parallel steps, though it is derived from *four* vari-

able sources, which are the latent and personal contributions of either parent.

Now, if there be any value in what has been already said of the special attributes of the sperm-cell and germ-cell, then, with reference to any qualities that may be transmitted from parent to offspring, so far as these can be conveyed by any material of communication, they can only be so transmitted from the male through the sperm-cell, and by parity of reason, though the case is here not so simple, from the female through the germ-cell.

And here we seem to be getting back to the views of Seneca, whose description, taken in a figurative sense, represents the matter in much the same light. "For," says Seneca, "in the semen is comprised the entire cause of the future man, and the unborn babe has written within it the law of a beard and a hoary head. For the whole body and the load of future years are already traced in delicate and obscure outlines in its constitution."

Further, with regard to the hereditary transmission of diseases and deformities: that some persons are more prone than others to suffer special forms of disease, which, upon investigation, may be ascertained to have affected one or other of their parents, and this possibly through several generations, is a circumstance now so well known and generally acknowledged, that it has come to form an important basis of calculation with insurance societies when estimating the probable duration of human life in given cases. But most writers upon this subject, which is commonly spoken of by the not very correct title of the "hereditary transmission of disease", since all that we can certainly affirm of it is that the tendency is transmitted, have hitherto taken little or no notice of its sexual limitation. Detached cases exemplifying this remarkable circumstance have been from time to time recorded, and the matter may have received a passing notice from a few authors. Moreover, it had been long previously known that a sexual limitation often characterised the prevalence of certain malformations when observed to occur in lineal descent, sometimes through many generations; but no one appears to have taken up the subject as one deserving of systematic inquiry regarding both diseases and malformations, until Dr. Prosper Lucas and Mr. Sedgwick brought together numerous cases, with a view to illustrate this peculiar limitation. Regarding diseases, the cases collected are chiefly illustrative of the mode in which a tendency to phthisis, asthma, gout, hæmorrhage, insanity, cutaneous and many other affections, are handed down from progenitors similarly affected, and are thus limited in their lines of transmission. But the inquiry, when extended to certain peculiarities or defects, such as the general colour of the skin, colour or form of the iris, defects in the organs of vision or hearing, colour-blindness, arrests of development, congenital deficiencies of fingers and toes, or the webbing of these, or the opposite condition, viz., supernumerary digits (polydactylism), affords results tending more or less in the same direction, as furnishing examples of a sexual limitation in atavic descent.

The general conclusions at which Mr. Sedgwick arrives, after a careful analysis of his cases, are, that sexual limitation in the transmission of disease is more common in the male than in the female; that such a limitation may affect either the development or the transmission of a given disease; and these two conditions are often antagonistic to each other, as in those cases where the appearance of the malformation or disease is strictly limited to the males, its transmission being quite as strictly limited to the female sex, occasioning the phenomenon of *double atavism*, as where neither sons nor daughters ever inherit their father's disease, but only the grandsons in the third and fifth generations, by transmission through the females of the second and fourth generations.

This part of the subject has been very fully discussed by Dr. Prosper Lucas, and also, under the title of prepotency in the transmission of character, by Mr. Darwin. But it becomes extremely complicated on account of this prepotency being found to run now more strongly in one sex than in the other, and again equally in both sexes; while further complications appear to arise on account of the secondary sexual characters. The greater part of those, however, who have taken up this subject, agree in this, that peculiarities first appearing in either sex, though not in any way necessarily or invariably connected with that sex, strongly tend to be inherited by the offspring of the same sex, but are often transmitted in a latent state through the opposite sex.

It would doubtless, therefore, very much aid our comprehension of this difficult subject of a sexual limitation of disease, if we could arrive at a more complete knowledge of the causes which primarily determine the division of sex into male and female, and that according to certain definite proportions; as well as of those conditions which in so remarkable a manner occasionally disturb that proportion.

In the English edition of Blumenbach's *Institutions of Physiology*, which appeared just fifty years ago, the following note by the trans-

lator will be found. "Sir Everard Home has published a singular hypothesis. He suggests that the sex is not determined at the first formation of the individual, but that the parts of generation are originally so situated, and of such a nature, that they are capable of becoming either male or female organs when the sex is subsequently fixed." Now this hypothesis, which then appeared so strange, and for which the data will be found in Sir Everard Home's paper in the eighty-ninth volume of *Philosophical Transactions*, has ceased to be an hypothesis, and has long passed into the region of ascertained facts.

Many observers have given their attention to this subject, but none so fully as Kobelt. According to Kobelt, there exists in the embryo a condition of absolute indistinction of sex in every individual. This depends upon a coexistence of all the elementary reproductive structures of each; so that, prior to the division of sex, each individual possesses the parts necessary to form either the male or the female, but yet without any true exhibition of bi-sexuality.

The nature of the first impulse towards a division of sex is entirely unknown, but the several elements out of which the fully formed organs are to be developed manifest a tendency to change in two opposite directions; in the one case suffering retrogression, in the other showing advance. The generative gland may at this time be converted into testis or ovary, and, through the duplex excretory duct, that of the Wolffian body for the male, and the duct of Müller for the female, the capability of conversion into either sex exists at this time in every individual. The development of one and the stationary condition or disappearance of the other of these ducts, together with the changes taking place in the generative gland itself, render now the beginning of the division of sex anatomically discoverable.

I have endeavoured to determine by observation, at what time this precise change occurs. In a human embryo of the fourth week, of which I have published a description, no trace of an ovary or generative gland was discoverable, but only slight indications of the Wolffian bodies. In another embryo, measuring 5 lines in length, the generative gland was only just discerned; while in another, measuring 8 lines, the distinctive characteristics of the ovary could be perceived. It may be said that in the human embryo the ovary cannot be discerned earlier than between the fifth and the seventh weeks, nor is it possible, previously to this, to distinguish the ovary from the testis.

Of the precise conditions which determine this division of sex, we are at this moment, as just stated, in perfect ignorance; although numerous most interesting facts have been collected regarding the circumstances of the begetting; such as the relative condition of the parents, regarded as the two factors; their relative ages; the equality of their potency in regard to the production of sex, or a *preponderance* on one or other side of a tendency to produce males or females (in some cases so remarkable as to take the matter entirely out of the category of so-called chance or accident); the tendency, again, to the prevalence of a single sex in quadruple or quintuple births, and the almost constant occurrence of the same sex in duplex monsters. These are matters which may ultimately lead to a better understanding of the whole question; while, at the same time, they serve to show how little is as yet known beyond the bare ascertainment of these and similar facts.

Before I conclude, I will refer to one other subject, to which I have occasionally adverted in the course of this address.

Again and again, passages occur in Harvey's work which lead to the conviction that he is in some sense a supporter of the doctrine of "equivocal" or "spontaneous" generation. And as, when noticing one of these, I stated that I would return to the subject, I feel myself pledged to say something more respecting it. But this must be very brief.

The notion that living things might arise spontaneously out of dead or putrefying matter, is undoubtedly among the oldest of all the doctrines relating to the several modes in which animated beings might be supposed to commence their existence. So consistent did this doctrine appear with the fact that scarcely is an animal dead before the carcase abounds with maggots and other living forms destined to devour it, but which nevertheless had no existence there before, that we cannot feel surprised if in those days, when the observant faculty of man was less keen than now, less sharpened by the constant practice of investigating facts, such a doctrine should meet with very general acceptance with regard to such cases as these.

It was not until eleven years after Harvey's death that the first distinct and systematic attack upon this doctrine of spontaneous generation was made by the distinguished Italian naturalist, a member of our own profession, Francesco Redi. The experiments which he instituted with a view of testing this question were of the simplest description, but they aimed directly at the root of this matter. And the arguments which he deduced from them were unanswerable. Moreover, simple as they were, they have formed the basis of almost every experiment which has been since made with a view to determine the same or similar questions

in analogous cases. Redi's experiments were intended to show that, whenever external agents, such as flies, were prevented from coming into direct contact with putrefying meat, by tying a piece of gauze over the vessel which contained it, such as would exclude the flies but not the air, no maggots were ever produced in the meat, although the ova which the flies had deposited externally were freely hatched in this situation.

But Redi's experiments sufficed to test this matter only in respect of such coarse examples as those just quoted. Their direct purpose was to show that, in those cases, the real mode of origin of the animals had escaped detection. They could not, however, fail to suggest to him the idea that, in all like cases, where living creatures seemed to arise out of dead matter, a similar cause was in operation, and the real explanation of their apparently spontaneous origin was to be found in the fact that their germs had been derived from some external source. In this form, the question seems to have slumbered for a period of more than eighty years, when, in the middle of the last century, it was again taken up by Needham, who, aided by the distinguished French naturalist Buffon, set to work to revive the ancient doctrine, though now under a new phase.

Buffon held the notion, in which, indeed, he has by no means stood alone, that all living creatures, whether animals or plants, were made up of separate organic molecules or living atoms, which are merely held together by some unknown force, in that particular form of association which serves to characterise the individual plant or animal; but that, on the occurrence of death, all these atoms are set free, and, while still retaining their vitality, become, when portions of the animal or the plant are infused in water, developed into so many infusorial animalcules.

Needham, falling in with these views, but seeing also that they were antagonistic to the now well-known observations of Redi, proceeded to put them to the test of a like experiment, varying it only according to the circumstances. By boiling the infusion, and afterwards, as he supposed, effectually excluding the air and continuing the heat, Needham concluded that he had destroyed all germs that might have previously existed in the solution, and at the same time prevented the entrance of any others that might be supposed to be floating in the air. The results of those experiments appeared directly to contradict the conclusions arrived at by Redi, and to resuscitate the old idea of spontaneous generation.

But they were not destined to remain in this condition. For, sixteen years later, Spallanzani, by a series of more carefully devised experiments, appeared to put Needham in the wrong, and to add further support to the views originally maintained by Redi. And now, again, another century has elapsed since these observations of Spallanzani; and, during this time, the question of the spontaneous origin of animals has been repeatedly revived and tested by every form of ingeniously-devised experiment.

The case of insects imprisoned in the galls that are found upon the oak, and other analogous examples, have long ago received a satisfactory explanation. The spermatozoa having now ceased to be regarded as distinct animalcules, are now classed with ciliated cells, of which they constitute undoubtedly the most important and interesting example. The presence of entozoa within the bodies of other animals was for a long time the stronghold of those who, not being able to discover them in other situations, saw no way out of the difficulty except by assigning to these also a spontaneous origin. But in time it was discovered that, while in most animals produced according to the ordinary form of sexual generation, the offspring soon comes to resemble the parents, there were still others in which the new individuals differ at first from the parents and also from each other, and that it is not until after certain intermediate or alternate forms have been passed through that the last of the series returns to the state of the first parents; so that the non-recognition of the larval form broke the chain of evidence regarding the origin of some of the more perplexing examples of the entozoa. And now the discussion is maintained only in respect of the infusoria. Regarding the origin of these, one side assumes that whenever in animal or vegetable infusions living creatures seem to arise spontaneously, their presence is due to pre-existing germs, which in some form already occupy the infusion, or the air having access to it. The other side considers that, in obedience to laws which are in the nature of ordinary chemical and physical laws, and not such as are commonly termed vital, new centres of life may arise even out of non-living matter, without the intervention of a pre-existing germ.

Now, if we compare these views with what Harvey asserts, the following, I think, will be the result. When Harvey is speaking of things arising spontaneously, equivocally, or automatically (for he employs all these terms), he is generally referring to insects and creatures of that class, which, as I have already shown, were commonly in those days supposed to have a spontaneous origin. Some, he says, are born of their own accord, concocted out of matter spontaneously. And in another place he expresses it thus: "In the same way are engendered

both those creatures that are said to arise spontaneously, by chance or accident, and derive their first matter or take their origin from putrefaction, filth, excrement, dew, or the parts of plants and animals, as well as those that arise congenitally from the semen of animals; because this is common to all living creatures—viz., that they derive their origin either from semen or eggs, whether the semen have proceeded from others of the same kind, or have come by chance or something else." But he intends, I think, to draw a distinction; for in his twenty-eighth exercise, speaking of the impossibility of the egg being rendered fruitful without the concurrence of the male, he says: "But this view is opposed to the opinion of those who derive the origin of animals from the slime of the ground." And further, in another exercise he seems to hit the whole of the matter, for he has it thus: "But on these points we shall say more when we show that many animals, especially insects, arise and are propagated from elements and seeds so small as to be inconspicuous (like atoms flying in the air), scattered and dispersed here and there by the winds; and yet these animals are supposed to have arisen spontaneously or from decomposition, because their ova are nowhere to be found." And then he adds: "This idea may be not without use to that school of philosophy which teaches that all things are produced from nothing."

And now, having brought before you all that I think can be said respecting Harvey's doctrine on this particular subject, and having endeavoured to exhibit Harvey in such a light as to increase, if possible, the interest which we all feel in one who, by the force of his genius, raised himself to a foremost position among the physiologists of the world, I will bring this already too prolonged address to a conclusion with the following extract.

"Wherefore," says Harvey, "according to my opinion, *he* takes the right and pious view of the matter who derives all generation from the same eternal and omnipotent Deity, on whose nod the universe itself depends. Nor do I think that we are greatly to dispute about the name by which this first agent is to be called or worshipped; whether it be God, Nature, or the Soul of the universe—whatever the name employed—all still intend by it that which is the beginning and the end of all things; which exists from eternity and is almighty; which is author or creator, and, by means of changing generations, the preserver and perpetuator of the fleeting things of mortal life; which is omnipresent, not less in the single and several operations of natural things than in the infinite universe; which, by his deity or providence, his art and mind divine, engenders all things; whether they arise spontaneously without any adequate efficient, or are the work of male and female associated together, or of a single sex, or of other intermediate instruments, here more numerous, there fewer; whether they be definite, or are equivocally or accidentally produced: all natural bodies are both the work and the instruments of that Supreme Good, for he also makes use of the motions, or forces, or vital principles, of animals in some certain way, to the perfection of the universe and the procreation of the several kinds of animated beings."

ON THE TREATMENT OF INGROWING TOE-NAIL.

FORTY years since, when I was an assistant, a young farmer one day came to the surgery, and was operated upon for an ingrowing toe-nail. This was done by tearing the nail away. The poor fellow suffered so severely that I was induced to say, "I will never perform that operation." Of course, in many years' active practice, I have had many such cases under my care; and my invariable mode of proceeding has been to find the edge of the nail with a probe, and then remove the whole of the granulations and hypertrophied cellular tissue on both sides, if requisite. In no case have I been disappointed, or ever had to treat the patient for a return of this grievous complaint. I fully expected that this mode of treatment was general; but my attention has been recently drawn to the case of a fine young man rendered almost a cripple by having had both his great toe-nails torn out, leaving the overlapping skin to such an extent as to prevent healing, with the probability of return on the growing of a new nail. This was performed by a surgeon to one of the large metropolitan hospitals, where, I am informed, this mode of treatment is taught. In a clinical lecture by another hospital surgeon, reported a few weeks since in the JOURNAL, are the following remarks: "The common mistake made in this case was to blame the nail; but it was not the nail that was at fault, but the skin surrounding. This became thickened and ulcerated, and grew until the nail was overlapped." Now the mode of operating which I wish to impress is to remove the offending granulations, instead of the unscientific cruel operation of tearing out the nail. I am aware that other surgeons follow this mode of treatment; and I considered it general until my attention was recently drawn to the case above-mentioned.

Epsom, July 1st, 1872.

GEORGE STILWELL.