

AN ESSAY

ON

THE BENEFICENT DISTRIBUTION

OF THE

SENSE OF PAIN,

BY

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As the first edition of this Essay was very favourably received, it is reprinted, the notes containing the remarks and additions consequent on a second edition. It was noticed in several publications; and formed the subject of an article in the *Quarterly Review* for January 1858, to which especial reference is made in the Notes.

P R E F A C E.

FROM the date it may be seen that this second edition of my "*Essay on the Beneficent Distribution of the Sense of Pain*" has been printed some time ; its publication having been delayed from a desire to issue with it a paper on the Cyclone Theory of Storms. This I have been unable to do, owing to domestic troubles and inability to devote the necessary time to the subject ; and therefore take the opportunity again to endeavour to bring my theory on the "*Cause of Rain and its Allied Phenomena*" under consideration, and to ask that its merits or demerits may be fairly tested.

The theory generally adopted on these subjects is, that evaporation is the effect of absorption of latent heat by the atoms of water, and that the ascent of vapour, the formation and suspension of clouds, and other phenomena of rain, &c., result from it. Now, considering that, in accordance with Black's experiments, it requires the absorption of 140° of latent heat to convert ice into water, I hold that the fact that evaporation will go on from ice even during the most severe frost, tells against this theory of evaporation ; for, from whence is the heat derived, when the ice and the medium by which it is surrounded are far below the freezing temperature, which can not only convert the ice into water, but also expand its atoms to upwards of eight hundred times their bulk as water, which must be the case to render them buoyant even in the heaviest atmosphere ? Again, clouds are at times at an elevation of not less than five miles : this phenomenon also tells against the theory ; for how can heat alone be the cause of the ascent of vapour and its suspension where an atom of water would be nearly three thousand times heavier than the air, and the temperature forty or fifty degrees below freezing point ? From these facts I contend that the ascent of vapour and the suspension of clouds must be dependent on other causes than the absorption of latent heat ; and I have the opinion of one whose name stands high in the philosophical world, "*that these facts are absolutely conclusive on the point.*" In addition to these objections to the theory, there are phenomena, such as the electricity of clouds, the formation of hail, &c., for which it affords no explanation.

It is generally considered that water in evaporation undergoes some change, and that its invisibility in a state of vapour is owing to this change. This I believe is an assumption without proof (as far at least as regards evaporation

at natural temperatures). The evaporation of water and mercury seems to be analogous ; and I believe that with both invisibility under evaporation is simply owing to the extreme minuteness of the atoms and their diffusion*.

As the theory I propose has been brought before the public in various ways, it is unnecessary for me to go much into details in describing it : briefly it is this, that the particles or atoms of water are so minute, that when separated from all others they are rendered by their natural coatings of electricity sufficiently buoyant to be wafted away by slight currents of air, and thus evaporation from ice may be accounted for ; but if the particles are expanded by heat at the time of their rising from the earth, their capacity for electricity being increased in accordance with their increase of surface, they are rendered sufficiently buoyant by the electricity to rise up into the air, where, if condensed (i. e. contracted in bulk) by the lower temperature, they become surcharged with electricity, and are still buoyed up by it ; until from passing over hills, or from the damp and conducting condition of the lower atmosphere, the surcharge can pass off, when the particles, being no longer sufficiently buoyant at such heights, fall as rain.

It is impossible in a brief notice to give an idea of the bearing of this theory on all points ; but in my "*Essay on the Cause of Rain,*" and various papers, I have endeavoured to show that it will fairly apply to every phenomenon connected with the subject. The theory is therefore fully open to controversion : I ask no one to adopt it ; all I ask is that it may be shown where it fails in affording a fair explanation in respect to the various phenomena, or that it may be tested by experiment : for I hold that a theory which affords a reasonable explanation of such varied phenomena as those of evaporation, clouds, rain, hail, lightning, &c., without being open to a decided objection on any point, must be an approximation to the truth, or at least deserving of investigation as to its correctness.

I know of no objection having been advanced against the theory, except that I cannot prove electricity to be material : this I grant ; but it is equally certain that it cannot be proved to be otherwise. Arago, in his "*Meteorological Essay,*" asserts that he could come to no conclusion on the point, "which appeared enveloped in ten thousand difficulties."

With the first proposition of the theory I suggested that a balloon, with an electric conductor extending from the earth to a cloud, might enable the sur-

* The evaporation of mercury tells against the theory of evaporation from the absorption of latent heat. For as the specific gravity of mercury is thirteen and a half times greater than that of water, an atom of that metal must be expanded to more than twenty-two times its diameter, or eleven thousand times its metallic bulk, to be buoyant in the atmosphere at the sea-level. That such an expansion as this takes place is extremely improbable, and cannot be proved.

No such difficulty presents itself with regard to the theory of evaporation from electric coatings ; for if the atoms of mercury are smaller than those of water, they may be equally buoyant with coatings of electricity of the same thickness. Thus a coating of electricity which, in accordance with the theory, would render buoyant an atom of water of a certain diameter, would give the like buoyancy to an atom of mercury of four tenths of that diameter.

charge of electricity to escape from the cloud, and thus produce rain. From subsequent consideration of the subject I feel more fully convinced of the correctness of this idea ; and the experience of Mr. Weeks with electric kites, as described by that gentleman in a letter to myself, not only shows the probability, but almost the certainty of the success of such an experiment. I merely suggest the experiment as a test to the theory, and not from an idea that any great effects could be produced by it. Still, if it gave a more correct knowledge of the nature of clouds, it might lead to important results ; and I believe the time will come when, by some means for promoting the escape of electricity from clouds, rain may be produced at times when it would not otherwise fall. The weather during the late dry season seems to support the views I advance : there have at times been very dense clouds, apparently ready to pour down rain, but from which hardly a drop, if any, has fallen ; and I ask if the dry and non-conducting condition of the lower atmosphere, and consequent isolation of the electricity of the vapour, is not a fairly assignable cause for the rain not falling at such times ? as often in very wet weather, when the air is very damp, rain will fall from every passing cloud, even if only a mere film in appearance.

It is now twenty-four years since I first ventured to submit my views to the public, and from the simple theory first advanced I have not found it necessary to deviate in the least degree. It is not on an abstruse or speculative question, such as whether the fixed stars are suns, or the planets inhabited, but on natural facts and phenomena which are hourly produced around us : surely then it must be possible by some means to ascertain whether the theory is in any degree correct. And when we consider the expense incurred in various establishments in observing and registering meteorological phenomena, and the very general desire for advance in meteorological knowledge, it cannot be said that the questions involved in the theory are unimportant. Since the first publication of the theory I have been enabled to investigate points connected with it under more favourable circumstances than previously, and have written several papers upon them : these have been read before philosophical societies, or published in scientific works. Some I had printed for distribution in quarters where I thought they might lead to investigations as to their merits. I have forwarded copies of my "*Essay on the Cause of Rain*" to many who take a leading part in the scientific world, or amongst the highest in the land, soliciting investigations as to the truth of the theory : but as yet I seem no nearer attaining my wish on this point than when the theory was first proposed.

To the Press, both local and general, I have good cause to be thankful. Every article I sent to the "*Edinburgh New Philosophical Journal*" was readily inserted, and in several cases copied into other publications. My papers have been reported at considerable length in the "*Athenæum*" and other journals, and often with commendation. The favour with which my "*Essay on the Cause of Rain*" was generally received fully equalled my wishes, and far, very far, exceeded my expectations. Much in this case may be attributable to a generous feeling excited by my statement that I am self-taught. Such being the case, and as all other means have failed to bring the proposed theory under the test of experiment, I may perhaps be excused if I endeavour

to obtain the aid of the Press in a still greater degree, by stating more fully the circumstances under which this theory was worked out.

The study of the cause of rain, and phenomena connected therewith, has not been with me the mere occupation of leisure hours, but a ruling passion, and carried on under peculiar circumstances. To its powerful influence over my mind I probably owe my position in life, and perhaps my existence to the present time. In my childhood the thunder-storm was an irresistible attraction to me; and since then such subjects have been almost constantly in my mind. I have thought on them by day and dreamt of them by night: well or ill, it has been the same: and I doubt if from my boyhood to the present time, even during painful sickness or other severe trials, my mind has been altogether free from the subject for one whole week. The only education I received was at a common day-school, (and such schools fifty years ago were very different from those of the present day,) and from that I was taken when less than ten years of age to assist an aged grandfather, in reality to be his only assistant at a small public-house, where, for two or three years during the summer months, my chief employment was to supply the customers in the skittle-alley, and to set up the skittles for the players; an employment strongly inductive to a desire to join in the game, and at this I became rather expert; but fortunately the study of the thunder-storm had the greater attractions, and quickly led to a total abstinence from skittle-playing. Soon after the expiration of my apprenticeship I was bitten in the leg by a strange dog, and in consequence was compelled to keep my bed for several weeks, was unable to work at my trade for full twelve months, and for upwards of twenty-five years was from time to time unable to do so. During the early part of that period the dread of more serious consequences would occasionally force itself on the mind; and during many restless nights I found relief in bringing my thoughts to bear on my favourite subject.

It was well for me that I could thus divert my thoughts from the circumstances of the time, as on one occasion, from an injury to my knee, I was confined to my bed for six weeks, and lame for several months. At another time, from working in a room where, unknown to myself, the small-pox had prevailed, I fell with that disease; and a year or two after this I had an attack of rheumatic fever, from which I was unable to leave my bed for twelve weeks, and was then several months before I could follow my usual occupation. These were such serious cases with me, that an occasional two or three days or a week in bed from sciatica passed over as a mere trifling matter. But my most serious illness followed an excess of work during the bustle previous to the installation of the Duke of Wellington as Chancellor of the University, when I was taken with a low fever and spitting of blood. For three years I was unable to take animal food, and was reduced to a most debilitated condition. My nights, although painless, were almost sleepless; and for many months I believe I did not have one hour's continuous sleep; and even from a sleep of only a few minutes I usually awoke reeking with perspiration, as if just taken from a hot bath. During this illness it was a great relief to me in having a subject for the mind to fall back upon; and but for this habit of mental employment I believe I could hardly have survived so many miserable and restless nights, which even now I can only think of with feelings of sad-

ness. I may add, that before I had recovered from this illness the duty on paper-hangings was repealed (viz. 1836), without any allowance of time for the disposal of the stock on hand, or drawback of the duty paid upon it; and by this measure, with the great reduction in the price of paper-hangings consequent upon it, the whole of my stock-in-trade was reduced in value to about one fourth its cost price.

These then were the circumstances under which my meteorological studies were carried on, as it was in 1839 I wrote my first paper on the theory; and till the night when I wrote it I had never made a note upon the subject. I do not state these circumstances in excuse for any deficiency in the theory, as that must be judged on its merits only; but, although in a great measure irrelative to the subject in question, I think I may advance them in support of my claim that the theory should be fairly tested, or at least as an excuse for any excess of anxiety I may express respecting it.

In asking that the theory should be fully considered, I am seeking no personal advantage. I am of no profession in which to look for advancement. I expect no pecuniary reward, and am happy in stating that I need none. But, as I am becoming an old man, I am anxious that the theory should be tested while I still live. Then if it fails there will be an end to it, and it must follow the many which have preceded it. If it is deficient, I may amend it. But if it will bear the test of investigation, I shall have the satisfaction of knowing that the study of my life has not been altogether in vain, and that I have added my mite to the general stock of human knowledge.

Oxford, Sept. 5, 1864.

The following papers on Meteorological and Magnetic subjects, connected more or less with the proposed theory, have been written by the Author:—

1. Conjectures on the Cause of Rain, Storms, the Aurora, and Magnetism; with a Suggestion for Causing Rain at will.

Read at a Meeting of the Ashmolean Society, 1839; at the Meeting of the British Association at Glasgow, 1840; and published in a pamphlet, 1841.

2. On the Connection of Evaporation with Electricity.

Read at a Meeting of the Ashmolean Society, 1841; and published in the Lond. and Edinb. Phil. Mag. 1842.

3. On the Cause of the Electricity of Steam.

Read at a Meeting of the Ashmolean Society, and published in the Edinb. New Phil. Journal, 1844.

4. On the Phenomena of Evaporation, the Formation and Suspension of Clouds, &c.

Published in the *Edinb. New Phil. Journal*, 1845.

5. On the Cause of Storms, and the Fluctuations of the Barometer,

Read at a Meeting of the Ashmolean Society, and published in the *Edinb. New Phil. Journal*, 1846.

6. On the Cause of Terrestrial Magnetism.

Read at a Meeting of the Ashmolean Society, and published in the *Edinb. New Phil. Journal*, 1847.

7. On the Aurora, and Declination of the Needle; and,

8. On the Cause of Evaporation, Hailstones, and the Winds of temperate regions.

Read at the Meeting of the British Association at Oxford, 1847.

9. On the Height of the Aurora-Borealis.

Read at a Meeting of the Ashmolean Society, 1847; and published in the *Edinb. New Phil. Journal*, 1848.

10. On a Plan for Simultaneous Meteorological Observations.

Read at a Meeting of the Ashmolean Society, 1848.

11. On the Change of Temperature in Europe, and the Variation of the Declination of the Needle.

Read at a Meeting of the Ashmolean Society, and published in the *Edinb. New Phil. Journal*, 1853.

12. On the Storm of September 22, 1856.

Read at a Meeting of the Ashmolean Society.

13. An Essay on the Cause of Rain and its Allied Phenomena, published 1859.

See Advertisement at the end of the Pamphlet.

14. A Lecture on the Storm in Wiltshire, which occurred on the 30th of December 1859.

Given at a Meeting of the British Meteorological Society, Great George Street, Westminster, 1860.

See Advertisement at the end of the Pamphlet.

ON THE SENSE OF PAIN.

IN 1847 I submitted a paper to the Ashmolean Society, "On the Beneficent Distribution of the Sense of Pain." I did so with some hesitation, and had, at that time, no idea of giving further publicity to it; but from its favourable reception, and the interest it seemed to excite, I was induced to send a copy to the late Professor Jameson, who published it in the "Edinburgh New Philosophical Journal," Oct. 1847; from whence it was copied into the American Journal of Science and Art, and some other works. A favourable opinion was expressed on it by many persons well qualified to judge on the subject, amongst whom was the late Dr. J. Kidd, the then Professor of Anatomy in the University of Oxford, and author of a Bridgewater Treatise. The only expression of opinion in deprecation of my views, of which I am aware, was an article in "Chambers' Journal," entitled, "Do animals feel pain^a?"

There are many points of interest connected with an inquiry into the use and distribution of the Sense of Pain; it is therefore surprising that so little has been written on the subject. I did hope my former paper might have stimulated some one to take up the question, who was well qualified to discuss it in all its bearings, but I am not aware of any publication of such a character: the few articles on Pain, which now and then appear in the Zoologist, the Naturalist, &c., seem to be written as an excuse for the entomologist and angler, rather than in reference to its importance to man and other creatures.

^a See note A. ; ; ; ; ;
 B ; ; ; ; ;

Under these circumstances, I again venture to bring the subject forward, although I know I am wanting in the necessary qualifications for doing so. I have no knowledge of anatomy wherewith to support my opinions; I can refer to no experiments in illustration of my views: all I can advance is simply the result of observations on such cases, bearing on the subject, as have from time to time come under my notice, and an earnest consideration of the question which has, more or less, occupied my mind for many years.

I have endeavoured to make my remarks as concise as possible, but have introduced many points connected with the question, to which I could not even allude in my former paper, which was of necessity very brief.

The conversations I have had with many persons on the subject, have given me a fair knowledge of prevailing opinions with regard to the sense of pain. Many justly consider pain to be a protective sense; but I believe very few fully appreciate its importance, either as regards the physical or social condition of mankind, or the evidence of its beneficent distribution throughout the animal creation; while by far the greater number have no opinion on the subject, or consider pain only as an infliction on the animal creation.

In the following pages I hope to shew, that the sense of pain is not an infliction, but one of the most useful and important senses we possess. That it is given to animals only in as great a degree as is necessary, and that no creature has a higher sense of pain than is required for the preservation of the class to which it belongs. I shall not attempt to shew how it is that animals differ in their sense of pain; whether it be that the nerves are more or less numerous, or different in their sensibility; or if a want of reflecting faculties, in some classes, render them more insensible to pain than other creatures: the only cause I can assign is, that it is the will of the Creator, and is evidence of merciful and benevolent design.

A slight investigation of the distribution of the sense of pain in man, shews how important it is for his protection. Man is liable, from many causes, to injuries, from which other creatures are exempt; he alone has a knowledge of, and uses fire, edge-tools, destructive chemicals, &c.; he has no natural covering, either for defence or for protection from the wea-

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ther ; and from his higher organization, injuries would be much more severe in their effects on him than on any of the lower animals ; he therefore requires some protection more than other creatures have, and this is given him in his possessing the sense of pain in a higher degree^b.

The human skin, although apparently a simple membrane, is in reality laminated, consisting of several subdivisions ; but as far as regards the subject in question, it may be considered as composed of two. The outer or scarf skin is a sort of horny substance, and insensible ; it is this portion of the skin which becomes thickened on the hands of labouring men, rendering them so hard ; but the inner or true skin is chiefly composed of minute blood-vessels and nerves, and is so highly sensitive, that the starting or skinking from any sudden injury is, as it were, instinctive, and independent of the mind. The body is thus enveloped in a membrane susceptible of the slightest injury, while the greater portion of the internal parts of the body, although the most important, being thus enveloped and guarded, are in a great degree insensible to pain.

The muscles of the body are almost insensible ; and it is known that the chief pain in most surgical operations, both human and veterinary, is in the first division of the skin. A gentleman, whose leg was amputated, and who I know underwent the operation with more than usual fortitude and nerve, informed me that he felt more pain from the cutting of the skin than from the division of all the muscles of the calf of the leg : and when we bear in mind the mass of the muscles to be divided in such an operation, compared with that of the

^b In using the term "sense of pain," I wish to be understood as speaking of a sense apart from that of touch or feeling : I know it is usual to class them as one and the same, but I believe there are grounds for considering them as separate and distinct senses. It is true that the principal organs of touch, i. e. the fingers and tongue, are highly susceptible of pain, but there are other parts of the body which are equally so, which have not the sense of touch. Any thing blown into the eye causes great pain, but I believe no one could distinguish the form of the offending object from the sense of feeling in that part. The stomach and bowels are also susceptible of pain, but not of touch. On these grounds I believe the sense of pain and the sense of touch may exist independently ; and that an animal may have the one sense without of necessity being possessed of the other. The remarks on *actiniæ*, page 29, bear on this subject.

skin, it is a subject for doubt whether any person could bear up against the intense pain of it, if the muscles were as susceptible of pain as the skin surrounding them. It is a popular opinion, that the pain in such operations is most severe in cutting the bone, and especially so from dividing the marrow; but both bone and marrow are alike insensible to pain, or nearly so.

The tendons are also insensible, and may be divided with little or no pain. But although the bones and tendons are so insensible, there is a high degree of sensibility about the joints: sprains or dislocations are exceedingly painful, and it is well they are so; a broken bone cannot be used, and the necessary rest must be afforded it; but a sprained joint may, and worse consequences follow, if the care necessary for the restoration of the injured part is not enforced by the pain of using it.

The exterior of the eye, or rather the inner side of the eyelid, is extremely sensitive, and the eyelid closes almost instinctively to prevent injury to that organ; but the back of the eye, being less exposed to danger, is almost insensible to pain; so also is the interior, as in cases where the eyeball has been pierced, the whole of its fluids have been discharged with little or no pain.

The sense of pain in the mouth guards the throat; in the stomach it affords a warning against improper food; and, in fact, every part of the body is susceptible of pain, wherever that sense is necessary to indicate disease or injury; but the heart, the brain, and the lungs, although the most vital organs, are protected from injury by the sensibility of the exterior parts of the body; a high sense of pain in them is unnecessary, and they are almost insensible to it.

The heart beats upwards of four thousand times in an hour; and if the pain from a diseased heart were very acute, it would indeed be sad for the sufferer; but the pain from a disease of that organ is seldom more than an uneasy sensation, and this more especially after violent exertion, being a check to unnecessary action, and so far useful. Sudden death often occurs from disease of the heart; not from the heart being suddenly diseased, but from the disease causing very little pain, and being therefore unknown.

The brain, although the source of sensation, is itself insen-

sible to pain ; in surgical operation portions of the brain have been removed without the patient exhibiting any sign of pain.

The lungs are highly susceptible of impurities in the air ; and thus we are guarded against the inhalation of injurious gases : their sensibility during inflammation indicates the danger and compels the necessary care ; but they are almost insensible to pain from mutilation or decay ; in such cases the sense would be useless, and an infliction. The lungs have been cut without causing pain, and during their decay in consumption the pain is very little.

It is not only the organs which differ in their susceptibility to pain, but a similar difference may be observed in the various parts of the exterior of the body. The thumb and fingers are very liable to injury, and those parts are highly susceptible, as in them a slight cut, or prick from a pin, will cause much pain ; whereas I have seen both men and boys *amuse themselves* by driving pins up to the head into the calf of their legs, and exhibiting no sign of pain from so doing. A high degree of sensibility in those muscles is unnecessary, as they are protected by their position ; but it is very different with the front of the legs, as the shins are very susceptible of pain, and one scrape of them against the edge of a bucket, will give a lesson for life on the importance of walking with the eyes open. It is not in cases of severe injury we find the greatest benefit from the sense of pain ; at such times pain may be useful in as far as it compels attention to the injured part ; but it is in our every day occupation that the sense is so necessary as a warning against injury. A few homely cases will best serve to illustrate the subject. The value of the sense of pain was forcibly brought to my mind a short time since. I had a plumber at work in a cellar lit only by the candle he was using ; in going to look on I struck my foot against something on the ground, and picking it up, I found it to be a piece of iron burning hot, and immediately dropped it. My fingers were burnt, and the pain was rather severe for a few days ; but if my hand had been devoid of the sense of pain, I should probably have held the iron till the muscles of the fingers had been destroyed, and thus have lost the use of them for life. I was once present when a young man sat down on some needlework, when he was sharply reminded of

his want of caution, and bounced from the chair with a spring which would have done credit to a clown in a pantomime : I have no doubt the pain he felt was acute for a short time ; but if the sense of pain had not intimated the hidden mischief, the needle might have penetrated to the joint, and caused lameness for life ; or it might have injured a nerve, and paralyzed the limb ; or, by piercing an artery, have caused a more serious injury.

Similar cases almost without end could be advanced if necessary ; but I think every one, on reflection, must see how much our well-being depends on this possession of the sense of pain : but for this sense, we should be in continual danger of burning or scalding the mouth or throat ; we might have lime blown into our eyes, and thus lose our sight, if not warned by the pain ; we should have no knowledge of our internal ailments, and therefore be unable to apply remedies, or avoid the causes producing them^c. In fact, there would be no end to our dangers, if not possessed of this useful monitor, which is a *guard against injury*, and a *check to excesses*. There may be pain and suffering, the use of which it may be difficult to see ; but I would rather attribute this to a want of knowledge, than believe that the rule which holds good in so many cases does not hold good in all.

It is not only with respect to man as an individual that the sense of pain is beneficial ; it is especially so also as regards his moral and social condition : but I am quite incompetent to do justice to this part of the subject, and therefore leave it for the reader to imagine, what would be the condition of society if there were no sense of pain to curb and restrain the excesses and passions of mankind.

The sense of pain is also of great importance as regards the distribution of mankind over the globe : most creatures are adapted for certain localities, and clothed by nature accordingly, (or are possessed of the means for rapid migration) ; but man has no such clothing ; and it is the sense of pain which enables him to adapt himself to any climate ; as it tells him when it is necessary to shelter himself from tropical heats, or protect himself from the cold of a frigid region. No instrument invented by man would suffice for the purpose ; the

^c See note B.

thermometer would be comparatively useless. How often we find the weather piercingly cold, with a temperature above freezing; and at other times, with several degrees of frost, the weather may not feel unpleasantly cold. It has been remarked by some polar voyagers, that at times, with the thermometer about zero, it has been so cold that the least exposure to the open atmosphere was dangerous: and at other times, with the thermometer 20 or 30 degrees lower, they could walk out with little or no inconvenience. As it is, frost-bites are not uncommon during winter in high latitudes; and how much oftener would this be the case with the inhabitants of such climates, if the painful sensations from cold did not compel the necessary attention to warmth at such seasons.

The painful sensation produced by extreme cold gives evidence of Divine mercy: if it compels man to take shelter, or to increased activity, so as to obtain the necessary degree of warmth, it is well; but if not, pain ceases when it becomes useless, and drowsiness, insensibility, and a painless death, are the natural consequences.

Many other points could be advanced on the benefit we derive from the sense of pain, but I believe quite enough has been given to shew that it is one of the most necessary and useful senses we possess; this seems so obvious to me, that I should not have dwelt so long on this part of the subject, but that I considered it necessary for the elucidation of the question as to the use and distribution of the sense of pain amongst the lower classes of animals^d.

With respect to the degree in which the lower animals are susceptible of pain, there are various opinions. One is, that as the general organization of mammalians is so similar to that of man, they must feel pain as acutely as ourselves; but that cold-blooded creatures, such as fishes, reptiles, insects, &c. may be less susceptible. Another opinion is, that the higher the organization of an animal, the higher is its sense of pain, and thus its susceptibility is in accordance with its higher or lower degree of organization.

These opinions, although in the main they may be correct, are far from giving a fair view of the question; they represent the sense of pain as a sort of penalty on organization,

^d See note C.

and a constant accompaniment of animal life. I hope to show cause for believing, that the sense of pain is given to animals, *let their degree of organization be what it may*—only as far as is necessary and useful to guard them from injury, or to compel them to the functions they have to perform; and that many of the lower animals do not possess the sense of pain, as to them it would not only be useless, but an infliction. In fine, my object is to show, that the distribution of the sense of pain, and the great law of nature, “Eat, and be eaten,” by which animals of one class live on those of another, are both conducive to the general well-being and happiness of all classes of the animal creation, and afford the strongest evidence of the mercy and benevolence of the Creator.

As the amount of pain of which the lower animals are susceptible is a question which does not admit of absolute proof, it is necessary to view the subject under various aspects to arrive at a fair and probable conclusion; and it may be well, in the first place, to consider the degree in which other senses, such as seeing, hearing, and smelling, are distributed throughout the animal creation.

It is not the highest organized beings that have the sense of sight in the highest degree; birds in general far surpass man in this respect; and this is necessary for them, as flying high in the air they have a more extensive field of view; many of them living on carrion have to distinguish their food at great distances: eagles, hawks, &c. depend on sight to catch their prey; and many of the smaller birds live on very minute and active insects. The capability of seeing to great distances is also necessary for birds in their migrations. But if man cannot see so far as eagles or hawks by day, he can see better than most of those birds by night, and thus has the sense of sight as is best suited to his wants.

As we descend in the scale of animated beings, we find a like adaptation of the sense of sight to the wants of all creatures. The mole has very small eyes, well suited to its subterranean habits; but the blind rat (*mus typhlus*) *has no eyes*; this animal is a mammalian, as large as the common mole, and therefore stands high in the scale of organized beings; yet as its habits are strictly subterranean, it requires no eyes, and has none, while thousands of creatures, of far inferior organi-

zation, have the sense of sight in great perfection; and flies, &c., after their last transformation, although their lives may not in general extend over more than a few hours, have eyes of most wonderful construction.

The above facts show that a higher or lower organization is no rule with regard to the distribution of the sense of sight, but that all classes of animals have it in as great a degree as is necessary for them; and it may be fairly advanced, as an *a priori* argument, that, as in the case of the blind rat, we see a sense withheld where useless, it may be presumed that the sense of pain would be withheld where unnecessary, and when no beneficial results could be derived from it.

The analogy between the sense of sight and the sense of pain holds good still further; for as we see in man that the sense of pain is given to those parts of the body where necessary, so also the organs of sight in all animals are placed in the positions best adapted for their well-being. Thus rabbits, hares, and herbaceous quadrupeds, liable to the attack of other creatures, have very prominent eyes placed on the side of the head, so as to enable them to see objects behind them as distinctly, or nearly so, as in front; but most beasts of prey have their eyes in front of the head, so as to enable them to follow their prey with greater certainty. Amongst birds also we find the like provision; eagles, hawks, &c. having their eyes in front, and birds liable to attack having them on the side of the head. The woodcock affords an apt illustration on the subject; it feeds in the dusk of morning and evening, inserting its long bill in the ground in search of worms, &c., depending chiefly on the sense of touch and smell for its food; when thus occupied it would be quite at the mercy of its enemies if its eyes were placed in front of its head, and near the bill; but they are placed near the back of the head, are very prominent, and thus afford the bird all the security the sense of sight can give.

It is difficult to ascertain in what degree any animal is possessed of the sense of hearing, but the position of the ears in various animals shows the like evidence of beneficent design. In the skull of the rabbit, hare, and such like quadrupeds, we find the auricular tube large, and directed upward and backward; so that when the animal is in its ordinary position, its

ears are inclined in the direction best adapted to prevent surprise, and when feeding, they are upright, so as to catch a sound from any direction. But in the polecat, weasel, and such animals as have to follow their prey through holes in the ground, the ears are directed toward the front; and in the owl, which depends in a great degree on the sense of hearing for its prey, the ears are directed downward and forward, so as to enable the bird in its flight to hear sound from below.

The sense of smell is in many respects analogous to the sense of pain; nature in both cases using offensive means to produce beneficent effects; pain as a protection to the body; offensive smells to compel cleanliness, or the avoidance of injurious gases, food, &c. Man is far from having the sense of smell in as high a degree as many of the lower animals, and it is well that it is so; an extremely acute sense of smell would be of but little use to him, and often an infliction; but it is necessary to the dog, and creatures who hunt by scent, and they have it in accordance with their wants. Many creatures, very low in the scale of the animal creation, have this sense in a very high degree. In "Insect Miscellanies^e," the writer says, "We once observed a pair of burying beetles (*necrophorus sepultor*, *De Jean*) in Copenhagen fields flying at the height of about twenty feet from the ground; when they suddenly descended, and crept under the body of a dead frog, hid amongst the grass, though this was so dried up with the extreme heat of the weather that we could perceive little or no smell, even when close to the place, and it was forenoon, when the sun was bright and powerful, a time when scents are much less diffusible than in the cool of a dewy evening. Few circumstances, we think, could more strikingly illustrate the acuteness of smell in these useful insects."

The common flesh-fly is attracted to dead animal matter long before any effluvia can arise from it sufficient to attract the attention of man. Some naturalists have expressed the opinion, that the senses of insects are not strictly analogous to our own, but I believe they have a similar sense of smell. I have seen, in the hot-house in the Botanical Garden, a flower of the *stapelia grandiflora* completely speckled with the eggs of the flesh-fly; this flower has the smell of putrid flesh,

^e Library of Entertaining Knowledge, published by C. Knight.

and it must have been the smell of the flower which had deceived the fly, and caused it to deposit its eggs on it. Prawns, shrimps, and such like creatures, being nature's scavengers in the sea as the flies are on land, have the sense of smell in a similar high degree.

These facts show that the sense of smell in animals, like the sense of sight, is not in accordance with their higher or lower organization, but is given to all creatures in the degree which is best adapted to their necessities, be their station in the scale of organized beings what it may; and affords some ground for assuming that the sense of pain is distributed in like manner.

It may be remarked, that smells which are disgusting and repulsive to some animals, may be attractive to other classes; the analogy still holds good, as very painful effects may be produced on some creatures by causes which seem to have little or no effect on those of another kind^f.

The situation of the organs of smell in animals is that which is most useful to them; and the habits of many creatures, which are generally attributed to instinct, may perhaps be the effects of smell. The mouth of a cow, when grazing, is preceded by her nose; and the general rejection of injurious plants is probably from some odour arising from them, which is unpleasant to the animal; for it is not only in the distribution of the sense of smell, and the position of the organs, that we find evidence of beneficent design, as it is equally shown by the odour bestowed on various kinds of matter. The offensive smell of coal-gas is extremely useful as a detective of its presence; but as this is an artificial production, it may not be fairly applicable to the question. I believe the degree in which the excrements of various animals is offensive will afford the best illustration. I shall make no apology for alluding to such a subject; and I think any objection to its consideration must be fastidious, as nothing created can be unworthy of the consideration of man, and it is in some of the meaner operations of nature we find the most striking evidence of a beneficent Providence.

It is a very general opinion, that the difference in the degree in which the excrements of various animals are offensive,

^f The badger and wasp, page 22; the earth-worm, &c., page 34.

is owing to the different sorts of food the animals live on ; and that the smell from the excrements of carnivorous animals is repulsive, but from those of herbivorous creatures it is not so, or in a less degree. According to this opinion, offensive effluvia are simply the result of the decomposition of certain substances ; but this gives a very poor and insufficient explanation, making the subject in question a mere matter of chance, and overlooking the evidence of merciful design which the case affords. I believe that nothing is offensive to smell except for some beneficent purpose ; and that the smell from the excrements of animals is more or less repulsive, according to their natural habits, to compel them to that degree of cleanliness which is necessary for their well-being. Rabbits in a state of nature burrow in the ground ; their excrements are offensive, and they go to some distance from their holes to void them ; their burrows are very free from dung, and when they have young, the nest and hole are particularly clean. Hares are similar to rabbits in habit, except that they do not burrow ; there is therefore less necessity for offensive smells to compel them to cleanliness, and they have but little or none. The dung of horses, cows, sheep, and the like, is not offensive, although they live, like the rabbit, on herbage ; with them no such compulsion to cleanliness is necessary, as in a state of nature they rove here and there, and their young can follow them as soon as born. The like remark may be made with respect to pigs ; they are not naturally offensive, but rendered so from being kept in a state quite contrary to their habits when wild ; the stinking condition of pigsties being caused by the unnatural accumulation of dung, and its consequent decomposition ; and stinking under such circumstances cannot be otherwise than beneficial, as compulsory to some degree of cleanliness. That animals of this class may be kept free from unpleasant smells, is shewn by the condition of those of the hog kind in the Regent's Park Zoological Gardens ; and, as a general rule, it will be found that the excrements are inoffensive, or nearly so, of those animals who have no fixed habitation, and whose young have the power of locomotion from their birth.

The fox, dog, cat, and such like creatures, whose nature it is to live in holes, and whose young are produced in a very

helpless condition, have excrements of a most offensive odour. It is true they are carnivorous, but so are eagles, hawks, *vultures*, and such birds, and their dung is not offensive to smell, or but very slightly so; and as they roost in trees, or fly here and there, any unpleasant smell from their excrements would only be offensive to other creatures, and of no benefit to themselves. As a proof of the inoffensive nature of the excrements of birds of this kind, I may state that a large sea-eagle was kept till lately in the Fellows' Garden at Worcester College, and although it was chained to nearly one spot for some years, it was but slightly offensive; whereas had a dog or cat been kept under like circumstances for so long a time, the stench would have been intolerable.

The difference in the degree of offensiveness of the excrements of the seal and otter, affords an apt illustration in support of my views. Both creatures live alike on fish, but they differ considerably in other respects; the otter frequenting some cave or hole, bringing forth its young in a blind and very helpless condition, and its excrements are highly offensive; but the seal merely frequents the seashore, and its young, when born, is able to go at once with its dam into the water, where they chiefly reside: there is therefore, in this case, no necessity for an offensive odour to compel cleanliness, and from all I can learn the excrement of the seal has none.

Much more might be advanced on this part of the subject, but I believe enough has been stated to shew, that offensive effluvia are not a mere matter of chance, but given only where necessary, and for beneficent purposes; and if, in matters like these, such as man would almost consider beneath his notice, we see the well-being of animals has been so fully provided for, it is fair to assume, that the like provision for their comfort and happiness has been made with respect to the sense of pain, and that this sense also is only given where necessary and useful.

The provision for the cleanliness of some animals when in a young and helpless condition is singular; and although a consideration of them may not be necessary with respect to the subject in question, a statement of a few of them may afford grounds for reflection.

It has been shewn, that the excrements of animals, which have the power of locomotion from their birth, are not offensive, and the same seems to be the case with respect to some others up to a certain stage; as with dogs, foxes, cats, and the like, the excrements are eaten by the mother, so long as the young are in a helpless state; but nothing would prevent their becoming offensive as soon as the animal has the power to run about. The dung of young birds, who can run as soon as hatched, is like that of the old ones; the young of birds, whose nests are suspended, have the instinct to discharge their excrements over the side of the nest, and this without reference to feeding, or any other time: this habit may be seen with rooks, the house-martin, &c., and in the latter case the young bird instinctively turns to the mouth of the nest for the purpose[§]; but where birds build in holes, the young one only mutes immediately after being fed, its dung being enveloped in a pellicle, similar to the white of an egg, by which the old bird takes it away: starlings may be seen doing so, dropping it after carrying it some fifty or eighty yards from the nest. The chimney-swallow and sand-martin may be seen to do the like.

The entrance to the nest of the kingfisher is said to be very filthy; this habit, so different from that of other birds, may be a provision for the protection of its young from the depredations of rats, &c., its nest being generally made in a hole in the bank of a river. But in this case the nest is clean, and the old birds, from their aquatic habits, would soon be free from any filth which may attach to them in going to or from it; and although the smell may be offensive to other creatures, it may not be so to them or their young.

The animal creation affords another proof that nature enforces beneficent effects by unpleasant means. The common bug is extremely offensive; yet if we think on the thousands of bedsteads which would never be taken down or cleaned but from the existence of bugs, and the heaps of rubbish which would accumulate in closets and elsewhere but from the dread of them—it seems probable that the fact that there are bugs,

§ This instinct is very curious, when we consider that the parent birds cling to the outside of the nest while feeding their young, whose heads must at such times be turned towards the mouth of it.

contributes more to the health of the inhabitants of large cities and crowded districts, than all the sanitary measures ever promoted by parliament.

Fleas are troublesome things, but when we see the exertions a dog will make to get at some parts of his body when teased by these creatures, and the thorough scratching and biting he gives himself in routing them out, it is obvious that fleas promote the cleanliness and consequently the health of the animal they live on; as it is a fact, that when a dog becomes too old or too fat and lazy to scratch himself, the middle of the back and parts most difficult to get at are the parts which first become offensive and diseased.

Lice are held in general disgust, but afford an interesting field for reflection. Mr. Denny, in his "*Monographia Anoplurorum Britannicæ, or Essay on the British Species of Parasitic Insects,*" gives the figures of upwards of 200 species; and from their variety in colour and form they would make a very interesting collection of pets for microscopic observation, if it were possible to keep them alive, and separate the idea of filthiness from the existence of lice.

Almost every species of bird and beast has its own peculiar parasite, and there can be no doubt that they are designed by nature for some useful purpose. Even to human beings they are useful. The dread of lice leads to personal cleanliness, and especially in this respect to the care of children; to those who are cleanly they are unnecessary, but to those of dirty habits they are a benefit. To put a strong case in point, let us consider the condition of a child—and unfortunately there are many in such a condition—whose parents are quite careless on such matters; its hair might not be rough and tangled only, but almost a hard mass from filth, were it not that these little stimulants compelled the child to scratch itself, and thus in some degree get rid of the dirt with which it may be coated. This is not an over-drawn case, and if we fill up the picture with that of a dog getting rid of its fleas, a bird preening its feathers, a horse scrubbing itself against a tree, or a whale at its toilet, scraping itself clean against the edge of a rock or iceberg; the whole tends to the same point, and shews that these parasites are not inflictions, but necessary and useful to the creatures they infest.

Many persons think that all animals have parasites of some sort or other, and the opinion has been humourously expressed, that

Great fleas have little fleas upon their backs to bite 'em,
And little fleas have lesser fleas, and so ad infinitum.

I believe there are no grounds for such an opinion, and that parasites (except in extreme cases) are only inflicted where necessary, and for the well-being of the animal creation.

Many animals are injurious to man ; this, in some cases, is probably owing to his having disturbed their natural distribution, by introducing animals foreign to the place: in such cases the natural habits and uses of such creatures cannot very well be known. The common rat was first observed in England about 100 years ago ; the cockroach (*Blatta Orientalis*) is, as its name implies, of foreign origin, and this may be the case with many other creatures, which are now looked upon as the natural productions of the country.

Some creatures may seem to be injurious from our looking on them only as regards ourselves, and not with respect to their uses in the general system of nature. The white ant, the woodworm, the teredo, clothes-moths, &c. are only injurious in carrying out the necessary law of nature, that all organic matter shall be destroyed and reduced to its original elements ; and the importance of this law is obvious, if we consider what must have been the consequence, if any animal or vegetable production had gone on increasing from the creation, and remained indestructible.

Wasps are generally condemned as useless and mischievous ; but during the late summer I had two wasps' nests in glass cases, in the Ashmolean Museum, which gave me a good opportunity for observing their habits ; and from the number of flies, caterpillars, &c. which they brought in for food, I am convinced that their office is important, if it is only to act as a check to a superabundance of such creatures, and thus assist in keeping the balance in the animal creation ; for, bearing in mind the various creatures which inhabit the earth, the destructive habits of some, and the enormous fecundity of others, it is difficult to conceive how the balance has been preserved, so that none preponderate in an overwhelming degree, and the various species continue to exist.

Leaving out of the question those extinct creatures, whose fossil remains shew that they belonged to a former system of creation, it is true we have proofs that some species of animals have ceased to exist since the creation of man; but there are grounds for assuming that their destruction has been owing to the agency of man rather than to natural causes. The dodo lived and flourished in the Isle of Mauritius, from the creation till about the year 1600, when the island was first resorted to by Europeans; the bird then soon became extinct, being destroyed either directly by man, or by his introducing animals which were foreign to the place. A like fate probably awaits the apteryx, as the introduction of dogs and pigs into New Zealand, where they have increased enormously, must soon lead to the annihilation of a bird which is unable to fly or swim, and has no adequate means of defence against its new and non-natural enemies. The great auk, at one time a British bird, has been driven farther and farther into the northern regions, as the shores of Europe have become more and more occupied by man, and is now nearly or quite extinct. The penguins will probably follow the same fate, as the islands of the Pacific Ocean and the southern hemisphere become more densely populated. Almost all the larger birds of prey have been destroyed or driven away, and many birds which once inhabited England in great numbers, are lost to us, or only known as strange visitors. The natural distribution of quadrupeds has in like manner been disturbed, as nearly all the larger species of mammalia which once inhabited Europe have (as civilization advanced) been destroyed, or forced to migrate to other districts.

The smaller quadrupeds and birds are held in check by man, but over the lesser animals he has comparatively but little influence, and amongst these the balance must be kept by the means nature has provided; yet even in this respect also the natural balance is often disturbed by the operations of man. Many kinds of birds, &c. are destroyed in great numbers, either wantonly or from an idea that they are mischievous; that they may be so at times is probable, but the mischief they do is in most cases more than counterbalanced, by the benefits they confer in destroying the smaller creatures, whose increase would otherwise be enormous. Instances

might be mentioned where, after some kinds of birds have been almost exterminated on account of their supposed mischievous habits, means have been resorted to for promoting their increase, to prevent fearful effects from the swarms of destructive insects, consequent on the destruction of their natural check—the birds. Rooks are often killed because they sometimes take a little corn, while their chief food consists of grubs, worms, &c.: they seldom eat corn except in dry or frosty seasons, when they are driven to it from necessity. The kestrel is destroyed as destructive of game, whereas its food consists chiefly of cockchafer and other coleopterous insects. The sparrow, with all its impudence and mischievousness, is extremely useful: on one occasion when ill, I for some hours watched a pair of sparrows who had young: I forget the particulars, but I was led to believe that, going on at the same rate, they could not have destroyed less than thirteen or fourteen hundred insects in the course of the day^h.

The common flesh-fly affords an apt illustration, both as regards the fecundity of the lower animals, and the importance of the check nature has provided against a superabundance of them. This insect, although generally considered a nuisance, is in fact one of nature's most useful scavengers, in clearing away dead animal matter, which would otherwise become injurious and offensive: their value must not be estimated from the annoyance they sometimes cause in the larder, but by their operations in the great field of nature. During the winter in the late war in the Crimea, there was a general expression of fear, that the dreadful mortality of men, horses, and cattle at Sebastopol, would be followed by a pestilence as the heat of the summer came on, and it was with surprise and thankfulness that the reports of improved health in the army were received; but in the letters in which the general health was spoken of with gratitude, there were often complaints of the great number of flies. These flies may have caused annoyance, but probably they were the principal agents in promoting the salubrity of the place; as flies could not have been produced unless there were some dead or decomposing matter, in the removal of which they had been instrumental.

Some eminent Naturalist has said, that two flies and their

^h See note D.

progeny would devour the carcase of a horse in less time than a lion could; and there can be no doubt of the correctness of the opinion. Such work is the duty nature has assigned for flies; and for this purpose it is necessary they should be produced rapidly and in great numbers. Reaumur has stated, that one fly will deposit twenty thousand eggs; these are hatched almost as soon as deposited, and the young maggots then set to work in earnest; as it has been ascertained that they will increase in weight 200 times in 24 hours; in eight or nine days they become full-grown maggots, and then, after lying in the pupa state for another eight or nine days, they come forth perfect flies; ready, if necessary, to produce their legions of maggots to forward the great work of purification: but as from the enormous number of flies produced they would soon become an evil, a necessary check is given to their increase. During the time they are in the maggot state, and performing the useful part nature has assigned to them, they are very little disturbed, and I know of no animal which naturally hunts for or preys on them when in a dead carcass; but as soon as they change to the perfect fly, they are the natural prey of a vast variety of animals, such as birds, bats, frogs, &c. The balance is thus restored, and the flies become in their destruction a source of sustenance and enjoyment to other animated beings.

The necessity for this destruction is obvious, if we consider what would be the consequences if flies could go on increasing even for a few months without a check. From sixteen to twenty days are sufficient for the development of the perfect fly from the egg; a month therefore is full time enough for a generation of flies, and it has been ascertained by Reaumur, (as stated above,) that a single fly will deposit 20,000 eggs; if these produce one half females, there would be in the first generation 10,000 flies, each capable of producing another 20,000, so that in less than six months from the deposit of eggs by a single fly, the sixth generation (without calculating those previous to it) would amount to 2,000,000,000,000,000,000,000 flies.

It is scarcely possible for the mind to form a fair estimate of such vast numbers, from a mere statement in figures; it may be some assistance to know, that calculating each fly

as half an inch long, a quarter of an inch wide, and the same in depth, that is, thirty-two flies to the cubic inch, there would be enough to cover all England and Wales, (which contain nearly forty millions of acres,) to the depth of upwards of three thousand eight hundred miles, or the whole world, both land and sea, to the depth of about one mile and a quarter.

Many other creatures are probably as prolific as the common flesh-fly; every ditch or pond affords an example, and the more it is filled with decomposing matter, the more stinking and filthy it may be, the greater is the number of its inhabitants assisting in its purification; these, when their work is done, are destroyed by other creatures, and so the balance is restored. Animalcula from the Thames water are often shewn in microscopic exhibitions, causing alarm and disgust amongst the audience; far better would it be, if they were shewn as examples of the wisdom and mercy of the Creator; as but for such creatures, during hot and dry seasons, the rivers, from the decomposition of animal and vegetable matter, would become stinking and pestilential.

If we look to the sea, we find similar examples of the abundance of animal life and vast fecundity; its shores swarm with living creatures, most of them doing the work of scavengers, in devouring the various substances thrown by the waves upon the beach. Were it not for the abundance of these creatures, the sea-shores must be avoided as offensive and a source of disease, rather than resorted to as healthful and pleasant. Amongst these scavengers of nature, shrimps, prawns, lobsters, and the like, are striking examples, both with regard to their activity and usefulness in the offices nature has assigned them, and also the extreme rapidity and numbers in which they are produced; but still, although they they abound in myriads, they are kept within proper limits by the voracity of other creatures. The codfish is another example of extreme fecundity; according to Leeuwenhök, the roe of one fish will contain eight or nine millions of eggs, and yet out of the myriads produced from these eggs, not more than about two fishes, on an average, can arrive at the same maturity as the parent fish; the remainder being destroyed at different stages of their growth, thus becoming food for other animals.

When we reflect on the enormous and constant destruction of life amongst the lower classes of animals, and in fact throughout the whole animal creation; it is difficult to reconcile such a system with the proofs we have around us of the mercy and beneficence of the Creator, if we believe that these creatures feel pain in that destruction. Take the case of the flesh-fly; we may see the necessity for their being produced in great numbers, and we must see the necessity for their being destroyed; but can there be any necessity for their feeling pain in their destruction? Pain would not assist them to discover and escape from their enemies; it could produce no moral effect with them as on man; they are created to be destroyed by a violent death, and pain to them would be an infliction. It may be difficult to conceive animal life to exist without the sense of pain, but surely no one can doubt the power of the Creator to render it so, especially when we bear in mind, that some of the most vital parts of our own bodies are almost or quite insensible to pain. It may be said, that all animals must have the sense of pain; but I doubt whether it can be proved. I might assert, that as vegetables have life, they must have the sense of pain, and who can prove that they have not?

Some years ago I observed a rather extraordinary illustration of the law of nature, "Eat and be eaten." I kept in a glass globe (a miniature aquarium) a variety of the smaller aquatic animals, such as the larvæ of dragon-flies, &c., and one day introduced amongst them a few of the common newts and water-beetles, one of which was the *dyticus marginalis*. The dragon-flies had been living on the animalcula, &c.; the newts attacked and devoured the dragon-flies; the next morning I found one of the newts lying at the bottom of the vessel half eaten, and while looking on, saw the *dyticus* attack another newt. Not wishing to have them all destroyed, I took the *dyticus* out of the water, and put it in the sunshine; when after a few minutes it flew away, and had not gone more than thirty or forty yards, when a sparrow flew after and caught it. This case presents a miniature picture of the whole system of nature, and one which it would be fearful to contemplate, if all animals feel pain in their destruction.

With respect to the different degrees in which various classes of animals are susceptible of pain ; I have met with many cases in which the effects of injuries to various animals seem to support the views I advance, (these were mostly given in my former paper ;) but before I state them, it will be well to consider what signs may be depended on as proofs of animals feeling pain. Convulsions are taken by many as indications of pain : this I believe is an error : convulsions only occur when sensibility has ceased, and the will has lost all control over muscular action. If an animal is killed by the dislocation of the neck, convulsions follow immediately ; but if it be wounded so as to cause death, no convulsions are caused by the pain, or occur till the animal becomes insensible : convulsions therefore are indicative of the cessation of pain rather than otherwise. The cry of animals cannot be depended on as a proof of pain ; pigs make a strange outcry if taken up ever so carefully ; and hares utter loud cries if caught in a net, which can give no bodily pain. It is also necessary to make allowance for the struggles when under restraint, which are natural to all wild animals.

Analogy affords no certain indications on the subject, as that which will cause severe pain to some animals may have little or no effect on others. Most animals are painfully affected by the sting of a wasp or bee ; but these insects are swallowed alive by frogs and toads as ordinary food ; and badgers seem to delight in wasps and bees, digging their nests out of the ground, and devouring both them and their larvæ. Some assign a degree of sensibility to animals in accordance with their nervous development ; but I believe the strictest anatomical research, alone, would not have led to a knowledge of the fact that badgers are so insensible to the sting of wasps, while mankind, horses, dogs, &c. are so painfully affected by them.

I believe the only means of forming an opinion as to how far animals are susceptible of pain, is by observing the effects injuries may have on their health, and the degree in which it interferes with their usual habits and appetites.

I will now state a few cases, to shew that injuries, apparently the most dreadful, have but little effect on many of the brute creation.

The first case which forcibly took my attention was that of a horse, feeding by the side of the road between St. Clement's and Headington Hill, having its leg broken by a coach-wheel passing over it just above the fetlock joint; the poor beast shewed evident signs of pain at the moment, the bone being dreadfully crushed, and protruding in parts through the skin. A number of persons collected around, but no one liked to despatch it, and on their standing aside, so that it might get out of the way of things passing, the moment the horse got to the side of the road it begun grazing; shewing no other sign of pain than holding up the injured leg.

Another case is that of a post-horse, which was going along the road between Botley and Eynsham; when it came down with such violence that the skin and sinews of both the fore fetlock joints were so cut, that on its getting up again the bones came through the skin, and the two feet turned up at the back of the legs, the horse walking upon the ends of the leg bones. The man who was with it would not consent to its being killed, till he had informed his master (who, I believe, was Mr. Masters, of Staple Hall Inn, Witney): the horse was therefore put into a field by the road side, and was found the next morning, quietly feeding about the field with the feet and skin forced some distance up the leg bones; and where it had been walking about, the holes made in the ground by the leg bones were three or four inches deep.

A similar accident once happened to a coach-horse, the property of the late Mr. Costar, of Oxford: it was found, when the coach stopped to change horses, to have dislocated the fetlock joints, and from the worn appearance of the ends of the leg bones, must have run a considerable distance along the road in that state.

I do not lay much stress on this case, as it is not very surprising that a spirited horse in harness with others, should continue running under such circumstances; but, in the former case, there was nothing to excite the horse but its hunger; and if the pain had been equal to what such a dreadful injury would seem to indicate, it would probably, if in ever such a famished state, have gone upon its knees to feed, rather than upon the injured parts.

In giving these cases, I do not wish to be understood as arguing that horses are insensible to pain: their starting from the prick of a spur, or the bite of an insect, is a proof that they have the sense of pain in a high degree; and the fact that a horse is lamed by an injury to its leg or foot, is not only a proof that they have the sense of pain, but also that it is useful in compelling the necessary rest to the injured part. My object in giving these cases is to shew, that as the sense of pain is not so necessary to horses as to man, they have it in the less degree. These remarks apply more or less to many of the following cases also.

It is curious to observe the apparent indifference with which some animals will devour parts of their own bodies. I once kept tame dormice, and, in shutting the cage-door, accidentally caught the tail of one of them, when it squeaked out, and left the skin of about two-thirds of its tail sticking to the door. Whether the cry was caused by pain or fear, I cannot decide: but it went about the cage for a few minutes apparently rather uneasy, it then took hold of its tail with its paws and eat all the injured part, and then seemed as well as ever.

Rats will often eat their tails when in confinement, if kept short of food; and the habit of eating their own tails is not uncommon amongst the monkey tribe. I knew a person who used to dip the end of his monkey's tail in tobacco water to keep it from being eaten, and some of the monkeys in the London Zoological Garden may at times be seen enjoying themselves in this way. But from whatever cause this propensity may arise, I believe it is never indulged in by the monkeys with prehensile tails; their tails seem to be too useful to be so wantonly disposed of, and I have no doubt are therefore possessed of a much greater share of the sense of pain.

A few years since, the Quarterly Review, in a notice of the late Dr. Buckland's Work on the bones found in the cave at Kirkdale, stated that an old hyena, kept in the Jardin des Plantes at Paris, had its leg broken, when one night it bit off the leg at the broken part, and eat it.

Pigs make a sad outcry when being killed, but I believe it is caused by fear, and the uncomfortable way in which they

are held, rather than by pain. I once saw a large pig which had been stuck, get away from the men who were holding it, and there was not the least cry after it had got out of their hands, although it was bleeding to death: when smaller pigs are killed by sticking them, and then letting them run about till they drop, there is no cry after they are let go; and if stuck skilfully, without taking hold of them, there is no more noise than a mere grunt or squeak, about the same as there would be if the pig had a slight blow with the end of a stick; and I have no doubt that a pig may feel more pain from a heavy blow, than from being killed in the usual manner. When it is considered that the nose of a pig is so very useful to the animal from its habit of routing in the earth, and may therefore be very sensitive, it does seem probable that the opinion is correct, that a pig feels more pain from having a ring put through its nose than in being killed.

In the next class of animals to which I shall allude, that is, rabbits and hares, I will endeavour to shew that the use of the sense of pain is, in a great degree, or almost completely, superseded by other senses, and that their sense of pain is very trifling, compared to that of most other quadrupeds. There can be little doubt that, although so very prolific, very few rabbits or hares in a wild state die of old age, as they are the food of a large class of beasts of prey. Foxes, wild-cats, martins, pole-cats, stoats, and weasels, could not exist without them; they are their natural prey; against the least of which the rabbit or hare has no means of defence when once caught; therefore, the sense of pain would be of no use to them, either to warn them from danger or to cause them to exert themselves to escape. But a slight examination of the form of both rabbits and hares will shew that they have other means of defence: their eyes are not placed in the front of the head as in beasts of prey, but on the side of the head, very prominent, so that they are enabled to see, before, behind, and all around them; their ears also can be turned this way or that way to catch the slightest sound, added to which they have a degree of timidity which keeps them always on the alert.

With regard to their sense of pain, it is well known that a hare never, or very seldom, cries out when shot, even if she

receives her death-wound, if she can run a few yards and hide herself; but if her legs are broken, or she is in any way stopped from running, even if (as before stated) caught in a net, which can give her no real pain, she utters most piteous screams; when followed by dogs, her screams always begin before they have actually caught her, and it is worthy of notice that she is much more readily despatched than perhaps any other animal of her size.

Rabbits resemble hares in this respect, as they utter no cry when wounded, but will do so from fear: if run down by a stoat or weasel, they always cry out when the enemy gets within two or three yards of them, and are generally so terrified that they lie down and are caught: therefore the cry in this case is evidently from a natural instinct, which induces them to avoid their enemies, and cannot arise from any previous experience of the sense of pain.

I one day disturbed a rabbit which ran away in so singular a manner that I followed it, and saw that the flesh had been eaten away from the back of the head to the top of the shoulders; the sight was so sickening, that I turned away, thinking the poor creature could not live many minutes. About two hours afterwards I went with a view to pick up and examine the rabbit, and when I came to the spot, was surprised to see it jump up and run away as before; the person who was with me ran after it; the rabbit ran into a bush, and he caught it. Now, although the poor thing was so injured, there was no cry when I first disturbed and ran after it, or when it was disturbed and followed the second time, but the moment it was caught it began to cry out, shewing that fear could excite a cry which all its sufferings could not.

Many experiments have been made to test the sense of pain in animals; some of them, such as any person with a fair share of humanity would shrink from trying; but there is one which I believe no one need hesitate to make on the rabbit. Perhaps the best way will be for the experimenter, in the first place, to test the sense of pain in himself by pinching the skin in various parts of his body: a few trials will be enough to prove the sensibility of that membrane: let him then try the like process on a dog or cat, and he will find them highly in-

dignant at such a liberty, and they may retaliate with a bite or scratch: but if the skin of a rabbit be pinched very hard between the finger and thumb, the rabbit will scarcely wince; that is, if he be one sufficiently tame to be handled.

When rabbits are caught in traps, if not taken out in a short time, they are almost sure to escape, either by breaking away by force from the trap, and tearing off the leg, or by biting the leg off. These traps are made to clasp very strongly; but to prevent escape as far as possible, they are made purposely not to close nearer than about the eighth of an inch, and the teeth are rounded so as not to cut; but rabbits are so indifferent to pain, that I have seen their legs left in traps with the sinews attached to them, just as the sinews are drawn from a fowl's leg previous to cooking; and yet although the bone is so broken, and the muscles and sinews torn apart in this manner, it seems to have little or no effect on the health of the animal.

I have seen them caught after having recently lost a leg, and to all appearance in as good health, and as fat as if nothing had happened to them. A short time since, I saw a rabbit caught which had but one leg, having lost one hind-leg apparently some time, and the two fore-legs very recently, but although the poor animal had been obliged to go along as it could with its one leg and the bare stumps of the others, it was in good condition and healthy.

In the notice of my former paper in Chambers' Edinburgh Journal, the writer, in allusion to the above cases, observes, that a jolly sailor sometimes gets fatter than ever after losing a leg, or even two. It may be so, but he must indeed be a jolly sailor who, if caught as described above, could pull away from the trap, leaving his foot in it with the sinews attached, and then walk about on the broken stump, and keep in good condition. He would beat the celebrated hero of Chevy Chase,

" Who, though in doleful dumps,
When both his legs were smitten off,
Still fought upon his stumps."

Rats will bite off their legs in a similar way, and escape; but I do not know of any animal which is strictly a beast of prey, or rather a hunting animal, that will do so. I have

never known a cat, polecat, or such animals do it, although they may sometimes lose a leg in a common trap which shuts close and is apt to cut ; and I have lately known a fox found in a wood in a dying state, from starvation, with a trap on its leg, an incumbrance that a rabbit would have been free from in a very short time.

These facts will, I believe, bear me out on the point, that the sense of pain is for the preservation of animals, by compelling them to take due care of themselves, and that no animal has a greater share of the sense of pain than is necessary for the preservation of the race to which it belongs. The loss of a leg must be a great inconvenience to any quadruped, but rabbits or rats may still procure food without it ; even the case before alluded to of the hyena does not tell against it, as the hyena does not get its food by swiftness of foot alone, nor is its foot the weapon of attack, as with the cat tribe ; but if a fox, cat, polecat, or any animal of that description, loses its leg, it is a great chance if it does not die of starvation, unless its prey be very plentiful ; therefore, as the legs are of so much importance to these animals, they seem to be endowed with a sense of pain in proportion to their usefulness, as a guard for their preservation.

Lobsters and crabs will throw off their legs and claws when under the influence of fear. This is not a mere occasional occurrence, but will often take place from very slight causes ; a clap of thunder, the firing of a gun, or a bump against the shore or another vessel, will often cause the whole, or nearly so, of the freight of a lobster-vessel to throw off their claws. If those parts are injured, they are thrown off, and in time a new claw or leg is formed : and in the case of a hairy porcelain crab (*porcellana platychelas*), “ this is not only done on the infliction of violence, but as if to occupy the attention of some dreaded object, while the timid creature escapes to a place of safety. The general method of defence is to seize the object with the pincers, and while these are left attached, inflicting by their spasmodic twitchings all the pain they are able to give, the crab, lightened of so great an incumbrance, has sought shelter in its hiding-place ⁱ.” These

ⁱ Bell's British Stalk-eyed Crustacea, p. 247.

facts shew, that in these creatures the sense of pain from mutilation must be very little ; and, according to the argument I have advanced, it may be asked, of what use can the sense of pain be to any of the crustaceous tribes? They are coated in armour sufficient to protect them from all minor enemies, and if they get into the power of an enemy strong enough to crush their shells, of what use can the sense of pain be to them then? But they shew signs of great pain when thrown into boiling water, and I see no reason why they may not be insensible to pain from mutilations, and yet be sensible, in a high degree, to pain from extreme changes of temperature ; for, as there are no bounds to prevent their ranging over all parts of the sea, it is probable that a sense of temperature is necessary to them, and many other animals also, to keep them to those parts of the world which they are formed to inhabit. It may also be useful to keep them to those parts and depths of the sea that are necessary for their young to arrive at maturity.

Actiniæ, or sea-anemones, (now so often an ornament of the aquarium,) inhabit the sea-shore, some species being commonly found between high and low tide mark. They are therefore exposed to extreme changes of temperature ; sometimes submerged in the sea ; at others exposed for hours on the rocks or in shallow pools to the direct rays of a summer's sun ; and often to severe frosts during winter. Under these circumstances any great amount of sensibility to temperature would be an evil, and the following extract will shew that in this respect no unnecessary susceptibility is inflicted on them. *That they have the sense of touch in a high degree* may be seen by the readiness with which any article of food is seized by its tentacula and conveyed to the mouth ; but from their exposed situation, and the softness of their bodies, they must at times be exposed to severe mutilations from animals of prey, and also from the dashing of the waves ; a sensibility to pain from mutilations would therefore be an infliction, and in this respect also they seem to have a merciful dispensation from unnecessary suffering. From their natural habit of attaching themselves to the rocks, they have no means of obtaining food except such as chance may bring within their reach ; it is therefore necessary that they should be able to fast for

a long time : and they can do without food for an almost incredibly long period.

“ The actiniæ are very patient of injuries ; and rival the hydræ in their reproductive powers. They may be kept without food for upwards of a year ; they may be immersed in water hot enough to blister their skins, or frozen in a mass of ice, and again thawed ; and they may be placed within the exhausted receiver of the air-pump, without being deprived of life, or disabled from resuming their usual functions when placed in a favourable situation. If the tentacula are clipped, they soon begin to bud anew, and if cut away, they grow again ; so that ‘ it seems these reproductions might extend as far, or be as often repeated, as patience or curiosity would admit.’ If cut transversely through the middle, the lower portion of the body will after a time produce new tentacula ‘ pretty near as they were before the operation ;’ while the upper portion swallows food as if nothing had happened, permitting it indeed at first to come out at the opposite end, ‘ just as a man’s head, being cut off, would let out at the neck the bit taken in at the mouth,’ but which it soon learns to retain and digest in a proper manner. In an experiment of this kind, the upper half, instead of healing up into a new basis, actually produced another mouth and tentacula ; so that an animal was formed which caught its prey, and fed at both ends at the same time ! If again the section of the body is made in a perpendicular direction so as almost to divide it into two halves, the halves unite again in a few days. If the section is complete, two perfect individuals is the result ; and to complete the wonder, if the body be torn away, and only a portion of the base remain, from this fragment a new offspring will sometimes rise up to occupy the place of its parent ! Yet these creatures, almost indestructible from mutilation or injury, may be killed in a few short minutes by immersion in fresh water.” Johnson’s *British Zoophytes*, vol. i. page 239.

The above statement of facts shews that these creatures have but little or no sense of pain, and to an animal so exposed to injuries, and incapable of moving to escape from its enemies, such a sense would not only be useless, but an infliction.

From the observations of Sir Humphry Davy, and others well acquainted with the habits of fish, it seems probable that the sense of pain in these creatures is very trifling; many cases might be advanced in support of this opinion, and when we consider the fecundity and consequent destruction of some kinds of fish, it is in accordance with the evidence of merciful design already advanced, that their susceptibility of pain should only be proportionate to their necessities for it.

In reptiles the sense of pain is generally believed to be very low, while their tenacity of life is almost incredible. "They seem, for the most part, to vegetate rather than live, to be insensible of a wound, and even scarcely to discover any considerable degree of anguish when cut to pieces^k." Experiments which have been made on the subject can hardly be recited without horror, as they must have caused misery, if not absolute pain; and examples enough may be given to shew the insensibility of such creatures, without wilfully injuring or mutilating any of them.

The slow-worm (or blind-worm) has the power of dismembering itself, and takes its name (*anguis fragilis*, Linn.) from that peculiarity. This reptile is almost defenceless, as it is not venomous like the viper, is much slower than the snake, and its jaws are so feeble that its bite seldom draws blood from the hand; it is to the process of dismemberment it resorts for security, doing as the beavers of old were said to do, that is, give up a part of the body to save the remainder alive. When caught hold of, or even if much alarmed, it will with a sudden jerk throw off the whole or part of its tail, which starts and jumps about, as much as to say, "Stay and eat me," while its lawful owner glides away into security. This tail is not a mere trifling, nerveless appendage, but is nearly as long, and contains as many vertebræ as the whole body, and is so nervously excitable as to continue in motion a long time after being thus voluntarily thrown off. A friend informed me, that one day his attention was attracted by the rustling of some leaves, which he found to proceed from the starting and wriggling of a newly discarded tail of a slow-worm, its owner having disappeared in the shades below;

^k Cuvier's Animal Kingdom.

from the singularity of the circumstance, he was induced to pay some attention to it, and found that muscular action had not entirely ceased in the tail till after about five hours.

These facts tend to shew the absence of the sense of pain in such creatures, and also, that mere muscular action is not always indicative of feeling, as it cannot be possible that any pain could be felt by the tail after being thus severed from the body. A knowledge of these facts may also be a source of gratification to the lovers of fried eels, as explanatory of a phenomenon sometimes exhibited during that kind of cookery.

Newts seem to be very insensible to pain, and will sustain life under severe injuries; the loss of the tail or legs appears to interfere but little or nothing with their usual appetites, and the reproduction of these organs seems like an approach to vegetable growth.

Frogs also appear to have but little sense of pain, and it is in accordance with the merciful designs of Providence that this should be the case; for of all deaths, that of the frog, when swallowed by a snake, seems the most horrible, if these creatures are susceptible of pain. The frog is the natural prey of snakes, and when followed by one will utter loud screams: this can only arise from an instinctive knowledge of its natural enemy, and not from any previous experience of pain; if caught, the snake generally seizes it by one of the hind legs, and begins at once to swallow it; this is a work of some time, the frog being drawn into the mouth by a peculiar motion of the jaws of the snake, and then passed slowly into its stomach. All this while the frog is alive¹; but during the time this apparently dreadful process is going on there is no cry; for as soon as the frog is seized by the snake its screams cease, and it seems to submit to its fate without a struggle. It is difficult to assign any certain cause for this apparent apathy; we know how readily the sense of pain is suspended in ourselves by the use of chloroform, or by excitement, and it may be that the breath of the snake has some peculiar effect on the frog, so as to suspend the sense of pain, or it may be suspended from the effect of fear; but however, it is quite opposed to all evidence of the mercy of God, to

¹ I have seen a snake killed directly after it had swallowed a frog, which was found alive in the stomach, and managed to crawl or hop slowly away.

suppose that these creatures should be created to undergo such a dreadful and lingering death, and be subject during the time to a feeling of pain. I believe frogs have the sense of pain in a very slight degree from mutilation; they seldom cry out except followed by a snake, or something which they take for one. I have seen a duck try for some minutes to swallow a large frog, without any cry being uttered by the frog, although still alive, and it is seldom that a frog does cry out under such circumstances; but I have known one to scream loudly from a long stick being pushed towards it when in high grass, and which I have no doubt was taken for a snake.

I once was witness to a curious (and to me painful) circumstance bearing on the subject. I was in a field, between the Oxford Canal and Port Meadow, where a man was mowing grass; the fields about this part are surrounded by ditches, in which frogs breed in great numbers, and they were very numerous in the grass. My attention was drawn to them by the mower, who said he was sick of his work, as the frogs were screaming out at every stroke he took with the scythe; but what seemed to puzzle him was, that the frogs which were uninjured screamed, while those which were cut so that they could not get away, made no noise, even if maimed ever so badly. However, such was the case, and I could only account for it by supposing the scythe in passing through the grass was taken by the frogs for a snake, as the frogs hopped away screaming when the scythe came towards them, while those that were cut in two, or lost their legs, made no noise whatever.

The foregoing cases—and many other such might have been given—shew the general insensibility to pain in these reptiles: this insensibility I by no means attribute to their merely being cold-blooded, but to the merciful designs of Providence; for as these creatures are very prolific, have but little or no means of defence, and are generally too slow to escape their enemies, a violent death is to most of them unavoidable, and consequently a sense of pain from mutilation would be an infliction.

Some creatures, much lower in the system of organized beings, and also cold-blooded, are far more susceptible of pain than reptiles; the common earth-worm may be taken as an

illustration. It is impossible for man to know the designs of Providence, or the purposes for which any animal has been created; but one great object in nature seems to be, that living beings shall abound upon the earth: all things tend to this great end, and nothing is wasted; the death of one creature provides food and enjoyment for others; even the excrement of some animals is the food of others, provided with tastes and appetites for such kind of sustenance; and the dead leaves and parts of plants become the food of worms, &c., who thus reduce them to the condition necessary to promote new vegetation. The worms in their turn become the food of other creatures, and consequently are subject to mutilations which they cannot avoid: how far they may be susceptible to pain in their destruction I cannot pretend to say, but they may not have the sense of pain from mutilation, as it is certain that the mere division of a worm does not destroy it, but, as in the case of the actiniæ, may be productive of two or three separate beings; be this as it may, it is well to give them the benefit of the doubt on the subject, and mutilation *must* cause misery and inconvenience, if not real pain^m. Another function of the worm seems to be that of keeping the earth in a condition for the percolation of water, and in dry seasons worms will penetrate to great depths in the earth, sinking lower and lower as the drought increases; they thus perform a necessary and, in some soils, a most important office in the economy of nature, to which they seem impelled by an intolerance and high degree of susceptibility of drought. Worms seem but little affected by temperature, as they will work up and lie out of their holes in very cold weather, short of absolute frost, or in very warm seasons, if moist; but the least exposure to dry air will evidently cause them uneasiness, and if they are placed in the rays of the sun, if even but mode-

^m "A leech, whose anatomy is of the same class as that of the worm, may be divided in the middle while it is sucking blood, and be so little disturbed by the operation that it will continue feeding for several minutes. Nay, there is a vulgar, though, we believe, an unfounded notion, that half a leech is better than a whole one. The blood which goes in at one end finding an outlet at the other, the animal is not gorged, and the common people fancy that a divided leech will in consequence do the duty of a dozen." *Quarterly Review*. This opinion I know is still held by many, and often acted upon.

rately warm, (and such as would be pleasing to most other creatures,) they seem in misery. That worms are so highly sensitive may be seen in other ways; the most minute portion of salt (which is so grateful to the human taste) will produce apparently intolerable pain if dropped on a worm, and a like effect will follow from the application of a mere particle of quick lime. It may appear inconsistent to attribute so high a degree of sensibility to worms from these causes, and doubt their susceptibility of pain from mutilation; but such I believe is the case, and that this also is evidence of merciful design: worms are naturally liable to mutilation from the animals that prey on them, and the division of a worm does not destroy its life; but exposure to dry air, or the sun, or the effect of salt or lime, they are only liable to from the agency of man; and by any of these means the worm may be destroyed.

With respect to the absence of the sense of pain in insects, I have seen a wasp eat a fly almost immediately after a portion of its abdomen had been cut off; I have also seen a cockchafer crawling and eating on a hedge, after its abdomen had been emptied of its viscera, probably by some bird; and a stag-beetle (*Lucanus cervus*) has been caught while flying in the like condition. It is well known that the dragon-fly (*Libellula varia*) will eat freely while confined by a pin through its body; and every one who has collected entomological specimens, must know the difficulty there is in killing some of the larger moths, as the tenacity of life in these creatures is truly surprisingⁿ. I will give one case illustrative of the tenacity of life in beetles, as it is singular, although not exactly bearing on the subject in question. A dead toad was taken to be stuffed by the person who preserves the animals for the Museum; this was on the Wednesday morning; the toad was not skinned till the Friday evening, when, as toads swallow their prey whole, the contents of the stomach were turned into a basin of water, and remained

ⁿ Not long since I saw in a shop-window one of the (commonly called) Daddy long-leg flies (*Tipula rivosa*) trying to get to the gaslight through one of the spaces at the bottom of the glass. Its long legs soon reached the flame, and were burnt, but still it pressed onward till its head came in contact with it also, and the fly fell dead.

there till the Saturday evening ; several small beetles were then taken from it, and pinned down as specimens for a cabinet, and on the Monday morning some of them were found to have revived, and were moving their legs about. I mentioned this case to the Rev. F. W. Hope, the munificent donor of the Entomological Collection in Oxford, who stated, that he had known of similar cases of revival ; and also informed me that he once had a case of foreign insects destroyed by one of the carnivorous beetles, which got loose, and, although with the pin through its body, walked about and devoured all the other specimens. Many other cases might be brought forward to shew the absence of the sense of pain in insects ; but it is unnecessary, as the subject, as far as regards insects, may be referred to in many entomological works ; and I shall again have to allude to them on another part of the question. I could state many cases to shew that the sexual habits of animals (even those of the larger domestic kinds) are but little affected by injuries or operations of (apparently) a most painful character ; but I suppose enough has been advanced to shew, that there are fair grounds *for believing*, that the sense of pain is given to animals, let their degree of organization be what it may, only as far as is necessary and useful to guard them from injury, or to compel them to the functions they have to perform ; and that many of the lower animals do not possess the sense of pain.

I have not alluded to the diseases of domestic animals, as they require a separate consideration. Sheep are liable to many diseases, but these may be owing to the artificial system under which they are bred and kept : in fact, the sheep, in its present condition, may be said to be an artificial animal, as no creatures, so deficient in means of defence, so inactive and incapable of long exertion, and so wrapped up in wool, could long exist where there were large carnivorous animals, except under the protection of man. It is evident that an animal so thickly clothed by nature was not created to inhabit low damp meadows, or to be exposed (panting for breath) to the direct rays of the sun in open fields during the hot summer months ; and therefore their being liable to the attack of flies, the foot-rot, &c., may not be the work of

nature, but of man. How far sheep are susceptible of pain from mutilation it is impossible to determine ; but the fact that they submit so quietly to the attack of dogs, seems to shew that their sense of pain in such cases is not great. In one respect sheep are treated with great cruelty, that is, in shearing them at inclement seasons, or without consideration as to the state of the weather at the time they are stripped of their warm clothing. Many times, when early in spring I have seen sheep shivering from cold ; I have wished that their owner could be obliged to undergo a like process, by being exposed to the weather in nothing but his shirt : yet such doings may not arise from an unfeeling disposition, but from a want of thought ; as, generally, the infliction of an injury producing blood is considered cruelty ; but without such outward signs of injury, much suffering may be inflicted and excite no notice. Nature did not clothe sheep with wool for the benefit of man alone, but also for the comfort and well-being of the animal itself ; and it is possible that much more pain and misery may be caused to sheep by shearing them at improper seasons, than by very severe mutilations. As it is, the laws of the country take no notice of the subject ; but Nature sometimes imposes a fine, as some three years since, a farmer, not many miles from Oxford, had about thirty sheep die in one night from exposure to cold after being sheared.

There can be no doubt that many diseases of domestic animals, such as the colic in horses, &c., occasion much pain : how far these diseases may be attributable to domestic habits, or arise from natural causes, it is impossible to decide ; but be this as it may, where nature holds the balance, and carnivorous and herbivorous animals are duly proportioned, no suffering could continue long from these or any other diseases ; as the moaning and cries of the distressed animal would attract its enemies, and it would at once be destroyed : this would be the case whether the diseased animal be herbivorous or not, as it is well known, that, under such circumstances, carnivorous creatures do not spare each other : even dogs in a kennel will often kill one amongst themselves, if diseased or wounded. It is true that amongst our wild animals we sometimes meet with cases of distress and suffering ;

I once found a pigeon with both its legs broken, and otherwise injured by shots, literally starved to a mere skeleton : I have seen a wild rabbit with so large a tumour that it had great difficulty in running, and must have had a miserable life. But although these are cases of wild animals, it must be borne in mind that our woods and fields are far from being in a state of nature, as all carnivorous birds and beasts (except foxes) are killed down as far as possible. I remember seeing a poor sparrow hanging by its leg from a spout, by what appeared to be a thread of a carpet, with which it had built its nest ; it was fluttering in this miserable condition for some two or three days before it died : had it been in a wood, the birds of prey would have been attracted by its cries and put it out of its misery in a few minutes : for so readily are magpies, jays, &c. attracted by such cries, that gamekeepers sometimes draw them within gunshot, by hiding in a thick bush and imitating the cry of some animal in distress.

The consideration of these cases brings me to the last part of my subject, which is, that the great law of Nature, "Eat, and be eaten," by which animals of one class live on those of another, is conducive to the general well-being and happiness of all classes of the animal creation, and affords evidence of the mercy and benevolence of the Creator.

There are so many points connected with this part of the subject, that I must of necessity pass them with merely an allusion to some two or three. Much might be advanced with respect to the necessity of a "superfecundity," and subsequent destruction of life, to keep the balance in the animal world. The vast number and variety of living beings, consequent on the remains of one animal affording food and enjoyment for others, opens a wide field for argument and reflection : but I will leave all these points, and confine myself simply to the consideration of the one, that the system of prey by which some animals live on and destroy others, is productive of very little pain and misery ; and much less than would be the result if all animals were to die by what is termed a natural death.

Leaving mankind out of the question, as they can assist each other when aged and sick, let us consider what would be the state of the world if all animals lived till they were

worn out, and died of old age; the animal creation would then present to view creatures decrepit, lame, blind, and miserable. Who has not sometimes seen a dog, a cat, or a horse, kept by its too fond owner till its existence has become a source of pain to itself, and a nuisance to all around it? Such must be the fate of every creature if all died a natural death; and every one in the last stage of its life must experience a period of weakness and misery, and all wild animals starvation also. But under the system of Nature as it now is, the animal world presents a picture of active life and enjoyment, weakness and misery being the exception, and not the rule; for as soon as any creature becomes incapable, either from accident or sickness, of enjoying life, it is attacked by its enemies, and freed from sufferings. It may be said, that the liability to the attack of enemies, and constant exertion to escape them, must be a source of misery; but this is by no means certain: animals avoid their enemies, not from a dread of death or pain, of which they can have no knowledge or experience; but from instinct, such as compels many of the lower animals to perform the functions for which they are created.

The principal question then for consideration is, in what degree are animals susceptible of pain when undergoing that destruction which is in reality the natural death of by far the greater part of the animal creation?

It is a very general opinion, that death, under any circumstances, must cause pain; and that even the smaller insects when dying are susceptible of it in a high degree. Shakespear is often quoted in support of this idea; and we are often told with great pathos that

“The poor beetle that we tread upon,
In corporal sufferance, finds a pang as great
As when a giant dies.”

Had Shakespear written these lines in the sense in which they are usually quoted, he would have appeared as a very indifferent naturalist; but it is a libel on the memory of the great poet of nature so to quote them. The lines occur in “Measure for Measure;” in the scene where Isabella, in

persuading her brother to submit to his fate with fortitude, says,

“The sense of death is *most in apprehension* ;
And the poor beetle,” &c. &c.

It is evident that (taking the whole passage) Shakespear's meaning was, not that the pain of death in the beetle is great, but that it is little or nothing in man. And there can be no doubt that this is a correct view of the question ; for however painful the causes producing death may be, there are ample proofs that no actual pain occurs from death itself. This could be proved by hundreds of persons, who have been drowned beyond all sensibility, and felt no pain. A heavy blow on the head may deprive any one of sensation, but give no pain at the instant : of this effect I have had some experience : a flower-pot fell from a window and struck me on the side of the head and on the shoulder ; for the moment, I felt nothing but a sudden loss of all sensation, (although I afterwards felt pain from the effects of the blow,) and had the blow deprived me at once of life, I am convinced I should have felt nothing of it. I know of a case where a man was hung for amusement, and his testimony is to the same effect : he was in company with several boon companions, and having in some way transgressed the laws of conviviality, he was forthwith tried, convicted, and sentenced to be hung ; and as a beam in the room was convenient for the purpose, execution was at once proceeded with, so far as placing him in a chair, and tying him by the neck to the beam : here, of course, it was intended the proceedings were to stop ; but one, more thoughtless than the rest, kicked the chair away, and the man was in reality hung by the neck : his dangerous position frightened his companions, he was cut down quite insensible, and it was some time before he recovered. He had not anticipated being made the subject of such a foolish experiment ; *he felt nothing of the sense of death in apprehension*, and experienced no pain : all he remembered of the circumstance was that of seeing a flash of brilliant colours at the moment, as he supposed, of his sudden suspension.

If death (apart from the sense of apprehension of it) be painless to man, there can be no doubt it is equally so to the

inferior animals ; and as they can have no anticipation of it, or conscientious reflections on an ill-spent life, and no dread of future punishment, the only question therefore respecting the pain of death to them is, what is the amount of pain they undergo from the causes producing death ?

Whenever any of the larger animals, either bird or beast, attacks another for prey, their first aim is to destroy life : the lion kills by a stroke of its powerful paw ; eagles, hawks, &c. dislocate the neck of their victim, or destroy some vital organ ; and the mustelidæ instinctively attack the head ; the polecat, stoat, weasel, &c., always aiming to destroy the brain, or divide the principal blood-vessels of the neck. The ferret, in killing a rat, does not bite here and there indiscriminately, but shifts its hold till it can give the fatal grip ; which is done by one of its long carnivorous teeth piercing the brain, or spinal cord close to the head, choosing the very spot a skilful surgeon would select to give the most instantaneous death. Life is thus extinct before the devouring of the carcass is commenced, and by a speedy death, so that the animal destroyed has no unnecessary period of suffering^o. And when we consider how readily the sense of pain is suspended in man, when highly excited, and this even in battle, where he must know his danger and liability to injury, it seems not only probable, but almost beyond a doubt, that the like effects are produced in animals when attacked, and that during their excitement, and endeavours to escape, the sense of pain is suspended, so that the death-stroke is not felt, and dissolution is painless. That the sense of pain in man is suspended during great excitement, is shewn by severe wounds sometimes received in battle, which are unheeded and unfelt at the time, although they may be of a fatal character. There are men in Oxford, who, during the late war, received wounds sufficient to disable them from further service in the army, but from which, *at the time*, they felt no pain, and did not know they were wounded. I have been informed of many extraordinary cases of like character, but will merely state one, the correctness of which I

^o The habit of the cat catching and tormenting a mouse, does not tell against the above, as, being a domestic animal, and not hunting for food, this habit is not strictly natural.

cannot doubt. During the siege of Sebastopol, an officer was with a party of his men in the trenches, when a shell fell and burst amongst them : he was lighting a pipe at the moment the shell exploded, and making some exclamation relative to its having knocked the pipe out of his hand, his attention was directed to a serjeant near him, who was killed by the explosion ; when, seeing that the eyes of his men were turned upon himself, he found that the shell had taken off one arm between the wrist and elbow, and three fingers from the other hand ; but till his attention was thus drawn to it, he did not know he was wounded, and felt no pain from it^p.

In the system of prey on the lower animals, such as reptiles, insects, &c., there is no such provision for the speedy destruction of life : birds will devour insects in part while they are still living ; the eggs of the ichneumon are deposited and hatched in the body of the caterpillar, whose natural habits seem in nowise affected by its lively occupants, although they are devouring it alive : and the common snake swallows the frog alive, (as before described ;) while serpents, living on animals who evidently are more susceptible of pain, kill their prey by a speedy and almost instantaneous death. These facts afford additional ground for believing that the sense of pain is little or nothing in many of the lower animals ; as it is quite opposed to the attributes of Divine mercy, and the proofs of

^p On the 26th of June 1857, the second day after the degree of D.C.L. had been conferred on Dr. Livingstone at the Commemoration, it was my pleasing duty to attend that gentleman over the Ashmolean Museum. I took the opportunity to present him with a copy of my essay (then recently published,) and, as he seemed much interested in the subject, I described its contents ; especially directing his attention to the opinion advanced, that the death of large animals might be painless under the excitement of an attack from beasts of prey. He at once stated, that few could speak from more experience than himself, as he had been attacked by a lion, which seized his shoulder with a terrific grip, and injured it very severely. *Yet, at the time, although he was fully aware of what had taken place, he felt no pain or even fear ;* the extreme excitement at the moment seemingly suspended both those senses ; and he believed that had he been killed at once, his death would have been painless. Such also Dr. Livingstone believed must be the case with all creatures under similar circumstances. This anecdote has since been published in his "Travels in South Africa."

beneficent design already advanced, that these creatures should be subject to such lingering deaths, and during the time be susceptible of pain.

In considering the works of Nature, we are too often led by appearances; and many natural operations are set down as productive of pain without sufficient proof that they are so. The destruction of drone bees is described by writers on the subject as a dreadful slaughter; but although they are stung to death by other bees, we have no right to assume that their death is painful: that the stings of bees and wasps should be painful to man and many other creatures, is necessary; for, as they are gregarious, their nests would afford a fine harvest to many creatures who are now kept at a distance by the dread of their stings; but in the case of the destruction of the drones, the sting is not for defence, but to cause death, therefore a painful sensation from the sting would be unnecessary and useless; and with the examples before us of frogs, toads, and badgers devouring live wasps with impunity, who can say that the death of the drone bee, when stung, is not painless?

One point, in some degree connected with the sense of pain, has been to me very difficult to reconcile with the otherwise evident beneficent designs of Providence,—that is, the use for which venomous serpents were created. I have never met with any thing calculated to throw light upon the subject, and cannot believe they were created otherwise than for some useful and necessary purpose. It has often occurred to me, that they may have been designed as a check on the superfecundity of the larger carnivorous quadrupeds: and that there is some such check cannot be doubted, as many of them are more prolific than the animals they feed on; lions, tigers, &c., producing more than one at a birth, but this is seldom the case with antelopes and the like. Carnivorous animals, when prowling for food, would be far more liable to be bitten by serpents than the herbivorous kind, who generally feed on open ground: with an abundance of prey, little exertion would be required of them in procuring food, and, consequently, they would incur but little risk of injury from their venomous foes: but with a deficiency of prey, there would be a superabundance of carnivorous animals, who must use greater exertion in hunting for food; they would be

more eager, and consequently less heedful while doing so ; and therefore more liable to be bitten by their deadly enemies. Thus the check to the increase of these creatures would be at the time when most needed and useful ; preventing an overdue increase and consequent state of starvation amongst them, and the annihilation of the class of animals they prey on,—and this by the most merciful means, as the bite of venomous serpents, when in full vigour, is productive of a speedy death, in some cases painless, and perhaps so at all times to the animals they were created to destroy¹.

The ideas advanced on the last case are more by way of suggestion for the consideration of others, than as a solution of the question of the importance of venomous serpents in the economy of nature. Practically, of these creatures I know nothing ; but as a proof of the painless effects of the bite of some of them, I have been informed by a reverend gentleman now living in Oxford, and who resided for some years in India, that when there, a native was brought to his house, who had been bitten by one of the venomous serpents of the country ; the wound was just above the knee, and no more than a simple puncture, from which the man felt no pain. The means adopted to prevent the usual deadly effect of the bite were, exertions to keep the patient awake ; consisting of sundry shakings, pinchings, prickings, &c., together with shriekings, and all the most unearthly noises the company were capable of producing ; the man being dragged about and kept in continual motion ; the whole proceedings were apparently calculated to produce the fatal effects they were intended to prevent ; however, the remedies were effectual, the man was prevented from sinking into a state of torpidity, and in a day or two was at his work again in the fields. Similar means are used in Australia as a remedy for the bite of venomous serpents.

In concluding this Essay, I hope that due allowance will be made for the circumstances under which it has been produced. My means of obtaining knowledge on some of the points were very limited ; the paper has been written at such odd times as my usual occupation has afforded ; and the variety of

¹ Dr. Livingstone concurred in the opinions expressed in this paragraph.

subjects touched on, and crowded into a mere pamphlet, are sufficient, if fully dilated on, to fill a volume. My aim has been to shew that the whole system of Nature is one of mercy and benevolence, giving existence to myriads of animated beings, whose life is enjoyment, and whose death is merciful and painless. How far I have succeeded in rendering my views clear and acceptable to others, I know not; but I trust that what I have advanced will induce some master mind to take up the question of the Sense of Pain, and give it that development it so well deserves.

It may be objected, that I have *proved* but little, and assumed much; it is so, and on a question like that of pain, it cannot be avoided: no absolute proof can be given either in support of or against the opinions I have advanced; yet I believe enough has been stated to show the probability of their being correct, to enable many to see the natural system of the animal creation under a far more pleasing aspect than it has been usually exhibited; and that torment and misery seldom arise from natural causes. That much cruelty is inflicted on animals by mankind cannot be doubted, and on this ground my pamphlet may be in some degree useful, if it is only in directing attention to the sources of pain. Domestic animals are sometimes beaten unmercifully, and so that no blood be drawn, or only a surface-wound inflicted, very little may be thought of it, under the idea that it is only the skin, whereas a deeper, but less extensive wound may be much less painful. The remarks on the shearing of sheep may perhaps save some of those creatures from unnecessary pain; and the facts I have given, of animals feeding when suffering from severe injuries, must shew that more misery may be caused by an insufficiency of food, than the infliction of severe bodily injury; and in this respect animals are too often neglected, and their sufferings but little thought of.

The greatest objection I anticipate to the promulgation of my opinions is, that they may tend to promote cruelty toward the lower animals; but I cannot give much weight to such an objection, or fear such results. It is one of the first duties to teach children to be merciful to all creatures, but I would not do so by teaching a false system of humanity. A child may be told that he must not injure a fly, "as the poor

thing has as much feeling as himself, and how would he like to be served so?" and directly afterwards be treated to a dish of prawns, shrimps, or other shell-fish, which he may have heard hawked about the streets, with the tempting assurance of the stentorian salesman, that they "were all boiled alive;" or he may see oysters brought to table, and swallowed almost in a living state. What, under such circumstances, must be the child's opinion of the sincerity of its teachers? He may be told that these creatures were designed for the food of man; but he must doubt the necessity for so many lives being destroyed for a single meal, if all animals suffer such pain in their destruction. As he advances in life, and sees that a continual warfare, from one creature living upon another, is the general system of nature; he may be led to believe that all is the effect of chance, and to doubt the existence of a merciful Creator. He may throw his humanity aside, and join in the general slaughter, as in one of the ordinary operations of nature; and we find an illustration in point in the Life of Franklin, who held the opinion, that man had no right to destroy life for the purpose of procuring food, and was a vegetarian for some years; but by chance seeing one fish swallow another, he at once concluded, that as they eat each other, he had a right to eat them, and so became an eater of fish, flesh, and fowl from that time. But teach a child that pain is a necessary and useful sense; that the destruction of one animal by another is necessary for and conducive to the well-being of all classes: that nothing in nature is painful or offensive, except for some useful purpose; and that even in the meanest operations of nature we find evidence of beneficent design:—he will then learn to respect the works of the Creator, and not wantonly injure or destroy his creatures, especially when he considers that it is impossible to *know* in what degree any animal is susceptible of pain. With such teaching he may learn to bear pain with patience and resignation; to look on the works of Nature in their brightest aspects, and thus

" Find tongues in trees, books in the running brook,
Sermons in stones, and good in every thing."

One great cause of cruelty is teaching children to look upon the lower animals, unless they are "very pretty," with general

dread and dislike. I can well remember how, when a boy, I have often picked up a caterpillar, and, while admiring its beauty or form, being told to throw it down and kill it; that it was a devil's ring, and if it got round my finger I should never get it off again. Such ridiculous ideas are not so common now as then, but, even at this time, children are too often led to adopt feelings of dislike to many creatures, merely because they are not pleasing to the sight, or have habits which run counter to our ideas of amiability. Toads and other creatures are cruelly used by boys from an habitual dread and disgust of them; and it is often thought quite right to torture carnivorous animals, such as the polecat, weasel, &c., as a punishment for their cruel propensities. Children are sometimes taught to look upon such creatures as "wicked things;" they are told of the crafty spider that catches the poor flies, or of the cruel hawk which kills the pretty birds: such teaching is not only ridiculous, but in some degree impious, as arraigning the laws of Nature. Man may be cruel, when, although endowed with reason, he wilfully tortures or injures any creatures; but how can any animal be said to be cruel when following the instincts with which its Creator has endowed it, and performing the functions for which it was created? A like charge of cruelty might be made against every human being who eats animal food; but the feeling that prompts such teaching is of a piece with that of the tender-hearted female, who, after dining off roast veal, expressed her surprise that butchers should be so cruel as to kill poor innocent calves.

The antipathies adopted in childhood often lead to ridiculous feelings in after-life. What can be more absurd than the conduct of a woman, claiming to be of years of discretion, and yet screaming and frightened at the approach of a frog? or that of a man, perhaps tall enough and big enough to be one of her majesty's guards, running away from a blind worm, which is in reality one of the most harmless of our British reptiles; and yet such cases occur, not so much from a want of courage as from the effects of early teaching.

Few persons, unless they have had experience on the subject, can fairly appreciate the pleasure to be derived from watching the habits of the lower animals: I have, from my

childhood, been fond of such pursuits, and at some time or other kept a great variety of creatures. When an apprentice I was on intimate terms with a large spider, which would come at my call to be fed ; the minnows in the ditch would almost take food from my fingers ; nearly all the animals I have had became familiar, and seemed to appreciate the kindness with which they were treated ; and all were sources of amusement : I do not hesitate to say, that even now I find pleasure in such pursuits, and perhaps as much enjoyment as others may from those of a more expensive and exciting character. I give this statement to shew the pleasure to be derived from such pursuits, and not to imply that all should or could be led to have a similar liking for them as myself : but, under every circumstance, children should be brought to look upon all creatures without unnecessary dread or dislike ; and be taught that all were created for some useful purpose ; that the destruction of any of them, when necessary, should be by the most speedy and consequently most merciful death ; but that none should be destroyed from mere caprice, or because their forms may not be pleasing to look upon, or their habits congenial to our feelings ; for all are the works of the same Almighty Power ; and if He who created the heavens in all their glory, the earth, and all that inhabit it, has created such creatures as they are, who may presume to arraign the wisdom of his Creator^r ?

^r See note E.

N O T E S.

NOTE A.

A like remark to that in the first paragraph holds good as regards the publication of the first edition of this Essay; as, in an Article in Chambers' Journal, Sept. 1857, entitled, "*The Beneficence of Pain?*" I am set down as one of those hobby riders, "who, irrespective of their importance, or of the disparaging estimate of others, urge views that to their contemporaries or successors appear whimsical or erroneous." The concluding sentence being, "We prefer viewing the operations of divine benevolence as they are actually represented, rather than through such vague theories as Mr. Rowell's." But it is probable that the editor has changed his opinion on the subject, as another insertion in the Journal, Nov. 1858, was entitled, "*Pain a Blessing;*" from an "*American Paper:*" the editor apparently not knowing that it was copied in the first place from the Article on this Essay in the *Quarterly Review*. However, as similar objections may occur to others, I think it necessary to notice some of those made by Messrs. Chambers.

NOTE B.

Messrs. Chambers contend that my views on this head are not altogether correct; as they say, "Mr. Rowell urges that pain is beneficial as an indication of disease. It is by no means a sure indication, however, as might be proved in a variety of ways. Let us take an example from the familiar instance of hysterical pain. Patients thus affected may for many years complain of excessive pain, which is in truth nothing more than disordered sensation in the part, and unattended with the slightest vestige of disease. Again, considerable pain may be present without its directly indicating the seat of disease; thus, in spinal affections, patients invariably refer to some other part, while in inflammation of certain joints, the surgeon's attention is not drawn to the one affected, but to its neighbour."

I am well aware that the pain is not always felt immediately at the seat of the disease producing it; but even in such cases it is

beneficial; as pain in the neighbourhood of an inflamed joint would compel the necessary rest and care which might not otherwise be afforded. In bilious attacks, although it may be the stomach which is out of order, the pain is felt in the head, still the headache is indicative of the cause, and it is far better that we should have this premonitory warning through the sense of pain, than wait till an attack of jaundice may be rendered obvious to the sense of sight.

NOTE C.

Any one desirous of pursuing this subject further would do well in referring to the Article in the "*Quarterly Review*," already alluded to, from which the following extracts are taken :

" Forming our notions of pain from what we feel on the surface, we imbibe the idea, that the deeper the wound the more severe would be the suffering; but this, says Sir Charles Bell ^a, is delusive, and contrary to the fact. The surgeon, he adds, who makes use of the knife, informs the patient that the worst is over when the skin is passed, and if, in the progress of the operation, it is found necessary to extend the outer incision, the return to the skin proves far more trying than the original cut, from the contrast which it presents to the comparative insensibility of the interior. The muscle is protected, not by its own tenderness, which is by no means acute, but by the tenderness of its superficial covering, 'which affords,' says Sir Charles, 'a more effectual defence than if our bodies were clothed in the hide of a rhinoceros.' "

" A man who had his finger torn off," writes Sir Charles Bell in his '*Animal Mechanics*,' "so as to hang by the tendon only, came to a pupil of Dr. Hunter. I shall now see, said the surgeon, whether this man has any sensation in his tendon. He laid a cord along the finger, and blindfolding the patient, cut the tendon. 'Tell me,' he asked, 'what I have cut across?' 'Why, you have cut across the cord to be sure,' was the answer. The tendon was as insensible as the string itself."

" Another of the examples adduced by Bell is that of the heart. The famous Dr. Hervey examined, at the request of Charles I., a nobleman of the Montgomery family, who, in consequence of an abscess, had a fistulous opening into the chest, through which the heart could be seen and handled. The great physiologist was astonished to find it insensible. 'I then brought him,' he says, 'to the king, that he might behold and touch so extraordinary a thing, and that he might perceive as I did, that unless when we touched the outer

^a In his *Bridgewater Treatise on the Hand*.

skin, or when he saw our fingers in the cavity, this young nobleman knew not that we had touched the heart.'”

“The brain, in subordination to the mind, is the physical centre of all sensation. Yet, strange to say, it is itself insensible to the wounds which are torture to the skin, and which wounds the brain alone enables us to feel. ‘It is as insensible,’ says Sir Charles Bell, ‘as the leather of our shoe, and a piece may be cut off without interrupting the patient in the sentence he is uttering.’ Because the bone which envelopes it is its protection from injuries from without, it has no perception of them when directed against its own fabric, though it is at the same time the sole source of the pain which those injuries inflict upon the other portions of the system. But the skull is no defence against the effects of intemperance, or a vitiated atmosphere, or too great mental toil. To these, consequently, the same brain which has been created insensible to the cut of the knife, is rendered fully alive, and giddiness, headaches, and apoplectic oppressions give ample notice to stop the evil, unless we are prepared to pay the penalty.”

“A drover went to sleep on a winter’s evening upon the platform of a lime-kiln, with one leg resting upon the stones which had been piled up to burn through the night. That which was gentle warmth when he lay down became a consuming fire before he rose up. His foot was burnt off above the ankle, and when roused in the morning by the man who superintended the lime-kiln, he put his stump, unconscious of his misfortune, to the ground, the extremity crumbled to fragments. Whether he had been lulled into torpor by the carbonic acid driven off from the limestone, or whatever else may have been the cause of his insensibility, he felt no pain, and through his exemption from this lot of humanity, expired a fortnight afterwards in Bristol hospital.”

Messrs. Chambers seem to deny that the sense of pain is necessary to preserve us from injury, and say, in the article before alluded to, “Without such protection as a sense of pain affords, our author (myself) assures us that our lives would be constantly endangered. There are undoubtedly certain conditions of life during which such an apprehension may with justice be entertained, but men are not all either children or fools. On this reasoning, we presume, we should be always pulling out our teeth, getting rid of our eyes, amputating our limbs—all considerations of utility in these organs being insufficient to secure their safety.”

I can hardly believe that the foregoing remarks were written in earnest, or that it is necessary for me to advance more on the im-

portance of the sense of pain to man for his preservation ; especially when bearing in mind the case of burning just quoted from the 'Quarterly Review.' However, I will give one more homely illustration, and I believe that such are generally the most telling. I remember a case in which a gentlemen, who, while looking at some article on a shop counter, over which an exposed gaslight was suspended, suddenly found his head very hot, and that he had burnt a hole in his hat. Now, I would ask Messrs. Chambers whether it would not have been quite as likely for him to have burnt a hole in his head, if it had been as insensible to pain as the hat he had upon it.

With respect to their observations on self-mutilations, they have set up a figure of their own to have the pleasure of pulling it down again, as no allusion has been made by me as to the probability of such occurrences. But, even on this subject, there is much to be said ; and I believe I could find sufficient grounds for my argument in their own journal. It is difficult to conceive to what lengths human beings would go if their bodies were as insensible as sticks or stones ; for even with the sense pain as it is, there are strange doings. Amongst savage nations they have such customs as tattooing the body, wearing heavy rings through their nose, mutilating the lips, extracting the teeth, or flattening the skull by compression ; all these customs arising from mere fashion or a desire to look more terrible in war—while, in China, the distortion of the feet by artificial means is almost incredible ; and at home, from a desire to have slender waists and small feet, I believe, that, in some cases, the only limit to tight lacing and compression of the feet is the greatest amount of pain it is possible to bear. I have stated that I have seen both men and boys drive pins into the calves of their legs, and not long since I saw a man drive several good sized pins up to their heads into the fleshy part on the front of the thigh. I once had an apprentice who delighted in making himself look horrible, this he did by turning his *eyelids inside out* ; and he would sometimes let them remain in this condition for a considerable time, in hopes of startling any who came near him. Now this he could not have done without suffering some pain, and he might have been led by this propensity to still greater acts of folly if altogether devoid of the sense of pain.

Children will sometimes play curious pranks : I know more than one instance of their cutting off their own or one another's eyebrows and eyelashes ; and it is quite possible that they might sometimes try their hands at carving each other's noses, or cut off their fingers

to see how funny their hands would look without them, if these organs were as insensible to pain as their eyebrows and eyelashes.

NOTE D.

From proceedings of late in France, and articles in various papers and publications, general attention has been so forcibly directed to the value of small birds as a check to destructive insects that it is hardly necessary for me to allude to the many cases in which the destruction of birds has led to serious consequences. Still, although it may be generally allowed that birds are useful, there is a great prejudice against sparrows, under the idea that they are not insectivorous. Now, although it may be a little foreign to the subject of this Essay, I will venture a few remarks in favour of these birds; who, from their familiar habits, seem to have a claim on us for protection.

I believe that, in gardens in towns or near dwelling-houses, more insects are destroyed by sparrows than by all other kinds of birds together. They are almost the only birds that can breed about our dwellings, as they generally make their nests out of the reach of cats and boys, whereas it is almost certain that the nests of other small birds would be destroyed by one or the other of them; and, as I have already shewn, during the breeding season sparrows destroy insects in vast numbers as food for themselves and young. Robins and martins often find security for their nests about our houses, but robins are so pugnacious that there are seldom, if ever, more than one pair of them about the same place: and martins only catch insects on the wing, whereas sparrows search trees for caterpillars &c., and this too in early spring, when such creatures are most destructive.

During the spring of last year the gooseberry and currant trees were sadly injured by swarms of caterpillars; so much so, in fact, that in some places hundreds of trees might have been searched without a single leaf being found upon them, and consequently the fruit withered on the branches. Now it is difficult to conceive that caterpillars could have been produced in such unusual numbers after the preceding very wet summer and intensely cold winter; but it may readily be conceived, that, from the rapidity with which insects are produced, such enormous swarms would result from the destruction of the natural check upon their increase, i. e. the birds that feed upon them. It may be said that the severe winter had destroyed the insectivorous birds in a more than usual degree; but they are mostly birds of passage, and only visit us during the summer season.

I believe the great cause of the evil to be the destruction of so many sparrows by poisoned wheat, which is now sold for the purpose at almost every chemist's shop. One chemist in Oxford informed me, that in eleven months he had sold more than a bushel and a half of wheat, every grain of which was sufficiently charged with strich-nine to destroy a sparrow. And from careful observation and inquiry I am certain that there are very few sparrows at this time to what there were before this poisoned wheat came into use.

It was evident, from the manner in which the caterpillars began their work of destruction at one part of a tree, and thence spread over the whole of it, that the produce of a single insect was sufficient to eat up every leaf on the tree, and consequently spoil the fruit, thus doing more mischief than a sparrow would do in a whole season; yet (if a few seeds are eaten in a garden) the sparrows are poisoned as far as possible, whereas every one of them, if left alive, would destroy hundreds of insects in a day.

According to the estimate I have given, a pair of sparrows and their young will devour thirteen or fourteen hundred insects in a day (Macgillivray calculated that a pair of spotted flycatchers caught upwards of sixteen hundred insects in that time). From this it is obvious, that when sparrows are very numerous, they must go far afield to find sufficient food for their young, and therefore destroy many insects in gardens at some distance from their breeding places; but if few in number, they may find enough nearer home. Now it is a fact, that while nearly every leaf, and consequently the fruit, was destroyed in the many small gardens to the north of the Museum, between the top of the Parks and Park Town, near which there is little or no harbour for sparrows to breed in—the fruit-trees in the Warden of Wadham's garden were not injured in the least, owing, I believe, to three or four pairs of sparrows having their nests about the roof of the house immediately overlooking it.

I could advance other facts in support of the opinion, that the swarms of caterpillars on gooseberry and currant trees in the spring of last year, were consequent on the great destruction of sparrows. However, let me be right or wrong *on this head*, it is certain that these birds devour myriads of insects, and are therefore useful in keeping the balance in creation, and preventing an excess of such creatures. It may be said that they are at times mischievous, and it is necessary to get rid of them to some extent; if so, then shooting them is the least objectionable, as where one is killed, many are driven from the spot. The great evil is the extent to which they are now destroyed, *owing to the readiness with which poisoned*

grain can be procured, as sparrows, from their semi-domestic habits, are more easily poisoned by it than any other birds, and nearly the whole of them in a neighbourhood may be, and are too often, allured and destroyed by persons who have a prejudice against them. That many have such prejudices is certain, and I fear that all I can advance will do very little to remove it; but I believe that the evils arising from the use of poisoned wheat will soon be so apparent that the sale of it must be prohibited. It is used for the destruction of rooks. I know of several cases in which cats have died, their deaths being attributed to their having eaten poisoned sparrows; and it is quite possible that human beings may be destroyed in like manner, from the use of poisoned grain to kill game and other birds. And when we consider that it was necessary that chemists should be restricted as to the sale of poisons, it is somewhat strange that an unrestricted sale should be allowed of grain saturated with one of the most deadly.

NOTE E.

I have been asked various questions on points connected with this Essay, but there are only two which I now think it necessary to notice. The first is, May not the beneficent distribution of the sense of pain be the result of natural selection, in accordance with the theory advanced by Mr. Darwin in his work on the "Origin of Species?" The second question is, Does not the instinct which leads the young cuckoo to destroy its foster brethren tell against the theory of beneficent design?

With regard to the first question. As Mr. Darwin's book has caused so much discussion, it is hardly necessary to state that, according to his theory, all organized bodies of the present time are descended from some few simple organisms of remote periods; the present forms, and various genera and species, being the result of slight but numerous variations which have chanced to occur from time to time; those variations which have been beneficial being retained by what Mr. Darwin terms "Natural selection," thus enabling the races amongst which they occur to hold their station or advance amongst the various classes of animated beings; while variations of an opposite character have been lost, from their tending to the destruction of the races in which they chanced to occur.

Now, I believe, that if two races of the same species of animals were in existence at the same time, and under precisely the same circumstances and condition in every respect, except that one race had the sense of pain so adapted to its wants as to afford a warning from injury—while the other was totally devoid of or deficient in

that sense ; then, the race having the necessary sense of pain might continue to exist and hold its place, while the other might die out.

So far, therefore, the beneficent distribution of the sense of pain may not seem to tell against the theory of natural selection ; but that theory altogether fails with regard to the absence of this sense where it is not required. For having the sense of pain, even in a high degree, where it is not beneficial, would not tend to destroy life, although a vast amount of pain and misery would result, if the sensibility to pain was distributed alike throughout our bodies and generally amongst the animal creation : and considering how in the human frame this sense is bestowed where necessary, and withheld where not required ; and also the grounds there are for believing that the same merciful dispensation holds good with all creatures—it seems to me quite impossible that such can be the result of chance variations, and that the distribution of the sense of pain affords the strongest evidence of beneficent design ; if so, then the theory of natural selection must be untenable and altogether superfluous.

The facts treated on in pages 11–14, afford additional and important evidence on this head ; for whatever doubts may exist as to the sense of pain in the lower animals, we can determine as to the offensiveness or non-offensiveness in the cases referred to. Now a similar degree of offensive effluvium to that which is beneficial to such animals as inhabit holes or caves, and whose young are produced in a very helpless condition, in compelling them to the cleanliness which is necessary for themselves and young, would not be injurious to such animals as roam here and there, and whose young are able to follow from their birth, although it might be unnecessarily offensive to themselves and other creatures. How then, on the theory of natural selection, can we account for the fact, that offensiveness should only prevail where necessary and useful ? It may be thought indelicate to dwell on such subjects, but, I believe, they are well worthy of consideration, shewing as they do, that in the great system of creation the wants and well-being of all creatures have been most wonderfully provided for, even in what may be termed the lowest offices of nature.

On Mr. Darwin's theory, instincts also are not special endowments or creations, but have been acquired by similar *accidental* variations in the conditions and habits of the creatures possessing them. Mr. Darwin contends, that if instincts do vary ever so little, then, even the most extraordinary instincts may be accounted for in accordance with this theory ; he gives a variety of cases to shew that

instincts in domestic animals do vary, and endeavours to explain how some peculiar instincts of wild animals have been acquired. One of these is that which leads the cuckoo to lay her eggs in the nests of other birds, and consequently her young to their care. In a paper read at a meeting of the Ashmolean Society, Nov. 12, 1860, I endeavoured to shew that Mr. Darwin's theory would not account for this peculiar instinct, and I insert the following abstract of the paper as the best answer I can give to the question, Does not the instinct which leads the young cuckoo to destroy its foster brethren tell against the theory of beneficent design?

In reference to the instinct of the cuckoo in laying her eggs in other birds' nests, Mr. Darwin says, that as she lays her eggs, *not daily*, but at intervals of *two or three days*, it would be inconvenient for her to make her own nest and hatch her own eggs, as she might have young of different ages at the same time in the same nest^t; but if the "ancient progenitor" of our European cuckoo occasionally laid her eggs in other birds' nests and profited by this occasional habit, or the young were made more vigorous from the mistaken maternal instinct of other birds than by their mother's care, then the young thus reared would be apt to follow, by inheritance, the occasional habit of their mother, and lay their eggs in other birds' nests also. And thus he believes "that the strange instinct of the cuckoo could be, and has been generated."

If the only points to be explained were, how the cuckoo might have acquired the habit of leaving her eggs to be hatched, and her young to be reared by other birds, then Mr. Darwin's explanations might perhaps be deemed sufficient; as there can be no doubt that habits may be acquired which become more or less hereditary; but there are many points in connection with this habit of the cuckoo that are unaccounted for by Mr. Darwin's explanation, and seem altogether inexplicable in accordance with his theory.

In the first place the egg of the cuckoo is *by far* less than that of any other bird, according to the size of the bird producing it; being about of the same dimensions as that of the skylark, a bird not more

^t Hawks lay their eggs at intervals of about three days, and generally begin to sit as soon as the first egg is laid, so that the young in the same nest often differ considerably in size. In the collection of birds from the Orkneys, lately presented to the Oxford Museum by the Rev. F. W. Hope, there is a group consisting of a male and female hen-harrier (*Circus cyaneus*) with their young, who vary very much in size owing to this habit of the bird. Owls also have a like habit, and the young in the same nest often differ in size still more than in those of hawks.

than a fourth the size of the cuckoo. It is not more than about half the size of that of the song thrush, and five times less than that of the common snipe, which bird is about as large as the cuckoo.

The long interval between the laying of the cuckoo's eggs is remarkable, when considered in connection with their small size, and seems to point to some special design; had they, on the contrary, been very large, it might have been considered as a prevention of too great a drain on the system, which would have resulted from producing them on consecutive days.

The immediate and final cause for the cuckoo's instinct seems to be the supply of sufficient food to her young. The nests of hedge sparrows, wagtails, and titlarks, or other small insectivorous birds, are *generally* selected by the cuckoo to lay her eggs in, and it is very rare that more than one cuckoo's egg is deposited in a nest. Now, although the young cuckoo destroys all its foster nestling, these small birds have to labour excessively to supply the young cuckoo with food, as its appetite seems insatiable, and its cry for food so incessant, that other birds will sometimes assist the foster parents in feeding it^u.

Cuckoos are strictly insectivorous; and as they have no strong bill, like the woodpecker, wherewith to tear down the bark of trees, or powerful legs and claws, to enable them to search in the ground for food, they seem to be no more able to collect food than such birds as are generally selected for foster parents; and as these small birds have so much difficulty in supplying one young cuckoo, it seems impossible for a pair of cuckoos to feed a whole brood; the necessity for foster parents is therefore apparent.

There are no insectivorous birds in England, of the size of the cuckoo, that could be foster parents to its young; the habits of the woodpecker being so very different from those of the cuckoo, and the night-jar is nocturnal. It seems therefore to be a special provision that the egg of the cuckoo should be so excessively small, as she is thereby enabled to lay her eggs in the nests of the smaller insectivorous birds, and thus secure a proper supply of food for her young.

The interval of two or three days between the laying of the cuckoo's eggs seems also a beneficial provision; as she is thereby better enabled to find nests proper for the reception of them, than if she lay her eggs daily; for as she lays only one egg in a nest, this must be after the

^u A few years since, a cuckoo was hatched in a hedge-sparrow's nest, in the garden of the Provost of Worcester college, and when it left the nest, a pair of whitethroats took to feeding it as well as the hedge-sparrows. I believe such occurrences are not uncommon.

smaller bird has begun to lay her eggs, and before she begins to sit on them. There is a further provision in this respect, in the cuckoo being able to retain her egg for a short time after it is ready for protrusion.

There seems also a special provision, in furtherance of the same design, in the very short time in which the cuckoo's eggs are hatched. In general, the larger the egg, or the bird producing it, the longer time is required for hatching it. Small birds' eggs hatch in fourteen days, hawks take from four to five weeks. Amongst gallinaceous birds, pigeons hatch in seventeen, and domestic fowl in twenty-one days, while turkeys and peafowl require from twenty-seven to thirty days for the same purpose: and amongst web-footed birds, common ducks hatch in four weeks, the Muscovy duck requiring more than a week longer; the common goose hatching in four weeks, while the swan requires six weeks to produce her young. Now, although the cuckoo lays so small an egg, according to her size, and usually deposits it where the other birds' eggs are a third or a fourth smaller than her own, yet the cuckoo's egg is generally, if not invariably, the first hatched in the nest.

As soon, almost, as the young cuckoo is hatched, it begins instinctively to clear the nest of all its foster brethren, and unhatched eggs, if any; and this it generally does during the day on which it is hatched. This singular instinct is necessary to secure for itself a sufficient supply of food; for if all the young birds remained in the nest they must starve, as it would be almost impossible for the old birds to procure enough food for all. How can this instinct be accounted for, except as directly imparted by the Creator? There is no apparent cause for its operating at such an early period in the creature's life, as at that time the nest affords ample room for all its occupants; and, in fact, the instinct ceases after a few days, diminishing as the bird increases in size, till it is lost altogether by the time the young cuckoo almost entirely fills the nest. But this singular instinct is not the only point for consideration, as with it we find an equally singular development of form, which enables the young cuckoo to effect the purpose of its instinct; as when first hatched it is much broader in the back than other birds of its size; it has also a very peculiar hollow in the back, from the shoulders to the rump, and when, by wriggling itself beneath, it gets either a young bird or egg into this hollow of the back, it is thrown out of the nest by a sort of jerk. This singular form can only be considered as a special provision, as the young cuckoo could not effect its pur-

pose of clearing the nest of its foster brethren, if it were of the general form of other young birds. The hollow of the back gradually becomes less as the instinct decreases, and the back of the young cuckoo becomes like that of other young birds by the time that the instinct is lost.

There seems also to be a special protection afforded to the young cuckoo by its ferocious appearance and fearless habits when it leaves the nest; as it does not skulk about and hide or flutter away like other young birds, but on being approached it puts itself in a posture for attack, lowering its body, while its head moves up and down in a threatening manner, every feather on its neck standing out so that the bird seems much larger than it really is; its mouth also, being large and wide open, the inside of it being of a glaring red colour, adds considerably to the ferocity of its appearance. Few persons, who had never before seen a young cuckoo, would venture to pick one up without carefully avoiding its bill and claws, although these are in reality very weak and can do but little or no harm, and even while still a nestling the appearance of the cuckoo is so formidable that I have known men afraid to take one from off its nest.

I once had a proof of the utter fearlessness of the young cuckoo, as while stopping to look at one that had left the nest only two days previously, it made a sudden dash up my arm towards my face; and although I was well aware it could do no injury, I was really startled by the young creature's attack. A similar instance is given by White in his "Natural History of Selbourne," who states that on his approaching a young cuckoo, which was in a titlark's nest on the ground, it sprang from the nest to attack him, and followed him several yards, buffeting with its wings and striking out with its legs like a bantam cock.

Now the ferocious appearance and fearless habit of the bird leaves it as it grows older, as the adult cuckoo is not only shy, but cowardly, and even the peculiar redness of the mouth also disappears. To what, then, can we attribute these peculiarities in the young cuckoo, except to design for the protection of an otherwise defenceless creature, who has no parents to protect it, and whose foster parents are too small to do so. And, taking into consideration the whole of the points to which I have alluded, I think I may fairly say, not only that Mr. Darwin utterly fails in his explanation of the cause of the peculiar instinct of the cuckoo, but also that the whole of the natural history of this bird tells against his theory; for, adopting Paley's illustration, we might as well assert that the ma-

chinery of the watch has been the result of natural causes, as that the whole of the peculiarities of the cuckoo have been produced by chance and accidental variations.

I have more than once been asked how I could account for the habit of the young cuckoo destroying its foster brethren, in accordance with the views I advance in my essay on the "Beneficent Distribution of the Sense of Pain;" and Mr. Darwin states that in his opinion it is unsatisfactory to look at such instincts as special endowments or creations. There is, certainly, at first sight, something repugnant to our feelings in this habit or instinct, but so far from telling against the views I advance in this Essay, I believe it affords another proof of the beneficence of the Creator; for no one can imagine that a bird before it is hatched can have any sense of pain, or even for a few days after, especially in such immature creatures as *small* birds are at that time; as the sense certainly could be of no use to them to enable them to avoid injury—birds in that stage may be said to exist only, and if destroyed they simply die; but if this instinct did not exist, and the foster brethren remained in the nest till they were shouldered out for want of room, which must be the case, as the young cuckoo at last *more* than fills the nest—then, being older, they would be more tenacious of life, and must when thrown out undergo a period of misery and starvation from cold and hunger.

It may be asked why the habits of the cuckoo should differ so much from that of other birds? In fact, I have been asked this question; and my reply has been, Why should there be any variety in colours or forms; why should flowers differ in so many ways, and why should not the whole world be monotonous and miserable to view, instead of presenting so much that is good and glorious to look upon? For my part, I consider this peculiar habit of the cuckoo as one of those variations which, when taken in the aggregate, affords such a wide field for the reflective faculties of mankind.

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