experience vouches for their efficacy, but we cannot recommend them as either elegant or scientific.

Sulphur ointment, the tar and citrine ointments, are daily employed in this disease; Mr Luxmore, to make sure of the business, mixes all three together.

Subacetite of copper, sulphate of zinc, sulphate of iron, and nitrate of silver, may be all very useful applications; solutions of some of them, we know, are active and efficacious. Lime-water, too, is no despicable remedy; and therefore probably it is, that Mr Luxmore dissolves all these active metallic salts in lime-water.

_Festula in Ano._—The observations given under this title shew the necessity of correcting constitutional disease; for, if the means directed to this be neglected, the most perfect operation, and subsequent dressings, will often prove unsuccessful. “In the treatment of this complaint, much attention should be paid in endeavouring to obviate its cause, as well as in the employment of local means, to induce a healthy disposition in the parts, without which a cure cannot be expected.”

Scrofula, syphilis, _erysipelatous disposition_, and a diseased state of the liver, in consequence of excessive drinking, are the principal causes noticed by our author as influencing the surgical treatment of fistula in ano.

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**IV.**

_An Essay on the Torpidity of Animals._ By _Henry Reeve, M.D._

Member of the Royal College of Physicians of London, and Fellow of the Linnaean Society. _London, 1809. 8vo._

Pp. 152.

In an inaugural dissertation de Animalibus Hyeme Sopitis, published by Dr Reeve at Edinburgh in 1803, he pledged himself to prosecute, at some future period, the interesting inquiry which he had then so successfully begun; and the essay now before us is the acquittal of this promise. The principal facts relative to the subject, which he has been enabled to collect from the best authorities, and some original observations, are here brought together into one connected view; and from these, the
the series of changes which the different species of animals undergo, during their hibernation, and the general causes which induce them to submit to that state, are deduced. Adhering with great steadiness to the principles of the inductive method, Dr Reeve does not appear to have been swayed by any preconceived hypothesis, nor to have hazarded any sweeping theory, to supply what is yet undiscovered, or to connect phenomena which yet remain disjointed. With becoming caution, he has contented himself with drawing such general conclusions, or making such remarks, as the facts stated seemed to authorize him to infer. If therefore, in a subject of great complexity, where much yet remains to be observed, he has not reached the end of the labyrinth, neither has he broken the clue, nor thrown obstacles in the way of others.

In this state of the inquiry, it cannot even be expected, that the whole of the ingenious author's remarks shall appear to others perfectly consistent and conclusive. Where the chain of facts continues interrupted, conclusions universally satisfactory are not attainable; and something like unsanctioned theory will obtrude itself.

The number of animals which become torpid at the approach of winter is very great. Most of these, as the amphibians or oviparous quadrupeds, insects and worms, are distinguished by the peculiar organization of their respiratory organs, from the more perfect animals, which seem incapable of hibernation. But there are other hibernating animals, viviparous quadrupeds, as the marmot and dormouse, which have a double heart, double circulation, and perfect lungs, and to whom perfect respiration in any other than the state of torpor is as necessary as to man, and cannot be suspended for any time, without irreparable injury to life. The phenomena, therefore, which attend torpidity in these, must appear much more surprising, than in insects and worms, or in oviparous quadrupeds, with membranous lungs, and a single heart, and whose respiration can be suspended for a longer time, without injury to life.

The phenomena of torpidity, as deduced from a great variety of authenticated observations, are shewn by Dr Reeve to be the following:

"1st, The temperature of hibernating animals is diminished." p. 12.
"2d, The circulation of the blood becomes slower." p. 17.
"3d, The respiration is less frequent, and sometimes, entirely suspended." p. 21.
"4th, The action of the stomach, and digestive organs is suspended." p. 25.
Dr Reeve on the Torpidity of Animals.

"5th, The irritability and sensibility of the muscular and nervous powers are diminished and suspended." p. 30.

We shall add a very few of the observations on which these propositions are founded.

1st, The internal temperature of the active and healthy dormouse, is 101°, of the torpid 67 and 73.—In animals of the same tribe in Russia, Pallas found the temperature 103 during summer, and 84 in its torpid state. The temperature of marmots, is 101°, 102°, and when torpid 43°, and even lower.

2d, The heart of the bat, in summer, beats a hundred pulsations in the minute, and as they are growing torpid sixty; and as the torpor increases, fourteen beats have been distinctly counted.

3d, Torpid bats cannot be observed to breathe at all. They have been placed in the exhausted receiver without perishing. Torpid marmots and dormice were confined by Spallanzani in hydrogen and carbonic acid gas for hours without injury. Had they breathed, they must have perished in a few minutes.

4th, Mr Hunter introduced food into the stomach of lizards going to hibernare, and upon opening them at different periods, the aliment was found unaltered. Similar observations have been made by Pallas and Spallanzani.

5th, Marmots are not roused from their torpid state by the electric spark. They are insensible to pricking their feet and nose. Bats are equally insensible. Wounds have been inflicted, and limbs broken, without the mutilated animals expressing any signs of pain.

The most surprising of these phenomena, and that perhaps on which all the others depend, is the suspension of respiration, a function, which, under all other circumstances, is known to be so constantly essential to the existence of life. Were hibernation a property of cold-blooded animals only, the fact might seem less difficult, as the variety observed in the structure of their respiratory and circulating systems would then connect and explain it. But there is nothing to our apprehension, in the structure or ordinary functions of the hibernating viviparous quadrupeds, which can throw light on this subject. The deviation of the superior cava into two trunks, or the larger size of the intercostal arteries and veins, or the number and size of the thymus gland, remarked in these, cannot help us one step in solving the difficulty; for these animals, when active, seem as incapable of surviving suspended respiration, as other quadrupeds not having the faculty of hibernation.
The first thing done, however, by these animals, when about to become torpid, is to assume a position, or seek situations, in which they cannot freely respire. They roll themselves up into the form of a ball, and bury themselves under ground, or otherwise cover themselves up from the access of air. Nay, it has been observed by Pallas, of a hamster, that, when inclosed in a box filled with earth and straw, it never became torpid, however great the degree of cold to which it was exposed, unless the box was buried four or five feet under ground, and earth thrown over it to exclude the access of the air.

We do not think the inquiry much advanced by the following observation of our author, even could we admit the truth of the distinction: "The most obvious distinction between those animals which hibernate, and those which are able to resist the action of cold, is the difference of their internal temperature, and the circumstances connected with that difference. While the latter possess a temperature much higher than the medium in which they are placed, and in some measure independent of it, the former differ from the surrounding medium only a few degrees, and are so much influenced by it, as to vary with all its variations."

It is true, indeed, that when hibernating animals are becoming torpid, their temperature sinks, and that when their torpidity is perfect, their temperature is comparatively very low, though still above the medium in which they are placed. But when active and healthy, we do not perceive any such distinction. On the contrary, their temperature exceeds that of healthy man, and approaches that of birds, the hottest blooded animals, and whose perfect respiration, Dr Reeve has produced, as one, amongst other arguments, against the supposed hibernation of swallows. The temperature of the active dormouse is 101°; of another hibernating animal of the order glires, 103°; of marmots and bats, 101°, 102°. How, then, can any distinction be founded on the difference of internal temperature observed in these and non-hibernating quadrupeds? or how can it be affirmed, that the temperature of the former differs from that of the surrounding medium but a few degrees?

In their active state, respiration, and the consequent production of animal heat, seem to be carried on as perfectly and independently as in those animals not subjected to torpidity. When they are assuming the torpid state, and their respiration is slow and languid, then indeed their temperature sinks; and when respiration is imperfectly performed, and at last altogether impeded, we are not surprised that their temperature differs from the
the surrounding medium only a few degrees. The wonder now is, how it is supported so much above it? The internal temperature of torpid dormice being 67° and 75°, and of another torpid animal, according to Pallas, 84°; temperatures greatly above the cold of a Russian winter.

Diminished temperature and confined air appear to be the first causes of torpidity. “Diminished respiration is the first step in the series of actions which accompany the state of torpidity. Confined air and intercepted breathing always precede the phenomena; the animal retires from the open atmosphere into some cavern or hole under ground; his mouth and nostrils are brought into contact with his chest, and, enveloped in fur, he falls into a profound sleep, and becomes cold and insensible.”

This account we believe to be perfectly just, and supported by all the phenomena. And we wish it to be particularly remarked, that the profound sleep, coldness, and insensibility, are posterior to the suspension of respiration. Prior to this, however, we must conclude, that a general state of diminished irritability is produced throughout the nervous and muscular systems, in consequence of the action of the external cold.

“Whatever may be the precise nature of actions induced by cold upon hibernating animals, the nervous system seems in the first instance to be affected, and the equilibrium which, in health, subsists between the nervous and muscular powers, is then destroyed.”

Here, however, we begin to be perplexed by some facts and observations, the truth of which must be acknowledged, though the conclusions become somewhat inconsistent.

—“Neither the lungs, the heart, nor any of the abdominal viscera, nor the nerves, have any influence upon the torpidity of frogs, salamanders, and snails, because they are equally affected by cold and heat in winter, after being entirely deprived of those parts, and even after the brain and spinal marrow are destroyed.

“The cessation of muscular action seems owing to the lowered temperature of the muscles themselves, because, when the transmission of nervous influence is prevented by dividing the nerve and destroying the brain, the irritability is suspended and recovered exactly in the same manner by the operation of cold, as in the ordinary state of torpid animals. The loss of motion and sensation, therefore, is owing to the diminished irritability of the muscular fibres, and that again is caused by the action of cold, and by suspended respiration; the capillaries of the vascular system appear to become contracted by the loss of animal heat; and this diminution always begins at the surface of the body, and gradually increases to the centre, as observed in examples of numbness from cold, and in applying the thermometer to different parts of animals, whilst they are gradually becoming torpid.”
Dr. Reeve on the Torpidity of Animals.

Now, we cannot help thinking, that Dr. Reeve has drawn this conclusion too broadly. For, although the irritability of the muscles of mutilated and decapitated frogs, can be for a while diminished or destroyed, and restored at pleasure, by the varied application of cold and heat, yet surely there is a great difference between these experiments and the torpidity of the entire animal. The frogs survive these experiments at most but a few hours; their natural torpidity may be prolonged, without injury to life, for years together. Besides, is not this inference somewhat inconsistent with that which we have before quoted, with regard to the influence of the state of the nervous system, on the phenomena observed in hibernating animals? And again with the following statement?

"The remote causes of torpidity in animals, induce directly or indirectly a periodical debility in the vascular system, which debility is connected with an alteration in the crasis of the solids and fluids, and in the action of the nervous system."—"The nervous system," he continues, "whose energies depend so much upon the mechanical and chemical effects of the circulation, partakes of the affection of the vascular system, and is perhaps one of the most immediate means of diffusing the influence of that affection over the rest of the body."

The truth appears to be, that the facts are not yet sufficiently analyzed to enable us to separate these different effects of the remote causes of torpidity, or to arrange them in the sequence of their occurrence. "The effects of low temperature on the respiration, on the circulation, and on the muscular and nervous powers," it is very justly observed by our author in the beginning of this investigation, "are so simultaneous, or so closely connected together, that it is difficult to attribute to any one the influence resulting from a strong action upon them all."

Besides the influence of cold, there is great reason to consider want of food as a principal remote cause of torpidity. It has been said, indeed, that hibernating animals become very fat before assuming the torpid state. But Spallanzani observed, that fat and lean dormice were equally susceptible of the action of cold. And it seems fully agreed, "that at the seasons in which hibernating animals become naturally torpid, their supply of food is cut off; and that, by feeding them regularly in the house, their propensity to hibernate has in some instances been obviated." It has been disputed, whether torpidity is merely an accidental habit, or a natural propensity of these animals? The question is argued with great acuteness by our author, and he concludes, that it is a natural propensity or instinct of those animals which are known to hibernate, always understanding by the term instinct, "a predisposition for certain actions when certain sensations exist."
Another question of considerable importance arises out of the preceding. Can other animals besides those which naturally and periodically hibernate, assume occasionally the torpid state when exposed to the strong action of similar remote causes? This supposition Dr Reeve is inclined to deny. The examples of sheep living for weeks under drifts of snow, and some wonderful cases related, of persons continuing asleep for seven or fourteen days, apparently from the influence of fear and anxiety, and other causes which tend to weaken the vital powers, do not strike him as applicable to the question.

"I have read accounts of the Swiss peasants being frequently buried in their huts by an avalanche, and after remaining under the snow for a considerable time, having recovered by the use of proper means. But I can discover no satisfactory evidence of such instances having really happened. From one narrative published, it appears, that the poor wretches were in constant dread of being starved; but I never could learn from any body in Switzerland, that a similar circumstance ever occurred, though I have frequently been told of men being lost in snow on the mountains, and that when found, several months after they had disappeared, their bodies did not shew the least signs of putridity, the cold having prevented any sensible decomposition.

"Though there are some singular histories in medical records which may appear to favour the supposition that man may become torpid under certain circumstances, yet we have the most positive evidence, that no such state was produced by causes which in other animals strongly predispose to it.—Dr Currie, in a very interesting account of the remarkable effects of a shipwreck on some matiners, mentions that these unfortunate men remained twenty-three hours on the wreck, and of fourteen, the original number, eleven in the end recovered: they were exposed to the air and to the sea water, the temperature of both of which, as nearly as could be guessed, was from 33° to 35°; and though exposed to such severe cold for so many hours, without any sort of food, or any liquor to drink, none of them were drowsy, not did sleep precede death in any of those men who perished.

"When we reflect how wide the difference is between man and other animals, especially in what regards their adaptation to climate, it will readily be admitted, that the arguments from analogy are fallacious; and in conjecturing that all animals, even the human species, might be rendered torpid with safety, there is danger of falling into that error which supposes events that do not exist." p. 112.

"If mankind were not exempt from that law of nature which forces such numerous tribes of the inferior animals to become torpid, we should have found it exemplified in some of the situations in which men have been placed, either by accident or by the common course of things. No allusion is made to so singular an event in the physical history of our species;
cies; and therefore we may conclude that it has never occurred, and is inconsistent with the established laws of the human frame.

"It may be objected to this conclusion, that mankind are liable to suspended animation from drowning, or breathing noxious gases, and are sometimes restored to life after being apparently dead. The facts, however, connected with submersion, are not irreconcilable with what has been already said concerning torpidity. There is an essential difference between the two cases. I consider drowning or suffocation as a case of syncope, produced by certain causes acting upon the centre of the system, and influencing the remote parts; whereas torpidity from cold first affects the sentient extremities of the nerves, and is propagated gradually to the centre. The change which takes place in the blood, and in the air in the lungs, is necessary for the support of the muscular action of the heart; and when that action has ceased, provided the cessation has not been for any long time, it is capable of being restored by inflating the lungs with atmospheric air or oxygen gas.

"Death takes place in drowning from the exhaustion of the irritability of the heart, probably in consequence of some change taking place in the muscular and nervous fibres of that organ, from the sudden loss of that stimulating power which the blood acquires in the lungs. In these instances, death comes on without the temperature being much reduced. Diminished temperature, therefore, is not the primary cause of suspended animation in submersion, or breathing carbonic acid gas: if that were true of drowning, as it is of torpidity, animals could not be drowned in a temperature so high as, or higher, than their own. - The great influence of atmospheric air on the action of the heart, shows the importance of inflating the lungs as the first step towards the recovery of drowned persons, whilst the loss of irritability must be attempted to be restored by communicating heat and tension to the faint and exhausted system.

"In all organized beings, the final cause of respiration is the same: but the organs by which this function is carried on are exceedingly varied; and it is curious to observe, that the more perfect respiration is, the more concealed are the organs which perform it, consequently less likely to be influenced by changes in the temperature of the atmosphere. Birds, whose respiration is so perfect, and whose temperature is so high, that I have ventured to remark that they never become torpid from cold, have the air conducted not only into their lungs, but into the cavities of some of their bones. Their respiratory organs are very different from those of oviparous quadrupeds, which constitute the most numerous class among hibernating animals." P. 119-123.

There is no part of Dr Reeve's speculations which has more perplexed us than these statements, and his reflections upon them. Not that we are disposed to maintain, that man and other animals have the faculty of occasional hibernation; but that we cannot forget, that the action of cold has induced in these a degree of torpor, attended with phenomena strongly resembling those which take place in hibernating quadrupeds. Dr Reeve, in a former part of his work, has himself given another
Dr Reeve on the Torpidity of Animals.

but contradictory view of this subject, in so far as relates to man at least, which appeared to us to prove, as far as any thing can prove, that the action of cold has in many instances produced a very complete, and yet recoverable, state of torpor in man.

"The effect of cold on our nervous system is shewn by the tendency to sleep produced by exposure to a very cold atmosphere in certain situations. This is very different from natural sleep, and nothing will prevent its taking place, but being removed to a higher temperature; nor can the propensity sometimes be resisted, although the person is well aware of the fatal consequences of indulging it."

After quoting the well-known instance of Dr Solander, he continues:

"This curious fact is still farther corroborated by an interesting account of the action of cold upon the French soldiers, in their passage over the Alps in the memorable campaign of 1795. The comatose state, the loss of sense and motion arose from the direct operation of the cold air upon the men, after considerable fatigue and exhaustion; and what shews incontestibly, that the nervous system was affected, and not the circulation, is, that all those who were fortunately recovered by medical aid, had none of their limbs injured by that species of mortification or congelation, so well described by the French writers."

This torpor, it is true, induced by the action of cold on our own species, if not soon obviated, terminates in death, whereas, the torpor of hibernating animals is prolonged for months, and that of the amphibians, and of insects, may be prolonged much longer without injury to life. In this, therefore, there is observed a material distinction. Nevertheless, we must admit a great similarity in the effects of cold on all animals, and allow that a very perfect torpor is produced by the influence of reduced temperature even on man.

In selecting those more difficult and doubtful parts of the subject, we have necessarily left unnoticed a great many excellent observations, which are given by our intelligent author in his 3d and 4th sections, on the variety of temperature in different classes of animals, on sleep, and on the application of cold in diseases.

We shall now close this article with the following philosophical reflection of our author, as exhibiting a general view of the different parts of his subject.

"In tracing back the phenomena of hibernation, we cannot help being struck with the great influence of three principal functions, respiration, perspiration, and digestion; besides the action of the nervous system, which it is impossible exactly to estimate or describe."

"Nothing
Nothing can be more admirable than the result of forces constantly varying and continually balancing each other, which are observed every moment in the animal economy, but particularly in animals under the influence of cold.

Respiration, by producing in the lungs, and probably in other parts of the system, a slow combustion of the hydrogen and carbon contained in the blood, occasions a disengagement of caloric absolutely necessary for the existence of animal life. Perspiration facilitates the disengagement of some portion of carbonic acid, and perhaps some other noxious matter, by giving out perspirable matter to the surrounding air, and prevents, at the same time, the accumulation of any excess of heat:—Digestion furnishes the blood with water, hydrogen, and carbon, and not only restores to the animal machine what it loses by perspiration and respiration, but afterwards rejects what is hurtful or superfluous.

This is what takes place in the ordinary state of the animal economy; but when the external circumstances are varied, the resources are equally multiplied, and the equilibrium is still preserved. When the two faculties of sensation and voluntary motion are suspended, they influence all the collateral functions. If an animal is reduced to a state of inaction and repose, the respiration becomes slow, and the circulation likewise; it consumes less air, exhales less from the lungs and skin, and consequently has less need of nourishment. If it be roused to great exertion, the respiration is accelerated, the consumption of air is greater, the exhalations are more considerable, and consequently a larger supply of food is necessary to repair what is expended. In this case, if the equilibrium cannot be kept up, disease and death is the consequence. Man in this respect is far superior to all other animals; he can live in all temperatures, and in all climates; his functions are more capable of resistance to external circumstances, and his system triumphs where others yield.

V.

Observations sur L’Anguille Electrique du Nouveau Continent,—
Voyage de Humboldt et Aimé Bonpland. Deuxième partie.
Observations Zoologiques. A Paris, 1807.

Some of these observations are curious, and still interesting. But it cannot be doubted, that, had our philosophic traveller been acquainted with the invention of Volta, the theory of electric tension produced by the simple contact of heterogeneous substances, and the many brilliant discoveries which have since been made