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16
17

AN ESSAY
ON
THE POISON
OF THE
COBRA DI CAPELLO.

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PREFACE.

THE object of this Essay has been to point out the influence of a peculiar Animal Poison upon the living body, and to inquire how far the symptoms it produces therein can be reconciled with the hypothesis of a decomposition of the Blood.

It would require a much more extended space to investigate thoroughly the correlation which exists between the venom and other poisons. But I cannot allow this opportunity to escape without pointing out what appears to be a marked contrast in their modes of action.

By investigations which offer a fine example of induction, Liebig has shown that arsenic produces its fatal results by preventing those destructive changes of the solids and fluids of the body which are essential to Life.

covering; and attached to and covering this are the muscles connected with the jaw. The contraction of these muscles at the instant and by the very act of biting, aided perhaps slightly by the consequent pressure of the tooth upon the elastic cushion of the gland, forces the venom from its receptacle. It then flows down the tooth, and so into the wound.

§ III.

The quantity and intensity of the poison eliminated from the blood is doubtless modified by many yet unascertained conditions intimately connected with the nutritive functions of the reptile. From our knowledge of the general law that the salivary and other glands secrete most under the influence of particular emotions, we may imagine those of rage or fear to influence the venom-bag of the snake. And this supposition appears to be corroborated by the fact, that the secretion of even the non-venomous serpents becomes more acrid under the existence of irritation, or the excitement of capturing their prey.

But, however this be, it is certain that the fluid transmitted through the poison-tooth is of a most virulent character, producing death with frightful rapidity when introduced in sufficient quantity into the blood-vessels or tissues of the human body. From some peculiarity of organization in the leech, slug, common snake, and hedgehog, they are said to resist that influence which spares neither the race of its possessor, nor, with the above exception, any of the

warm-blooded creatures. The sensible characters of the yellowish venom are scarcely to be discriminated from those of the ordinary colourless saliva. Like that secretion it is viscid to the touch, and its viscosity, partaking of an oily nature and somewhat greater than that of saliva, ranges between various degrees. Tested by the sense of taste it is said to be neither acrid nor burning, simply producing upon the tongue a sensation resembling that excited by the contact of oily matter. Under chemical reagents it evinces (as has been stated, though, it appears, erroneously) neither an acid nor alkaline reaction.

There are recorded experiments in which it has been smeared upon the lips and tongue, or even swallowed, with impunity. How deeply interesting is this fact in a physiological point of view! Nearly all other poisons, when received into the stomach in a liquid form, are immediately filtered through its membranous walls into the circulating current, to affect injuriously in their transit remote portions of the economy. But from the above experiment it would appear that simple contact with mucous surfaces modifies its character, and disarms the venom of its fatal attributes. Surely this fact must stand on the threshold of the discovery of its true nature and antidote. Is it not possible that the secretions of the mouth and stomach have a decomposing or a specific effect upon the poison? If this be so, the application to the bitten part of gastric juice or saliva, or some chemical agent analogous to these in composition, ought to neutralize the venom. A mixture of albumen and hydrochloric acid might fulfil the required conditions. In suggesting this plan of treatment we must not, however, be considered to have lost sight of the possibility that

There are other poisons which seem to have the effect of accelerating those changes to an extent inconsistent with the performance of the vital functions. It might, I am inclined to think, be contended with success that the venom acts in this manner.

The Cobra poison and arsenic would thus be distinct types of two classes of poisons, the *septic* and the *anti-septic*.

We must neither overlook the fact that there are poisons which have a mechanical and a chemical action, one or both, nor the possibility that septic poisons may generate new changes as well as unduly accelerate the natural ones.

Subject to this remark, the classification just adverted to would seem to be indicated by observed facts.

In addition to the authorities cited in the text, I have to acknowledge my obligations to various articles in the "Cyclopædia of Anatomy and Physiology," by Professors Todd, Carpenter, and Rymer Jones, to the "Traité de Physiologie of Burdach," and to the "Elemens de Zoologie" of Milne Edwards.

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§ I.

THE shock occasioned by the recent dreadful death from the bite of the Cobra di Capello has aroused an active spirit of inquiry and suggestion as to the best possible means of treatment under circumstances so painful. Our knowledge of such cases in this country is too limited to admit of any extended induction as to the true nature of the poison and its mode of action in the human economy. The history of the symptoms and treatment of the cases occurring in tropical climates is too vague and scattered to allow of our drawing such conclusions as might furnish us with faithful and trusty guides in such a contingency. Many new scientific data are, consequently, required to fill up the chasm between the more empirical remedies used and those which a sounder medical knowledge should supply. Still it must be admitted that, within the last few days, the deplorable nature of the accident and its quickly destructive results have given rise to much discussion, and elicited contributions from individuals, both professional and non-professional, alike warm in the cause

of science, and desirous of contributing their share to the relief of suffering humanity. It is to be hoped that an impulse will now be given to a more extended range of experimental inquiry into the nature of a class of animal poisons so recondite in their nature, and instantaneous in their results, that they afford but little opportunity for that calm deliberation so necessary in most cases which call forth the resources of the healing art. Here, to delay is to lose the golden moment—to hesitate, to yield the victory to the hand of Death.

Before proceeding to the more immediate subject of this Essay, it may not be considered inexpedient to premise so much of the Zoology and Special Anatomy of the Poisonous Ophidian Reptiles as may render the views hereafter to be submitted more intelligible.

The extensive geographical distribution of the serpent tribe has rendered its members, in one form or another, familiar objects to mankind of almost every nation and age. As if by the general aspect of all to give warning against the venomous properties of a few, nature has invested the whole class with characters which have ever been contemplated with dread, sometimes amounting to superstitious awe. And from these feelings of repugnance the glittering splendour and educability of some—and even the deadly Cobra affords an example of docility and sagacity under proper tuition—have scarcely redeemed them.

To such outward characters there correspond, at least in the poisonous classes, dispositions calculated to confirm our first emotions of horror. Cold by nature, apathetic or torpid in their ordinary state, they are aroused by irritation or want to a degree of ferocity from which there is scarcely any escape, and to the exercise of an often mortal power of aggression.

Of the whole tribe the poisonous serpents constitute in number about a sixth part, and are divided into those of the Land and Water. Of the latter, more than fifty species are peculiar to the seas of tropical Asia and Australia. Little is at present known of their habits, but it is agreed that all are more or less venomous.

Zoological classification recognises two families of the Land Snakes, namely, the Crotallidæ (rattlesnakes), and the Viperidæ (vipers). The true rattlesnake is confined to the warmer parts of the Western world, where it is said to attain the length of six feet and the thickness of a man's arm. It differs from all others of the reptilian class by its curiously constructed tail, about which strange stories have been told; indeed, if we may credit them, it is a *Serpent-Orpheus* which charms the birds by its melody. This snake is described as being of slow and inactive habits, rarely attacking human beings unless molested. According to M. Bosc, animals in general evince an instinctive dread of them. Their food in summer consists of squirrels, hares, rabbits, rats, &c., while in the winter they fall into a torpid condition.

These dangerous reptiles are said, upon the authority of Blumenbach, to be destroyed in large numbers by a small animal of the weasel kind (the *ichneumon*), and also to be eaten as food by the Indians.

The other family, the Viperidæ, more extensive than that of the Crotallidæ, possesses all their general characters and habits, but differs in the absence of the rattle, and in enjoying a less restricted range of geographical distribution, being common both to the Old and New World. Indeed, even in our own

country, we occasionally hear of serious results ensuing upon the bite of our indigenous representative of the venomous inhabitant of the tropics. But by far the more terrible of these creatures are denizens of warmer latitudes. And foremost among these stands the subject of this Essay, the Cobra di Capello, or—as it is sometimes termed from the fancied effigy with which its head is marked—the Spectacle Snake.

§ II.

This reptile, in common with others not necessary to be specially mentioned, is characterised by a peculiar mechanism, situate in the mouth and organised for the secretion and ejection of its venom. The precise arrangement of this mechanism, as well as the structure of the poison-tooth itself, varies in different species. In some, the poison-tooth is capable of a slight motion in a direction parallel to its axis. In others it is susceptible, not only of this movement, but of the more complicated one to be described almost immediately. Serpents with this complex system are the most deadly. The Cobra is among them.

The fang may be briefly described as a tooth with either an internal channel or an external groove. In the latter case, the groove runs longitudinally down, commencing at the insertion of the tooth and terminating near its point. In the former, the closed channel perforates the base of the tooth near its centre, and terminates in a lateral opening near the apex. This lateral orifice is not invariably circular, but often

presents the appearance of a longitudinal slit nearly parallel to the axis of the fang. To this last description the poison-tooth of the Cobra corresponds.

These formidable fangs when of the complex kind are attached to small moveable maxillary bones destitute of other teeth. When not in use they are turned backwards and concealed in a fold of the jaw. They can however be protruded and erected almost instantaneously. In the rudimentary germs placed near their roots we see a provision made for their reproduction in the event of accidental destruction or injury.

It may be as well to add, that a single row of teeth in the lower jaw and a double row in the palate are features common to the whole tribe of serpents. In those which are not venomous the whole of the outer edge of the upper jaw is furnished with teeth, even to the back part. The poison fangs on the other hand, which are two in number and symmetrically situate, are the sole occupants of the upper jaw of those of the poisonous class; and, placed as they are upon its anterior edge and occasioning a corresponding increase in its size, they may perhaps be considered to afford some slight external indication of the venomous character of their possessor.

We have now to describe the structure and position of the venom-secreting glands. This deadly apparatus is the fountain-head whence the poison flows along the channels of the teeth. It is situated at the side of the head, and consists of a congeries of lobules. The individual lobules are subdivided into still smaller secreting portions, and constitute in their totality a gland which eventually terminates in a single duct. This duct is continuous with the perforated base of the poison-fang.

The gland is invested with a dense aponeurotic

covering; and attached to and covering this are the muscles connected with the jaw. The contraction of these muscles at the instant and by the very act of biting, aided perhaps slightly by the consequent pressure of the tooth upon the elastic cushion of the gland, forces the venom from its receptacle. It then flows down the tooth, and so into the wound.

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the effects of the poison are arrested by the surface to which it is applied, or destroyed by the process of endosmose or absorption.

The researches of the early investigators concerning the essential nature of the venom were unproductive of results. The subtle agent on which its poisonous effects (in common with those of other animal poisons) depend, has hitherto baffled all attempts to ascertain its essence. It appears equally to have defied the analysis of the chemist and the assisted eye of the micrologist, whilst the anatomist only sees the wreck it has occasioned.

We gladly refer those who would fathom the present extent of our experimental knowledge respecting these peculiar poisons to the works of Mead, Redi, Portal, Fontana, Russel, Bosc, and Majendie. That of Fontana takes the lead in this interesting department of inquiry, on account both of the number and variety of the experiments which it details.

Though possibly the poisons of the entire serpent family are identical in their nature, the difference being of degree not of kind, there must (at least judging from their mode of action) exist radical differences between them and some allied animal poisons. Let us for the sake of illustration select one which, in some striking points, presents a singular resemblance to the serpent venom, while in others it entirely differs from it : I mean the virus engendered in the rabid dog.

Both these poisons are located in the region of the salivary glands ; both are propagated through the medium of a wound inflicted by the teeth. Yet how differently do they influence the play of the organism !

The Serpent-poison, as we have seen, is rapidly

destructive, and its effects almost immediately consequent upon the bite. But if we scrutinize the history of the victims of the canine virus, we read of the long and treacherous calm which often precedes the unfolding of those dreadful phenomena which terminate only with the life of the sufferer. This latter poison, after what we may term its period of incubation has expired, appears to act in some mysterious manner upon the nervous system. In Hallucination and Illusion, and in the Dread which is commonly deemed a characteristic trait, we see the respective indications of derangement of the Sensational and Emotional Ganglia.

In the case of the Serpent-poison, we perceive the mental faculties speedily reduced to a state of unconsciousness. In that of the Dog, we behold them actively cognizant of the fearful conflict between the strivings of the will and the wayward play of the muscles.

As contradistinguished from the effects of the Serpent-venom, those of the Canine virus give rise to a true convulsive disease. But whether the nervous centres are influenced primarily or secondarily is still a *quæstio vexata*—one of the unsolved problems of medical science. We have but little clue to guide us through the mazes of the subject. During life we only witness clonic spasm with intense nervous irritability. After death we find no obvious disease of the Blood, and none of the Nerves or Muscles, save the mere congestion consequent upon the increased functional activity of the organs. We can in short discover nothing within adequate to account for that which has been so fearfully apparent without.

Canine Rabies appears to stand in some undefined relation to Ague, and both to be allied to the class Neuroses. This idea was first suggested by that acute thinker and distinguished practical physician Dr. Billing, in his "Principles of Medicine," page 61. Ague however in our opinion would seem to be of a mixed nature, resembling the Neuroses in its periodicity, whilst the swollen spleen and perverted Hæmatose indicates its alliance with the diseases of the blood.

Other most interesting suggestions respecting these poisons naturally force themselves upon our attention. Is there a similitude, and how great, between the effects of the Serpent-poison and those of the fatal Endemic Fevers of the Tropics and many of the Exanthemata familiar to us here? Can the system which has once been the subject of the venom become a second time the prey of its pernicious influence?

§ IV.

Having thus far sketched the Natural History of the Poisonous Serpent and the Anatomy of its Poison-tooth and Gland, and compared the venom with that of certain other poisons, we shall next proceed to treat of its effects when introduced amid the tissues of the living body; we shall afterwards consider the therapeutics of the subject; and, lastly, suggest a theory of the uses of the secretion of the poison in the economy of the reptile.

It is scarcely necessary to recapitulate the varied experiments of Majendie (*Phénomènes Physiques de la Vie*) or those of later physiologists on the absorption of poisons into the system, or on the speed with which they traverse its remotest bounds. It may

be simply stated that the transit takes place with a rapidity which serves to explain the induced symptoms—phenomena before avowedly obscure—on the principle of blood contamination. Much will doubtless depend upon the part bitten, and the rapidity of the circulation at the time the poison enters its current. And occasionally the manifestation of the symptoms of constitutional poisoning does not correspond in point of time with the ordinarily ascertained rate of absorption. Still, it must not be inferred that the poison remains inactive. Its influence is probably such as is detailed under the head of “Treatment.”

In considering the symptoms produced by a bite of one of these venom-bearing reptiles, we think we shall best fix the attention of the reader by tracing them through four of the best known members of the class—the Common Viper, the Rattle-snake, the Lance-headed Snake of Martinique, and the Cobra di Capello.

We shall for this purpose freely avail ourselves of the description given by Fontana, Russel, Ruftz, and others; and afterwards, by a careful analysis of the symptoms common to all, see how far we may generalize concerning them.

1st. Symptoms following the bite of the Common Viper. Pain ordinarily acute throughout the length of the wounded member, one or two minute wounds denoting the bitten part; redness and swelling soon succeeding of a livid red colour, with the occasional appearance of vesicles. At a later period constitutional signs, pain and weight of the head, anxiety and nausea or actual sickness, bile being ejected; fainting not uncommon. Within fifteen or twenty hours the wounded part much swollen, with jaundiced tint of the body; cold perspiration, with

ardent thirst and drowsiness; fainting more frequent. In two or three days the symptoms may amend; a more or less abundant perspiration may break out, and recovery may ensue; or, in some cases, even death may follow from an aggravation of the symptoms.

2nd. Symptoms following the bite of the Lance-headed Snake of Martinique. The following graphic description by Ruftz is highly characteristic. He has studied the symptoms with the greatest care and states—first, that death may be instantaneous, which result he attributes to extreme terror; or, secondly, it may occur some days after the accident, by a manifestation of the primary symptoms of poisoning at the very moment the sufferer deems himself secure; thirdly, that death may result from intense nervous disturbance developed from the first; fourthly, that the fatal termination may be the result of congestion of the lungs; and lastly, that even when the puncture was not serious there often supervened swellings, abscesses, partial mortification, paralysis of sensation and motion, neuralgiæ, together with a disordered condition of the intellect lasting for a considerable period. The remaining symptoms resemble those produced by the Common Viper, only intensified.

3rd. Symptoms following the bite of the Rattlesnake. These are still more serious and rapid, but of the same nature. Sometimes death has followed within eight or ten minutes, the patient rarely surviving longer than three or four hours. The wound becomes gangrenous, a black blood flows from all parts of the body, the tongue is prodigiously swollen, and the thirst insatiable. The other symptoms already enumerated ensue equally upon the bite of these serpents, but are aggravated to the highest degree of violence.

4th. Symptoms following the bite of the Cobra di Capello. We select the fatal case so fresh in our memory as the type of this kind of poisoning, the individual being perfectly healthy at the time of the bite, and the only commemorative of importance being his intoxicated condition previous to its infliction. We have gleaned the following details from the published statement of Dr. Burder:—

E. H. Gurling, keeper of serpents at the Zoological Gardens, Regent's Park, was bitten in the face at 8.10 a.m. For twenty minutes after the bite no peculiar symptoms were manifested and no applications made, simple ablution being alone adopted. Forty minutes afterwards Gurling was carried to the hospital, and the following points observed:—lividity of the face, imperfect respiration, difficulty of locomotion and swallowing, frequent application of the hand to the throat, loss of consciousness, the body being in a state of free perspiration. After the application of galvanism, and a trial of artificial respiration, there supervened increasing stupor, faintness, paralysis and coma, followed by death. The pulse was somewhat unequal, but tolerably full and strong, nearly to the close, and to this point we invite especial attention.

After death, fluid was found in the ventricles of the brain; the spinal cord softish in its lower part; the lungs congested posteriorly, exuding a black fluid when cut into; heart healthy; the left cavities empty, the right filled with dark fluid blood; no clots were discovered in the vessels; in fact, the blood was altogether of unnatural fluidity. The abdominal organs were filled with a dark blood, and the spleen enormously congested, soft and black, exuding abundantly dark blood. There was external and local internal ecchymosis.

On analysing the symptoms of the poison of these serpents, we are at once struck with their uniformity; the difference in minor points appearing to be obviously attributable to the quantity or intensity of the venom admitted into the blood stream. They all denote serious disturbance of the vascular and nervous system. A great question now presents itself to us for determination, namely, which of the systems is the seat of the primary action of the poison. Two theories, each advocated by distinguished investigators, have obtained currency as explanations of the results.

In one—that of Mead, Russel, and others—the nervous system is supposed to be primarily and principally affected. The effects of the poison upon this system has been by an able writer compared to those of prussic acid; annihilating as it were the functions of the Medulla Oblongata, and thus terminating the act of respiration. But regarding as we do the venom of all these serpents as identical in their nature, and analysing the case cited from the late Mr. Samuel Cooper in which death occurred upon the eighteenth day after the bite, from the formation of extensive abscesses in the body, we still think the action of the poison is best explained by the second theory, and that the difficult respiration results from the action of decomposed blood upon the lungs, or Medulla Oblongata. The interval between the bite and the destruction of life from these poisons has been so variously stated as to render it probable that, like the symptoms, it depends rather upon the varying quantity and intensity of the venom introduced, than upon any difference between the species of serpent by which the wound is inflicted.

In the other theory—that advocated by Fontana—the blood is the *fons et origo mali*. “It seems that

all poisons supplied by the animal kingdom occasion death by destroying the irritability of the muscular fibres, and disposing both solids and fluids to a sudden corruption. The same may be said of those vegetable poisons that are no sooner introduced into the blood than they are succeeded by death.”—[“On Poisons.” Vol. I., page 106.] This opinion we unhesitatingly adopt, though conceiving a third mode possible; the simultaneous affection of the two systems. But before proceeding to indicate those special changes which in the Serpent poison would appear conclusively to demonstrate blood poisoning, it may be more instructive to direct attention to the characters which denote decomposition of the blood from various causes; we therefore extract the following account of its decomposition from Bock [“Lehrbuch der Pathologischen Anatomie”]:—

“The dissolution, sepsis, putrid decomposition of the blood, is characterised in general, according to Engel, by its great liquidity and permeability without coagulation, with dirty brown colour and more decided disposition to putrefaction and to copious hæmorrhagic or albuminous exudations, soon undergoing putrefactive change. This sepsis may be protopathic, from speedily accruing disturbance of the nervous system, or through the reception of putrefactive matter. Miasms are other poisons introduced into the blood, or may be consequent upon other phases (Hyperinos or Hypinosis). According to Engel, augmented volume exists in acutely occurring dissolution, and this occurs particularly after albuminosis, irregular typhus, scurvy, and pyæmia. The chronic form is attended with diminished volume of the blood, and to such a condition appertain all scorbutic conditions

developed after great loss of its plastic constituents. It is also seen in primary scorbutus and morbus maculosus."

Condition of the dead body in Blood Sepsis :—" Body swollen, discoloured with large, dirty livid death spots; quickly occurring putrefaction, the parenchyma collapsed, pulpy, and moistened with dirty brownish-red blood; discoloured bloody serum, evident hypostases and bloody transudation exist in the various cavities; the dirty brown-red blood is specially accumulated in the vessels, being frothy and without blood or fibrinous coagula."

On contrasting this description with the naked-eye characters observed in cases of poisoning by the reptiles quoted, we cannot fail to trace in many points a great and marked resemblance. The congested spleen, liver, and kidney; the liquidity of the blood, occasioning ecchymosis in the tissues; its blackish colour, observed in its exit from the depurating organs above named; its peculiar odour and the cadaveric exudation of frothy mucus from the wound, indicate, by signs not to be misunderstood, the altered properties of the blood.

It would have been most desirable to have ascertained whether the blood in fatal cases evinced any tendency to unusually early putrefaction, and whether organic micro-chemistry could have detected any unusual phenomena in the physical and chemical characters of the blood.

We direct particular attention to the condition of the spleen, as especially supporting the hypothesis of blood-disease. Whatever theory of its function we may adopt—whether that of Hewson, that it is a lymph-generating organ to form blood globules; or the more recent one of Kölliker, that it serves for their solution, the colouring matter being employed in the formation of

bile—we must admit that the spleen is in some intimate manner connected with the healthy elaboration of the blood.

The following quotation from the Treatise on the Spleen by this very distinguished microscopist and histologist, bears immediately on the subject matter in question:—

“It is known that the enlargements of the Spleen which constitute the most serious diseases of that organ, have a special coincidence with complaints, in which either a dissolution, or some other abnormal condition of the blood is present.

“This is the case in typhus, typhoid cholera, putrid exanthemata, erysipelas, scarlatina, measles, dyscrasia of drunkards, ague, scurvy, purpura, chlorosis, acute rheumatism, tuberculosis. In these blood diseases the texture is much altered, the size of the Spleen often amazingly increased so that it possesses a volume of 1 to 300 cubic inches and a weight of 10 to 20 lbs.”

Having thus attempted, and we trust not in vain, to shew that the Serpent-poison influences the economy by producing a true blood Sepsis, we are naturally led to speculate upon the manner in which this fatal alteration of the blood ensues.

The entire subject of the *modus operandi* of Septic agents upon the constitution of the blood is still involved in the greatest obscurity; it is a riddle which has been yet but partly guessed. Our present amount of knowledge upon the subject perhaps warrants the belief that these agents may exercise both a vital and chemical action.

If we may attach importance to the investigations of Schultz [“Natur: System der Allgemein: Pharmakologie”] it appears certain that the blood discs can, by en-

dosmose, be vitally influenced by Septic agents which have obtained entrance into the circulating channels. And it is undoubted that some sedative influence is thus exerted upon the contractility of the cell, at once destroying its function and its life. Possibly by its very destruction the decomposed elements may, under the influence of the Septic agent, become converted into ferments, and thus disseminate the mischief far and wide. This view is supported by Schmidt ["Charac : der Epidem : Cholera"], who has shown that matters are contained in the blood and blood cells, the decomposed products of which serve as a ferment to the Diabetic Fermentation and also to that of Urea. And that in various diseases sometimes the one and sometimes the other ferment may be produced.

To shed some little light upon these remarkable changes, we venture to paraphrase a portion of Liebig's views on the nature of Ferments.

According to Liebig's view, most ferments have a constitution analogous to that of Albumen, and it is probable that a number of effects which we are accustomed to refer to peculiar vital influences, are determined by the very causes on which fermentation and putrefaction depend. Albumen, Fibrine and Membranes when putrescent exert a peculiar influence upon many substances, inducing visible chemical change.

It is to be remembered that Majendie had already shown that putrid blood, or bile, &c., applied to a wound, might occasion languor, vomiting, and even death.

Those who desire further information, connected with the nature and action of Ferments, are referred to Liebig's "Familiar Letters on Chemistry," where the entire subject is treated by the great organic chemist with his usual ability.

§ V.

When we carefully consider the fearful symptoms ensuing from wounds inflicted by these reptiles under the influence of rage, long ought we to pause before yielding to the belief that they are to be controlled by all the various remedies proposed; the *post hoc ergo propter hoc* may induce us to place an unsafe reliance upon remedies which come to us, in many cases at least, upon doubtful testimony. Would it not, in the face of the facts we have cited, be safer to concede (at least for the present) that, where recovery has occurred, it may be explained either on the supposition of the quantity of poison absorbed having been insufficient to prove fatal, or on that of such protective influences as the following:—

First. Idiosyncrasy, or that peculiarity of constitution by which some individuals, when exposed to their influence, resist the action of animal poisons,—those of plague, typhus, small-pox, measles, for example.

Second. The bite being inflicted through the clothes, thick skin, hair, &c.

Third. A sudden gush of blood washing away a small quantity of venom.

Fourth. The venom bag being nearly empty, and the venom greatly diminished in intensity in consequence of the reptile having bitten several times immediately before.

Fifth. A very depressed state of the cutaneous circulation, and, consequently, a contracted state of vessels.

These suggestions being borne in mind, the principles of treatment will now be explained.

TREATMENT.

THE treatment may be naturally divided into the local and constitutional. Before proceeding to the detail of local measures, we deem it of paramount importance to state that, in order to secure their full influence, they must be early put into operation. Although in the late case twenty minutes are stated to have elapsed prior to the supervention of symptoms of constitutional poisoning (at least no objective phenomena were observed, during that time), we must not thence infer that the interval was one of inactivity. From all that we are taught with reference to the absorption of poisons into the blood, we must conclude that the poison was already absorbed, and fulfilling slowly, though unfelt, its fatal destiny; that it was altering the healthy condition of the blood, and simultaneously or consecutively deranging the functions of the nervous centres.

LOCAL MEASURES.

WHEN local measures are employed, they may be thus enumerated in the order of their respective importance:—

(1.) Compression by ligature, or other modification of mechanical pressure. Of all these measures we deem pressure above or on and around the wound as the most important; it being calculated, by the local fulness of vessels it occasions, to prevent the onward passage of the poison. This fulness of the vessels being antagonistic to absorption, time is thus afforded not only for a trial of the remaining remedies, but for the decomposition of

the poison itself. If the poison be unstable in its nature, the results of its decomposition may be incapable of exerting any prejudicial influence upon the constitution, or, combining with the animal matter of the system, it may form inert compounds.

(2.) Suction by the mouth or cupping glass, or by the larger apparatus for producing a vacuum at present extensively employed in Germany and France.

(3.) Excision, or even removal of the bitten part.

(4.) The destruction of the part by the burning iron or caustics—such as lunar caustic, strong nitric and similar acids.

(5.) Remedies which we may suppose to act chemically, as Ammonia, &c., or perhaps in some less obvious manner, like the Guaco (mentioned by Humboldt as used by the American Indians) and various other local irritants. Within this class of remedies will fall that suggested at page 11.

(6.) We do not recommend ablution, considering it to act injuriously by diluting the viscid matter of the venom, and thus facilitating its absorption into the vessels. In place of water we should rather suggest the attempted removal of the poison by a dry sponge, spongeopiline, or other similar material; or some absorbent powder, as magnesia, or chloride of calcium which also possesses cauterising properties.

CONSTITUTIONAL REMEDIES.

WHEN once the constitutional symptoms are developed, in all their appalling intensity, we feel the actual embarrassment of our position, and learn the general powerlessness of our art. We know no process for the rapid manufacture of new and pure blood, or for re-

generating that which has become corrupt and poisoned. Life is perilled in its inmost sanctuary: "The silver cord is loosed, the pitcher broken at the fountain." The remedies, however, which experience has sanctioned may thus be stated:—

1st. General stimulants, which act by rallying the vital powers, as *Æther*, Brandy, &c.; or those supposed, independently of their stimulating power, to act in a chemical manner in decomposing the venom, as Ammonia, Chlorine, Eau-de-Luce; or those again which have some mode of action on the nervous system hitherto unexplained, as Arsenic and some vegetable substances. Can it be that arsenic acts by its antiseptic power? If so, Pyroligneous Acid from its known tendency to arrest fermentative or putrefactive change, would be the chemical remedy par excellence.

2nd. Special stimulants to the respiratory and circulating functions, as galvanism and artificial respiration.

3rd. General and local stimulants to the cutaneous circulation, which favour abundant perspiration and maintain the Heart's action; as the hot air and vapour baths or remedies internally given for this purpose.

4th. Narcotics; Belladonna, Hyoscyamus, &c.

5th. Mechanical remedies under particular circumstances, as an artificial opening made in the windpipe.

6th. Remedies to relieve pulmonary congestion.

7th. Tonics, mineral and vegetable, in the stage of recovery.

We shall venture to criticise two divisions of the remedies proposed in the last case, viz., stimulants and narcotics.

With regard to stimulants, in favour of which so much has been urged in the late case, we are bound to confess that, from a careful consideration of the symptoms

observed, they would appear to be physiologically contra-indicated. The pulse, though unequal, was nearly to the close of the catastrophe *full* and *strong*, while the livid face, mirroring the condition of the brain, and the congested lung, were not conditions likely to have been improved by their administration. Even artificial respiration—the means most likely to prove serviceable by facilitating the chemical changes of the blood in the lungs—was ineffectual in rallying the sufferer.

With respect to narcotics again we urge the same physiological objections, independently of an influence ascribed to them of rendering the blood non-coagulable.

There yet remains one mode of treatment to propose, and I do so with diffidence, from the known gravity of the operation and the difficulty attending its performance, and only under a deep conviction (from what I have witnessed in some experiments relating to poisons) that it may be justifiably adopted under the desperate circumstances of these cases. I allude to the transfusion of blood, and would suggest a trial of it in that stage which is characterised by livid face with stertor, free bloodlettings being first premised.

In even the mildest cases of constitutional poisoning I would suggest the continued administration of diuretics for a considerable period, on the principle of removing as speedily as possible from the system the decomposed material of the spoiled blood particles.

While thus particularising the various rules of treatment, we cannot too earnestly direct attention to the interval between the infliction of the wound and the development of the constitutional symptoms of poisoning. Under a deep conviction of its truth, we unhesitatingly advance the opinion that when wounds have been in-

flicted by one of the larger poisonous snakes upon an exposed and delicate surface of the body (and more particularly upon that in the proximity of large veins), and when once poison of a certain intensity and quantity has been forced into the wound, and has induced its full constitutional effects, the case may be considered beyond the reach of any means at present known to medical science.

If we would hope to gain some glimpse of the mode by which life is terminated, we must more rigorously investigate the nature of the poison, and the relation it stands in to the human body; and this we must do under the light of modern science. Let me express a hope that the subject may attract the attention of abler and more experienced individuals, and that some effective means may be discovered to avert the fatal issue, should a similar accident occur in this metropolis or country.

§ VI.

Hitherto our task has been limited to the bare description of matters of fact or, at all events, to the suggestion of analogies the verification of which falls fairly within the province of observation, and of remedies the operation of which must be learned from experiment.

To deviate from the path of detail into that of speculation ought perhaps to be regarded as the exclusive privilege of master-minds—of the Newtons and Cuviers of science. So that if I appear to wander from the dry region of fact into the more alluring but delusive sphere of conjecture and hypothesis, I must find my excuse in the dearth of discussion and absence of

authoritative opinion upon a comparatively rare topic. Be it remembered that my reflections are not delivered as dogmas, but merely as suggestions which may serve the humble, though useful, purpose of attracting abler minds to the discussion. With this remark, let us proceed to the consideration of a question to which the mind will seek, even if it should not succeed in obtaining, an answer. I mean, the relation of this anomalous venom to the great scheme of Nature, including in that phrase its special reference to the organization of the creature itself.

We learn from Physiology that the entire Glandular System is functionally subservient to the separation from the blood of matters either recrementitious or excrementitious; and that some of these matters serve ulterior purposes in the animal economy. I would suggest that the secretion of a fluid ancillary to assimilation may be one, if not the only one, of the uses of the poison-fang, and that ultimate excretive ends may be another. At all events the opinion hazarded is not beyond the range of experiment, and we may thus perhaps gain some new view of the manner in which the reduction of food and the general functions of nutrition are performed in these animals.

There is, no doubt, what appears to resemble a law of nature in reference to these deadly adjuncts. The general defencelessness in other respects of those members of the animal kingdom to which these mortal qualities are superadded—and that through the instrumentality of a special apparatus—appears to be matter of common observation. It is as if nature, to compensate for the want of endowments accorded only to more privileged beings, had invested these

with the possession of a fatal gift subservient in a more than ordinary degree to the requirements, instincts, or passions of the possessor, and, by the universal horror which it inspires, indirectly conducive to the protection of the whole genus. As little can it be forgotten that analogous weapons are given to certain creatures—the *Gymnotus* and *Hydra Polyp* for example—as a means of obtaining their prey. But these defensive and predatory purposes do not exclude the co-ordinate ones of assimilation and excretion, and this co-ordination is all that I contend for.

Under this aspect an analogy is possibly traceable between the secretion of the venom and that of the sepious matter of the cuttle-fish. That the ejection of such matter partly subserves the preservation of this *Cephalopod*, by enabling it to evade the pursuit of its foes, can scarcely be doubted. It admits perhaps of as little doubt that the dusky veil, behind which the *Mollusk* finds its safety, is composed of the effete products of its nutritive and locomotive energies. A substance analogous to *Urea*, is one of its constant constituents.

It would not be uninteresting to inquire how far we can trace the simultaneous manifestation of two or more of these purposes from the humble nettle of our hedges to the stinging-nettles of the ocean (*Acalephæ*); through the articulate and molluscous classes to its full perfection in the deadly reptiles, concerning which we have endeavoured, albeit unsuccessfully, to treat.

From the last remark it will be seen that the view which we have ventured to take is not inconsistent with the absence of all trace of one at least of these purposes. Certain members of the zoological series

—the Scorpion, Hornet, and (as affecting the sense of smell) the Weasel tribes, for instance—are endowed with defensive organs, which do not appear to be in any way connected with the reduction of their food. But it does not follow that their products are not to be regarded in the light of true excretions, subordinated at times to the instincts of the creatures possessing them.

The contents of the cuticular sebaceous glands consist of oily matters separated from the blood in order that its standard composition may be maintained in purity. The excretion of this very matter is subservient to a purpose of defence by acting as an unguent in moderating the effects of external friction. In like manner, the bird guards itself against the effects of wet by lubricating its feathers with the oily matter separated from the blood by the action of its glands. So, a double purpose appears to be served by the pigmentum nigrum of the eye and the ceruminous matter of the ear.

The volatile products of the odoriferous glands of various animals may also be cited as co-ordinate both to the elimination from the system of effete matter and to various important functions of the organism. These products appear to be analogous to the chemical class of the Ethers. The secretions of the Musk-deer, Civet-cat, Musk-rat, Castor-beaver, and Weasel tribe, are only marked instances of the provision by which the odour of certain glands is made to operate as a stimulus to the exercise of the reproductive functions. This very collocation affords one argument for creative intelligence in the animal economy.

In the Light-producing animals, again, as the Glow-worm and Fire-fly, we see the “Lamp of Love,” which allures their mate, kept burning by

the refuse matter produced by the exercise of the organic functions. In fine, in numerous instances Emotion is the vinculum between secretion and excretion. It would not be difficult to augment the catalogue of cases similar to those cited, but we refrain from doing so, under the conviction, that, if these are insufficient, the analogy by which we have attempted to strengthen our argument must be considered as unsupported.

If in the case of the snake however, despite this view, the poison-fang be simply regarded as the instrument of a deadly defence—a defence so frightfully disproportioned to the danger it is calculated to repel—objections as forcible present themselves to the mind. The venom-apparatus must then be deemed simply an organ of destruction.

Still, even in this event, a true philosophy tells us not to hold up this apparent exception as an anomaly in the great scheme of Benevolence and Providence written in indelible characters on the face of Nature, but rather to regard it as the manifestation of some wise but inscrutable purpose.