Analogy
OF THE ACTION
of
Morbid Poisons
to
Fermentation
by
John R. Nicholson.
The imperfection of pathological chemistry," says M. Pinelle, "oblige us to refer to the vital forces, a host of diseases which necessarily depend on lesions of mixture. A great number of physiological and pathological phenomena which we consider as dependent on the vital forces, will pass under the domain of the chemical and organic forces, in proportion as the laws of these forces shall be better known and more generalised."

Encyclopædia Britannica, Article Medicine.
Much attention has of late been directed to Pathological Chemistry. Its previous advancement has been much delayed by the want of unity in the studies of Pathology and Chemistry, but, now that the subject has awakened an interest in the mind of every scientific student of Medicine, sanguine hopes are entertained for the results of its cultivation. The creation of the ill-defined vital force tended greatly to retard the study of Animal Chemistry, and its universal application to the phenomena that occurred in the Animal body almost extinguished inquiry in that direction. Almost all the actions within the organism, inexplicable by physical laws, were
referred to the influence of this force. When, for instance, it could not be explained how urea was formed in the Urine, for what Digestion of the food was due, they were immediately ranked as vital phenomena. It is now known that these changes can be accomplished independently of the organism. The so-called vital phenomena have been, within the last few years, greatly diminished in number by the researches of Chemists into the nature and constitution of the products of changes effected in the animal economy. The investigations of Demarçay, Kemp, and Thayer on bile, of Meyer, Redtenbach, and Varentrapp on fatty substances, those of Jones, Vogel and Ahener on blood and milk, of Liebig, Wöhler, Bergelius, Bence Jones and Garrod on the Urine and Feces, of Liebig and Proust on food, have combined to show that the products of Assimilation, secretion and Digestion are governed by chemical laws. Many Physicians, while denying this doctrine in words, unwittingly countenance it in practice. Thus for instance, they, according to rule, refuse vegetable food to
persons labouring under Diabetes Mellitus, not being conscious that it is by a chemical process that the Amylaceous constituents of the food are converted into the sugar which appears in the urine and that a similar conversion can be effected out of the human body.

Let me not be misunderstood by these remarks to imply that all the phenomena of the organism may be resolved into chemical effects; but a clearer and more accurate insight into the distinction between what is due to the chemical, and what to the vital force may be obtained by close examination and experiment. Chemical action, for example, may not be able to produce a leaf; but it can be ascertained with certainty that sugar in germinating seeds, and the formation of Hydrocyanic acid in bitter almonds are the products of chemical decomposition.

Now often, at the present day, are heard complaints, from eminent Pathologists of our lack of knowledge as to the action of remedies and the causes of disease. But let it be remembered that the acquisition of such
Knowledge, like the necessities of life, is the fruit alone of labour and effort rightly directed. There is want only where no firm will exists, where no adequate exertions are made; the necessary means and instruments exist everywhere.

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The theory of the analogy of the action of morbid poisons to fermentation is not of modern origin. Hippocrates thought that the cause of fever was some morbid matter in the blood, which was prepared in a certain number of days, by concoction for elimination from the body and was then expelled by hemorrhage, sweat, alvine evacuations or deposited on the surface in the form of abscesses or cutaneous eruption. A very distinct notice of this theory is to be found in the work of Rhazes, an eminent Arabian physician and acute observer of the phenomena of disease, who flourished at the end of the ninth and beginning of the tenth

[De variis et morbillis. Ioannes Channing 1766.]
centuries. Although a Mahometan, he carefully noted the phenomena that occurred in the previous fermentation and, from his observations, conceived the idea that a similar process took place in the human body. He compared the blood of infants to the sweet milk, that of youth to the period of effervescence, that of manhood to the strong and settled liquor and that of old age to the weak fluid in which was beginning the acetic change. He considered that the variolae appeared when the blood purified and gave off its superfluous vapours; and that the variolae themselves were analogous to the effervescence of the vinous juice.

In the translation previously mentioned, it is thus rendered:

"Quapropter assimilatur sanguis infantum et pulchrorum multo," (sive succidae pressio) in quibus pulvis incepit fieri cocitio per eundem ad maturationem perfectam et in illum non contigisse motus ad ebullitionem excitandam. Assimilatur autem sanguis juvenum multo, quod jam efferuit, ididique tonum, et evaporavi e illi, abundantia vaporum et superfluitatem ejus, uti venum quod jam quievit et sedatum est et, uti ejus perfecta. Sanguis autem venum veteri assimilatur, ex quo, jam evaporata est, ut ejus, et, in promptu est, ut frigescat, et fiat acendum."
Van Helmont, to whom the writer of the Article, Medicine in the Encyclopaedia Britannica, gives the credit of first propounding the doctrine, also adopted the theory of ferments being the causes of disease. He, however, included in his theory the doctrine of the Archeus an invisible spirit regulating the internal actions of the body. Sylvius, Willis, Hoffmann, and Herzig with a number of others supported the theory that Fevers were due to the Putrefaction of the Blood. Sydenham, who made great reformation in the Medicine of his time, still held this doctrine entire. The Theory has since that time received alternately encouragement and rebuffs till Leibig presented

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2. Opera Medica (Dr. Lütbib) 1649.
3. Opera omnia 1680.
4. Institutiones Medicae. 2. Berolinum auct. aber
It is in a new form and denuded of some of its errors. Even thus presented it has received strenuous opposition in many quarters, but it has also received much support generally.

* Liebig, Organic Chemistry applied to Agriculture and Physiology.

* lest I should be accused of plagiarism, seeing how nearly the views and opinions in many parts of this essay, coincide with those advanced by Liebig, it behoves me to state that I did not read nor even meet with Liebig's expressed opinions on this subject, until the greater and most material part of this essay was written. J.P.N.
A knowledge of some of the fundamental laws of Fermentation being necessary to the elucidation of the argument of the following pages I shall premise a sketch of that process and the phenomena attending it.

It has been decidedly proved that no animal or vegetable substance passed by itself into a state of Fermentation, but that the change is due to the action of a Ferment, in the presence of Hydrogen and Oxygen. This action, however, is not excited in all organic compounds, but only in those in which the force of the Ferment is able to overcome the resisting force of affinity or in compounds of unstable equilibrium. The general phenomena of Fermentation are best explained by the following theory. When a body is in a state of progressive change, the particles of which are consequently in a state of motion, is placed in contact with another body, the particles of which are in a state of unstable equilibrium, the amount of motion mechanically communicated to the particles of the latter from those of the former is sufficient to overcome the existing equilibrium.
and by the formation of a new compound establish a new equilibrium more stable under the given circumstances. I consider the special mode of action of the ferment to come under the principle long since recognised by Laplace and Berthollet: 

That an atom or molecule put in motion by any power whatever may communicate its own motion to another atom in contact with it.

Such is the general theory of fermentation, but there are modifying causes which demand some notice. Temperature affects the products of fermentation. Sugar at the ordinary temperature yields by fermentation, alcohol and carbonic acid; at a higher temperature the products are lactic acid, carbonic acid, mannite, and vinum. Milk at the ordinary temperature becomes sour by the conversion of its contained sugar of milk into lactic acid; but, at a temperature of from 70° to 80° the fermentation is accompanied with the evolution of carbonic acid and alcohol remains in the fluid from which it may be obtained by distillation. Boiling arrests fermentation in all cases. Malt, by this means quoted from Liebig's Letters on Chemistry.
can be made to lose its property of converting starch into sugar. In grape juice heated to the boiling point, all fermentation ceases; and in almond milk, which has been allowed to remain for only a few minutes in boiling water, any alkaline dissolves without exciting any change. Mineral acids, Chlorine gas, Sulphurous acid, Arsenious acid and Corrosive sublimate when added either to the liquid or Ferment effectively check the Fermentation.

The Ferment is a substance undergoing Putrefaction and is therefore, according to the general principle enunciated above, capable of inducing its own peculiar action in any substance in which it is able to overcome the resisting affinity of the particles for each other. Yeast may be taken as a type of this class of substances and is probably the best producible illustration, although any matter in a state of putrefaction may act as a Ferment. Yeast is gluten undergoing putrefaction and its action may be well seen on adding it to a solution of sugar. Fermentation is induced, Carbonic acid is evolved, Alcohol remains and may be obtained separately by
distillation, while the yeast entirely disappears. In the fermentation of Malt for the production of Beer, the process, although essentially the same, is in some particulars different. The infusion, which contains principally sugar and gluten, is boiled with hops. The original fermentation being thus arrested, an expansive ferment is necessary. Yeast is added and a double action is induced in the liquid. The action on the sugar is the same as in a pure solution of that substance and the gluten disappears. If the fermented fluid be examined on the cessation of the fermentation a substance is found floating on its surface possessing all the characters of yeast although nearly thirty times the amount of that originally expended. This has been produced from the gluten by the action of the yeast.

Yeasts, when minutely examined, is seen to consist of numerous cells, hanging in rows or strings in some measure resembling the lower class of plants to which in fact it belongs. Its reproduction in the fermented fluid gave rise to the long entertained opinion, which
is still sometimes promulgated, that fermentation was a vital process dependent on the reproduction of these cells. The reproduction of these cells, however, is the effect and not the cause of the action. This may be easily demonstrated. When yeast is added to a pure solution of sugar, the pure fermenting action is induced and the proper results, Alcohol and Carbonic acid, are obtained, but the yeast disappears. If the fermentation then were dependent on the growth of these cells (no such result could be expected or obtained). Liebig has conclusively shown that it is on the decomposition not the reproduction of the yeast that the process depends. Yeast, when left to itself for a time, loses entirely its property of inducing Alcoholic fermentation. This property is also destroyed when the yeast is rubbed on a levigating stone till all trace of organic structure has disappeared, but the power of decomposing all organic substances is not annihilated for it acquires the property of converting a solution of sugar into Lactic acid. Letters on Chemistry.
It is obvious that fermentation is a process necessarily dependent on time; that it cannot accomplish its results in an immeasurably short period like other chemical processes, on account of the decomposition being brought about by successive transmission from particle to particle throughout a mass. The time will depend on the ferment used and the nature of the fermentation. There are several varieties of ferments and fermentations. The varieties of ferments are yeast, vegetable albumen, film, or caseine and the corresponding animal substances, also as I have before said animal matter generally undergoingPutrefaction. The different kinds of fermentation may be included under the heads 1. Vinous - 2. Viscous - 3. Lactic - 4. Butyric. Vinous fermentation is the name given to the process by which sugar in solution is resolved into alcohol and carbonic acid and this occurs at a temperature of from 140° to 86°. When the saccharine juices of beet, root, carrots, etc are exposed to a temperature of from 86° to 104°, the viscous fermentation is excited, the products of which are lactic acid, Mannite and gum.
Lactic fermentation occurs when pressed curd, which has been exposed to the air for a time, is brought in contact with a solution of sugar at a temperature of from 75° to 90°. Butyric fermentation is induced when the preceding mixture is kept at a temperature of from 90° to 105°.

The last three kinds of fermentation may, under certain circumstances, occur simultaneously, and it is apparent that the viscous is a modification by temperature of the various butyric of the lactic fermentation.

As the whole of the diseases caused by Morbid Poisons would, by the mere description of each, fill a moderately sized volume, it is my intention to confine myself more particularly to one class and notice very generally the types only of the other classes. I have selected for consideration that of the Exanthemata so named by Cullen and described by him.

*Gregory. Elements of Organic Chemistry*
as "Morbi contagiosi, semel tantum in decursu vitae aliquem afficientes; cum febre incipientes; definitum tempore apparent phlegoses sapa plures, exigua per cutem sparce." "Contagious disease, attacking a person only once in his life, beginning with fever. As a definite period small inflammations, often numerous appearing scattered over the skin.

I shall enter into no philological discussion about the use and meaning of the words Contagium and Infection. That contagious disease is understood in this essay to include any disease communicable, by any means, from one person to another.

Of the origin of the Exanthemata we have no account, but it has been shown that small-pox prevailed in China so early as 122 B.C. and in Hindostan almost as early. From nation to nation and tribe to tribe the disease was transmitted as the means of intercommunication became developed. Till we have more tangible evidence of its presence at the siege of Mecca in the sixth century accompanied by Measles. Thence it was widely diffused by the wars of

Oklahoma, and his followers; and it is supposed to have first found its way into Europe at the time of the invasion of Spain by the Moors. There is no mention of any such disease occurring in Europe previous to this time, to be met with in the writings of either the Greek or Roman authors. Columbus imported it into the New World in 1492. St. Domingo received the disease in 1517, and Robertson states that it was introduced into Mexico by the Spanish expedition from Cuba. There from a negro landed on the coast, in whom the disease was fully developed, it spread with such rapidity that three millions and a half died in a short time. This disease was unknown in these countries before its introduction by Europeans. Measles generally accompanied small-pox and spread almost in the same direction.

The history of this class of diseases and the observations of the most careful inquirers concur to show that, the phenomena they present, may be comprehended under the three following heads. 1. That they spread...
by contagion - 2. That, the progress of the disease is marked by specific eruption - 3. That the same individual is not, for the most part, liable to more than one attack during life.

These laws will apply generally though there are some few exceptions, as in the peculiar results of scarlatina without the distinctive eruption which nevertheless render the liability to recurrence. Exceptions to the last, laus also occur though but seldom. Small-pox and measles admit of a very few exceptions scarlatina of more.

The eruption in each of these diseases is characteristic. In variola the eruption presenting itself after the initial fever consists of small, hard, red-pointed eminences which gradually enlarging become flattened, depressed in their centre and of a dull white colour. A tendency to purulence exhibits itself in these spots as they enlarge and they finally appear to be distended with

Dr. Rayer doubts the recurrence of small-pox at all and states that the instances related as such have been modified forms of varicella in the primary or secondary case. Maladies de la Peau.
pus, the central depression vanishing. They then begin to decline into brown peals which, gradually detaching themselves, ultimately fall off. These peals or crusts sometimes conceal small ulcers, the hollow, rounded cicatrices of which are indelible and very characteristic of the previous presence of the disease. In vaccinia the pustule, in its progress, appearance and structure bears a great resemblance to that of smallpox. It is however more extended, and in general only appears at the place upon which the puccinia virus is inoculated. It contains a false membrane and a contagious fluid. At the point of culmination it is deeply umbilicated. Varicella is a modification of variola. The eruption sometimes presents the external characters of variola. The eruption is usually vesicular but is sometimes pustular. In the latter form it may readily be mistaken for variola. The eruption shows itself wanting in the pseudo-membranous discol of the umbilicated character entirely. Crusts are formed on the fifth and detached on the eighth day. In rubella spots often papular.

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in their appearance, are evolved upon the skin which, in the intervals between the spots, frequently preserves its natural appearance and colour or presents no more than a faint reddish hue. Scarletina is characterised by a suffusion of a scarlet or bright raspberry red colour, general over the body and nearly continuous, with few or no intervals of healthy skin. Towards the end of the disease the tongue loses its epithelium and becomes of a purplish red colour. Dr. Davis has pointed out that Typhus ought to be included in this class. The eruption is well marked and distinctive consisting of spots extending over the body with intervals of healthy skin.

The morbid poison after its introduction into the system lies dormant there for a certain time more or less definite in each disease. This is called the latent period. Its duration varies in each disease and also admits of great latitude in the same disease in different persons. The latent period of the variolous virus is well-marked. It extends to eight days when inoculated and when otherwise received to twelve.

*Transactions of Provincial Medical and Surgical Society*
or fourteen days. In Rubela it is usually from four to five days but greater variations are of frequent occurrence. In Scarlania it varies even more than the preceding but commonly extends to four or five days. In Plague the latent period is usually from nine to ten days. The latent period is followed by the eruptive fever. It lasts in Smallpox from thirty six to sixty hours, in Measles from one day to two days, in Scarlatria from one day to four days. This again is followed by the eruption previously described.
Many theoretical speculations have been advanced by authors as to the nature and constitution of the Contagous Agent, and each writer has endeavored to establish his favorite doctrine by analogy or experiment. Among these, the Theory that Contagion is due to the development of Parasites, either Animalcular or Fungoid, number many able supporters, foremost among whom stand Dr. Holland and Professor Henle. The analogies indeed, brought forward by the latter, at first sight, appeared so apt, and the conclusions based upon these so evident, that it was conceived the manner of the hitherto mysterious action of the Contagious agent would be no longer difficult of solution. The most prominent of the analogies, and the one to which Professor Henle attaches most importance, is that of the blight, which occurs as a pestilence among the silk-worms in the South of France. This disease, called Muscardine, is produced by a peculiar Fungus (Botrytis Bactiana). The progress of the disease is marked by the appearance on the surface of the worm of a white efflorescence which rapidly extends, the body shrivels up.
and the worm dies leaving nothing but a quantity of this efflorescence to show where it formerly existed. The same phenomena are observed in any worm inoculated with the fungus. An analogous blight, Professor Henle conjectures, is produced by the action of Morbid Poisons. Thus he accounts for the latent period as being the prime requisite for the development of these Parasites. Such a doctrine, however pleasant, is open to many and serious objections. 1. The analogy is defective. — 2. Symptoms are present during the action of Morbid Poisons which no parasite could produce, and symptoms are absent which Parasites, if injurious, invariably produce. 3. The existence of these parasites in the Blood has not been demonstrated.

By the researches of M. Audouin and others, into the results of the inoculation of the Botrytis Bassiana, it has been shown that the fungus extending from the point of inoculation increases at the expense of the animal; it destroys tissues and kills the worm by exhaustive drain. As with this so with other parasites. Their effects are in direct ratio to their extent and death ensues.
where in an ostensible mass they occupy the space or nutriment of the animal. The effects of Morbid Poisons, on the contrary, leave no trace and local disorganisation, so far from having reached its acme at the time of death, will barely have commenced.

The second objection will also be found to be just on comparing diseases of which parasites are the known causative agents in the human economy, with those produced by Morbid Poisons. In every disease of the former class, the symptoms are primarily local from irritation and become general from impoverishment of the blood. The primary symptoms of the action of Morbid poisons, on the other hand, are general and the local changes follow at a distinct and distant period.

The third objection might be left without comment, were it not that I might be thought captious to pass silently over the labours of Messrs. Swain, Britain, Grove, and Dendy. The three gentlemen first named have given each an account of the supposed discovery of Fungi in the evacuations of Cholera patients.

\(1\) Lancet 1849. \(2\) Medical Times 1849. \(3\) Lancet 1849. \(4\) On small pox. Lancet 1851.
which discoveries have not been confirmed by subsequent observers. Mr. Grove nevertheless
has since published a work in which he strenuously upholds the view of Fungi being the cause
of Disease.⁷ Although the observations of the many eminent microscopists, who have
turned their attention to this subject, negativing those of Mr. Grove, cannot be doubted, yet, allowing
the latter to be correct in his observations, it does not follow that the disease is due to these fungi.
The existence of similar fungi can be detected in all putrefying matter of the nature of animal
evacuations, and similar appearances may also be seen in the evacuations of many diseases
which cannot be traced to the action of a noxious poison.⁸ They are the effects not the causes of
the disease. Mr. Dendy has communicated his observations in regard to the crusts of
smallpox.⁹ After washing these crusts in Liquor Potassae he discovered in them several
small black points which he denominated "spores." He does not give any data or characteristic

⁷ On Epidemics. ⁸ Vide discussion on Mr. Dendy's paper. ⁹ In a paper on Smallpox, read before the Medico-Chirurgical Society
marks by which he arrived at such a conclusion. Again, I say, even allowing this to be correct, to establish which will require many and conclusive confirmatory observations, it does not follow from their presence that these spores are the causes of the disease. The only conclusive test in this case, if it were possible, would be the freeing from animal secretion and inoculation with them.

The Hypothesis of Insect life* (which ought rather to have been denominated animalcular life), being the cause of disease, has been chiefly advanced to account for the latent period of Morbid Poisons.

But surely such a theory was not necessary. Mostly, if not all, of our familiar Medicines, in daily use, entirely independent of vitality, either Animalcular or Fungoid, have a latent period, of greater or less duration, before their action commences.

And further all the objections urged against the previous theory apply with more force to this.

It is much more probable that the Contagious agent is Animal secretion, which has been modified by the operation of external causes peculiar in their action. And, it may

* Dr. Holland.
be justly reasoned that, if these peculiar causes were again called into play, acting on the same secretion, they might again originate the same contagious agent. Or if their action were directed to other secretions, or the original secretion were influenced by other peculiar external causes, a new train of contagious diseases, with different symptoms, might arise. The conversion thus effected is some form of Putrefaction. It is well known that the virus of Small-pox is purulent matter undergoing Putrefaction, but so modified as to produce Small-pox and not the usual symptoms of the induction of ordinary putrid matter into the human body. Ordinary putrid matter will however produce in the living body symptoms of general disease. It is a well ascertained fact, that when Gale, Blood, Central matter, or any other substance, in a state of putreence is laid on a fresh wound, the general symptoms of the action of a morbid poison are produced. Nausea, followed by vomiting, debility and ultimately death ensue. And every anatomical student is conversant with the fact, that bodies in the dissecting room undergo a process of decomposition and
that the induction into the body of the decomposing matter, by a wound from a knife or any other instrument, is followed by a general affection of the system. The dangerous consequences of such wounds diminish in the ratio of the time that the body has been dead. The cause of this is easily made manifest. The nearer the body the more rapidly and forcibly is the putrescent change progressing and the more readily, therefore, will it communicate this change to the parts of the living body that come in contact with it. The older the body the more pluggingly is the transformation being effected and, therefore, the change is not so readily and forcibly communicated to the living parts in connection with it.

There is an instance where putrefying animal matter has produced peculiar results. I allude to the poison of the Würtzembergsausages, which was very often fatal in its effects. These sausages are composed of different substances, such as Blood, Liver, Bacon, Brains, Meat, &c., which are mixed with salt and spices and then placed in fladders or intestines. These, after being boiled, are smoked. They may be preserved for months.
when well prepared, but when the salt and spices are not in sufficient quantity, or when the sausages are not sufficiently, or are too late smoked, putrefaction commences. The symptoms produced by the eating of the sausages in this state are peculiar, though the putrefaction does not differ in appearance from the ordinary transformation. There is a gradual wasting of the muscular fibre and of all the corresponding tissues of the human body. The patient becomes much emaciated, his body dries up to the appearance of a mummy and then he dies. During the progress of the disease the faeces becomes viscid and emits an offensive odour. These symptoms will be seen to present a marked difference from those ordinarily produced by putrescent food. The putrescent matter, when placed in contact with the ingredients of the healthy sausage, produces a transformation quite similar to the charge which it has originally undergone. The poisonous property has been ascribed to many causes and the agent sought for. Its peculiar action has been supposed to be due to the presence of Hydrocyanic Acid.
or Sebacic acid. The former of these cannot be detected in the sausages and the latter, though present in some quantity, possesses no poisonous properties whatever. Boiling water and alcohol destroy the poisonous action of this matter; therefore it is not probable that it is dependent on any inorganic poison but rather on the state of Putrefaction which has been modified in a peculiar manner to possess peculiar properties. In the same manner, it may be conceived, the virus of small-pox is putrefying animal matter similarly modified. We know that such a modification will take place in the erysipelasous matter by the overcrowding of wards, whereby secondary abscesses are produced, and that these may be avoided. Boils sometimes spread in the manner of a contagious disease. The spreading of ulcers in certain ships could not otherwise be accounted for than on the supposition of Contagion. The matter here may have been peculiarly modified so as to be rendered contagious, and if this be true of the virus of one disease it is probable that of the whole class of like diseases.

Although the peculiar poison in some of these diseases only exists as a volatile agent yet the blood containing the poison is capable of producing the same results when inoculated, as the volatile agent, in the same manner as the virus of small-pox whether inoculated or inhaled produces the same results. Dr. Francis Home communicated Measles by means of blood taken from persons labouring under that disease, and repetitions of the experiment have proved equally successful. Attempts were made to modify Scarlatina and Measles in Vienna, Geneva, and other places by inoculation with the blood of those affected with the diseases. Although the attempts to lessen the severity of the disease was not altogether successful its communicability in this manner was clearly demonstrated. It is probable, therefore, that the volatile poison is only a higher state of development of the Contagious Agent. In this form it is more readily influenced by external agents. Bateman states that in a volatile state the poison becomes innoxious at a distance of a few feet, if allowed free aeration. Chlorine gas, mineral acids &c destroy the poison in this form.

*Philosophical Transactions 1826. **Bateman on Epidemics.
more readily than in any other.

From what has been said it is
deducible that the Contagious Agent is Animal
secretion morbidly altered. Sir J. Blane says
There is not a secretion or exhalation of the human
body which may not be so vitiated as to produce
diseases communicable to others by contact or
respiration, under various fortuitous circumstances
of concentration and stagnation, application and
action; so that there may be new maladies
awaiting our species which are still to develop
themselves under the endless combination of
the incidents of human life, through endless
ages to come. a

The manner in which the
Contagious principle invades the system is a
subject which has given rise to considerable
discussion. Some authors have supposed that
its first effects are visible on the nervous system.
Some have maintained that its first attack is:
Sir J. Blane on Infection.
made on the blood, and that thence the nervous system is affected. Others again have asserted that it acts, primarily, on the solids only and that the results on the circulatory and nervous systems are secondary. Dr. Copland supports the view that the Morbid Poison, whether inhaled into the lungs or inoculated, first manifests its presence by its effects on the nervous system. The last of the three hypotheses will be found to be defective, when an attempt is made to apply it generally. Especially will this deficiency be perceptible when the manner in which contagious effluvia, inhaled into the lungs, act upon the system is considered; for the poison in such cases is visible in its effects upon the whole circulatory and nervous systems long before any characteristic mark of its presence is developed in the solids. Nor can it be maintained that the poison (never thus, by inhalation enters the system but always gains access through the skin. Abundant proof, in opposition to any such assertion, was given at the time of the visitation of the plague to Buonaparte's army in Medical Dictionary. Art: Infection. Contributions to Pathology. Dr. Todd in Lange's, also supports this view.
Egypt, for it is stated that many oiled their skins and wrapped themselves in cloths to avoid, but did not escape, the disease. It is also related of Napoleon himself, that he proceeded round the hospital and touched the bodies of those affected with the disease, and escaped the effects of the contagion by being careful to inhale as little as possible of the effluvia emanating from their bodies. Numerous other facts might be adduced to shew that this hypothesis can not have a general application.

Watson thinks that the second hypothesis explains the manner of the entrance of the contagious principle. He considers that the blood is primarily affected and that the effect on the nervous system is due to the commotion excited. Alison is of opinion that the blood is the vehicle by which these poisons are conveyed into the system.

In the following, the first of his general laws relating to the action of morbid poisons, he gives some reasons in support of it. It is a well ascertainment fact, he says, that the morbid effect of these poisons is remarkably increased.
by debility and emaciation, and diminished by fulness and excitement of the vascular system; and this gives good reason to believe that their action is consequent on their absorption into the blood, because it is known in Physiology, that by these circumstances absorption is remarkably increased and diminished. Henderson considers that the system is acted on both through the solids and blood, the former in some cases, being primarily affected.

Whenever of these doctrines be admitted, it is well established that the blood undergoes, at an earlier or later period of most contagious diseases, a remarkable change as regards its appearance and sensible properties. In the Elyanthemata, the Albumen is increased. The proportion of serum is considerable in the last period or decline of the acute forms of these diseases. In diseases dependent on Contagion, the separation of the colouring matter of the blood, and its solution into the serum takes place very early. The taste of the blood is altered. In health it has a saltish taste but in fever and
malignant diseases this character is lost. Its odour is also materially changed. Louis de la Croix states that the blood of two plague patients infected their apartment with a foetid odour; and Zacarius relates that three persons were struck dead by the odour of the blood drawn from a person sick with the same disease. Gulerius Alpunner, and Water all allude to cases where physicians have been dangerously affected by the fœtus of blood during its abstraction from persons suffering from fevers and malignant diseases. Dr Stevens has shown by analysis that the saline constituents are diminished in quantity, or altered in their combinations in the advanced period of these diseases. The blood may be altered by the direct entrance of the virus. This is exemplified in the familiar instance of its insertion in the process of vaccination.

I have previously mentioned the experiments of Dr Francis Home and others in regard to the blood in measles and scarlatica.

There is in the human economy generally a susceptibility of the contagious influence.
But this is not always apparent. It is remarked of smallpox, and it is true of the other diseases of this class, that the human body is not always susceptible of the contagious influence. Some individuals are more liable to it than others; and the same individual at one time more than another.

In regard to the first of these propositions, Mr. Croos relates that of 215 unvaccinated persons who never had had smallpox, living in the same house with persons affected with this disease, fifteen escaped the contagion, and of these five had been previously similarly exposed without being affected. In reference to the second proposition another case in point occurs in the same work. A man had for twelve years acted as nurse to the establishment for inoculated persons. At the end of that time he took smallpox and died. This may have been a second attack, for the man stated that he had been previously affected. Mr. Dockley gives clearer evidence in a case which he has put on record. He attended a woman who, at the age of 84 took smallpox and died. She had, up to this time, been in the habit of acting...
As nurse to those affected with this disorder and fancied herself proof against the contagion, though she had not previously had the disease. A further illustration is given by Dr. Watson. He attended a lady who became affected with Measles at the time that they were prevalent in the village where she resided. She had previously nursed eleven of her twelve children through the disorder without being attacked.

There are causes also which modify the action of the Contagious principle according as they are present in greater or less proportion. The general causes of predisposition to disease affect its action. If the emanations from the sick be allowed to accumulate round a patient, especially where several are confined in places badly ventilated, the disease will be aggravated, new characters imparted to it, and an atmosphere may be generated capable of producing a modified or even a different disease from that which originally existed. *Humidity not only has a manifest influence in the predisposition of the human frame to contagion but it also accelerates and favours its effect, and greatly*

aggravates the whole of its resulting phenomena. Dryness of the air, on the other hand, retards the action of the contagious agent, or altogether prevents it. A certain dry warm wind is known to have prevented the spread of smallpox and caused it to cease on the coast of Africa. Exposure to wet and cold, a debauch, fatigue, unpleasant, and distressing intelligence, exhaustion from any cause, each, besides being a cause of predisposition, exercises great influence in accelerating and aggravating the effect of this agent. Temperature acts as a modifying cause. A moderately warm moist atmosphere greatly favours the spread of contagion. The approach to extremes of temperature acts as preventive to its spreading. Plague does not become epidemic when the temperature is below 60° or above 90°." Typhus, measles and scarlatina scarcely ever occur between the tropics. It is generally remarked that fevers, resulting from eruptions commence in spring and gradually decline towards autumn. Vaccine lymph when exposed to great cold or to heat above 90° loses its property of producing the characteristic

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*Dr. Henderson, Lectures.  B. Dr. Watson. Practice of Physic. F. Russell on Plague.*
vaccine vesicle.\footnote{D. Watson, op. cit.} Yellow Fever does not spread when the thermometer is below 80°.\footnote{Sir G. Blane, Medical Logick Select Dissertations, op. cit.} It is stated, in answer to this, that medical men are not agreed as to its contagious nature; but it has been proved that one form is eminently so.\footnote{Sir G. Blane, op. cit. Rygn on Yellow Fever, and several others.}

* In some experiments made during last summer and autumn I found that the vaccine virus, after being allowed to remain in boiling water for a short time did not on inoculation produce the usual resulting phenomena. Care was taken, as far as possible, to guard against any fallacy, as to the cause of failure which otherwise might have been thought to be due to the virus itself. The matter was kept in capillary tubes such as are recommended by D. Husband. Each of these tubes held sufficient matter to vaccinate two or three children. From six of these I posted half the matter contained and vaccinated five children. In all it succeeded. The remaining matter was placed in boiling water for a time varying from ten to fifteen minutes. From four of these tubes I now inoculated four children. At the end of the eighth day the pustule had healed in three of them and in the fourth a small pimple only had arisen which was now rapidly disappearing. At the subsequent vaccination with true virus the vesicle was formed in all. This description of which has been just given in a paper read to the Medico-Chirurgical Society.
My next endeavour shall be to point out, by a summary from the preceding pages, how far the analogy, between the action of morbid Poisons and Fermentation, extends. This I shall consider under 1. The Agents, and 2. The Fluids acted on.

The Agents. — Under this head the analogy, in composition and relations, falls to be considered.

It has been seen that, no fluid passes by itself into a state of Fermentation, but that the change is due to the action of a Ferment. This agent is animal matter or vegetable, undergoing a process of Putrefaction. On the other hand, it is confessed by Contagionists and Non-contagionists that the production of the diseases previously described, is the result of the action of certain agents generally denominated Morbid Poisons. These, I have endeavoured to demonstrate, are animal matter undergoing the process of Putrefaction. They correspond then in composition. The agent cannot excite in the fluid its own peculiar action after that has been once completed. This is a truism as regards Fermentation. In regard to Morbid Poisons some few exceptions are to be met with. Scarletina and Small-pox offer examples...
of this. But, some of these cases are open to doubt, and
in others, where the recurrence has been placed beyond
doubt, the primary attack has been found to have been
unusually mild and wanting in some of the essential
characters of the disease. The agent is reproduced
in the fluid. Direct evidence is given of this in the
exanthematicous diseases and in fermentation. The
agents are acted on by the same modifying causes in
a similar manner. I have already shown that heat
holds the same power over the vaccine virus as over the
ferment. Bateman says that heat alone is capable
of destroying contagious matter. The Plague virus
is no doubt, influenced in a similar manner as the
vaccine virus; for it does not act except within certain
limits of temperature. Certain substances
having the power to arrest the action of the ferment
as Mineral acids, Chlorine gas, Boracic sublimated, etc.,
possess a similar power over the contagious agent.
Mineral acids could not be administered in sufficient
quantity to arrest the disease, without danger to the
patient; but it is known that they are very efficacious
in preventing the spread of contagion. Chlorine
water has been found very serviceable in preventing

Bateman on Epidemics. On Contagion.
and arresting the tendency to putridity in scarlatina and other diseases of this class. Corrosive sublimate is also antagonistic to the action of the Morbid poison in the system. All these substances, with many others, as Sulphurous and Arsenious acids, which prevent the action of the ferment, also, on addition to those poisons which exist in a tangible form, prevent the development of their action in the body. Exposure to a moist, warm atmosphere, for a time, causes these agents to lose their power. When exposed to a dry atmosphere they retain this power for some time. This is not inconsistent, with what has been formerly stated; for on being exposed to a warm moist atmosphere the purifying change is accelerated and therefore they act more readily, when fresh, but soon lose their power. The contrary, of course, will be true of a dry atmosphere. True ventilation is serviceable in preventing the action of the Contagious effluvia. It is well known that in Fever wards, where a number of patients suffering under contagious fever are placed together, the contagious effluvia act with more violence than when the more beneficial arrangement, of placing three or four in a general ward, is practiced. * May Christian in Monthly Journal of Medical Science.
not this be explained on the principle above enunci-
ated? The contagious effluvia have free access to the
warm atmosphere of the ward, which always contains
some moisture, and thus more quickly lose their
power. Contact with alcohol prevents the
action of these poisons. Empyreumatic oils, smoke
and a decoction of coffee exercise the same influence.
All these substances retard fermentation and when
present in sufficient quantity annihilate the power
of the ferment to excite this change.

2. The Fluids acted on. The fluids acted on are
of unstable equilibrium and are rendered more stable
under the given circumstances by the action induced
by these agents. It has been already seen that
an individual is readily susceptible of the contagious
influence and that the blood is the part to which
its action is chiefly directed. Some change is
thereby affected in the blood which is rendered
incapable of again receiving the action. The blood

is also at all times readily affected by external causes. For example in passing through the lungs, where it comes in contact with the air, it parts with its Carbonic acid and receives oxygen, its colour meanwhile being sensibly altered. This does not affect the whole constituents of the blood, and in the same manner the contagious agent may only affect some part. Fermentation, it is generally admitted, is only excited in compounds of unstable equilibrium which under the given circumstances become more stable. The fermentable fluid is incapable of again undergoing the peculiar action which has just been completed. External causes manifest a similar influence on the fluids in relation to the agents. Increase or diminution of temperature affects the products of the action in each case. In confirmation of this as regards disease, I need only quote the results of the method of treatment formerly pursued for smallpox. The patient was confined in a hot room, with blankets, whose weight was even inconvenient, heaped upon him. Hot drinks were administered frequently, and everything cooling strictly prohibited. Heat was called for by the Medical
man, cold by his patient, who being generally overruled, paid the penalty. A disease commencing mildly, with every prospect of a safe termination, was thus converted into one of the confluent kind in its most malignant form. Mr. Rouyer states that epidemic measles are mild in temperate climates, but in warm or cold climates are generally fatal. Yellow Fever although not a disease included in the class under question may be taken as an illustration. This disease has been a bone of contention among medical men for nearly a century. Arguments and negative facts have been advanced to demonstrate its non-contagious character, and, when a comfortable belief in this has just been realised, arguments supported by conclusive facts are poured in on the contrary to prove its contagious nature. Not one of the writers on this subject, that I have consulted, except Mr. Blane, has taken into consideration the influence of temperature. He asserts that, although sporadic cases may occur, it is never epidemic below the temperature 70°. May its contagious nature then not be developed with the increase of temperature?

Mr. Rouyer Maladies de la Peau. * Medical lecturer Select Dissertations
A naval surgeon, who has had some experience of this disease, assures me that it was almost certain death to some, unprotected, in contact with a patient when the thermometer stood at its greatest height, and that the danger diminished in proportion to the fall in temperature. Dr. R. Dundas considers the intermittent and remittent fevers of the tropics to be identical with the Typhus of this country. Dr. Charles W. Bell has attempted to shew the identity of the intermittent fever of Persia with the Typhus of this country. I have formerly shewn Page 19.* 10 that heat exercises a modifying influence over the products of Fermentation. Different forms of contagious disease may occur in the same individual at the same time. Mr. Manson relates a case where Small-pox and Scarletina occurred in the same individual at the same time.* 2 Dr. Patrick Russell relates two cases of Small-pox and Measles also occurring under similar circumstances. If a mixture of variolous and vaccine matter be inoculated the two diseases may occur the one slightly modifying the other. Dr. Henderson relates

* Lancet 1847. 1 Transactions of Society for improvement of medical and surgical knowledge 1820.
A case of a child vaccinated on a Saturday in whom the usual course of the Vaccinia was pure, yet, on the Sunday, week, the eruption of Small-pox made its appearance. The child had been, no doubt, infected with the variolous poison previous to the vaccination. On this case Dr. Henderson grounds an objection to the theory advocated; observing that if it were true, either the variolous or the vaccine matter would not have produced its effects. Now it is evident that the two poisons were acting in the system at the same time, though the eruptions were not coexistent, it may be from the variation in the latent periods.

It has been previously stated that two or more forms of Fermentation may exist in the same fluid at the same time. The different forms of Fermentation sometimes, also, from the increase of temperature, to merge into each other as to be only distinguishable in their results. In the epidemic which occurred at Bussorah in 1773, great difficulty, was experienced in distinguishing Remittent fever from Plague. The non-identity of Typhus and Typhoid fever has only been.

\[\text{Lectures on General Pathology.}\] \[\text{Transactions of the Society for Improvement of Med. and Surg. Knowledge 1820.}\]
recently demonstrated in this country. This has been pointed out previously to exist in places on the continent, where the temperature differs in any material point from our own. A certain temperature requisite for the production of contagious diseases in the same manner as for Fermentation. This is not very well marked in the case of Small-pox though it generally prevails in the Spring and Autumn. Typhus usually commences in Spring and declines in Autumn. Measles generally occur in the winter and decline as the warmer months approach. Many medical men only vaccinate in the Spring or Summer, alleging that the resulting phenomena are then more readily producible and the prophylactic power more complete. Plague never occurs at a temperature below 60°. From authentic accounts, possessed by Dr. Russel, of the epidemic that appeared at Busseolah in 1773, it is ascertained that it made its first attack in March and began to diminish in April, ceasing with the termination of that month. Sudden exposure to cold has been known to arrest the development of many contagious diseases. The exposure, taking place while the disease was progressing and the eruption present, caused the eruption.

\footnote{Dr. Jenner in the Monthly Journal of Medical Science.}
to fade rapidly, and every symptom of disease to cease for a time, but the disease recurred with great violence when the ordinary temperature was restored. The action of the Ferment requires a certain time for its development. These poisons also require time for the development of their action which has been spoken of when discussing the latent period.

From the foregoing remarks, I think it is deducible that the contagious agent, is subject to the same laws as the Ferment, agrees with it in composition, and that the general mode of its action comes under the principle of d'aplat and Brehal's formerly quoted. Also, that the Blood comes up to the general requisition of a fermentable fluid.

The subject next to be considered is of a more speculative character, yet without it the essay would be incomplete.
The part or constituent of the blood from which the morbid poison is reproduced is a subject, the consideration of which I approach with great diffidence; for very little has been written on it, and this only, conveyed in vague hints. Some have thought that the whole of the constituents of the blood are equally affected. This I deem highly improbable, for, in that case, those constituents especially destined for the nutrition of the body would be converted into poisonous compounds rendering the disease inevitably fatal sooner or later. A more probable supposition is that only one of the constituents is principally affected and the others, such as are capable of being acted on, subordinately. The blood in its normal transformations offers many analogies to this. In the change accomplished in its passage through the lungs, only one constituent is primarily affected, the others secondarily. The elimination, by the different secreting organs, of substances is another analogous instance, and these instances might be multiplied. From the consideration of them it is very natural to suppose that a substance of the nature of a morbid poison will only affect one part principally.
This again leads to the question, whether the part so acted on was originally necessary to health, and being thrown out, the blood sustains a loss or whether the results of the decay of tissues, substances which are constantly found there, are the part affected. My own opinion inclines to the latter theory; for those constituents are not normally opposed to health and only become injurious when converted into new forms unhealthful in their action, while the nutrient of the body does not suffer by their loss. These products of decay are found mostly in persons under puberty, in whom the decay of the thyrmus gland, and other organs and tissues enriches the Blood with these matters. Therefore it would naturally be expected that, at this age, there would be a greater liability to such diseases; and this is found to be borne out by experience. Of the manners of large towns there are few adults who have not passed through Measles, scarlatina and one form or another of Small pox. The mortality, as will be seen from the following tables of Mr. Watt, falls chiefly on persons under twenty.
### Deaths under Ten Years

<table>
<thead>
<tr>
<th>City</th>
<th>Measles</th>
<th>Scarletina</th>
<th>Small-pox</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edinburgh</td>
<td>92 per cent.</td>
<td>64 per cent.</td>
<td>82 per cent.</td>
</tr>
<tr>
<td>Glasgow</td>
<td>85</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td>Perth</td>
<td>92</td>
<td>63</td>
<td>87</td>
</tr>
<tr>
<td>Dundee</td>
<td>90</td>
<td>66</td>
<td>95</td>
</tr>
</tbody>
</table>

### Deaths under Twenty Years

<table>
<thead>
<tr>
<th>City</th>
<th>99</th>
<th>97</th>
<th>95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edinburgh</td>
<td>99</td>
<td>97</td>
<td>95</td>
</tr>
<tr>
<td>Glasgow</td>
<td>100</td>
<td>98</td>
<td>91</td>
</tr>
<tr>
<td>Dundee</td>
<td>100</td>
<td>95</td>
<td>94</td>
</tr>
</tbody>
</table>

### Deaths above Twenty Years

<table>
<thead>
<tr>
<th>City</th>
<th>0.09</th>
<th>1.3</th>
<th>4.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edinburgh</td>
<td>0.09</td>
<td>2.04</td>
<td>4.8</td>
</tr>
<tr>
<td>Glasgow</td>
<td>0</td>
<td>1.4</td>
<td>8</td>
</tr>
<tr>
<td>Dundee</td>
<td>0</td>
<td>4.6</td>
<td>5.1</td>
</tr>
</tbody>
</table>

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Everyone is aware that these diseases are much more fatal in adult age than in youth, therefore it is conclusive that persons under that age are those chiefly affected. It may be said that this is not a fair way of considering, because only those adults who have previously escaped the

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*Extracted from Alison's Pathology and Practice of Medicine.*
diseases, suffer from them at this age. This is allowing that those of the junior age are principally affected and that the cases which occur subsequently are exceptional. Such an argument would tell greatly in favour of this hypothesis. It seems probable then that it is from this constituent of the blood that the poison is reproduced. The general symptoms may be the result of the circulation in the system of the purulent matter thus engendered. Gendrin asserts that the blood drawn from smallpox patients exhibits a crust or buffy coat of a dirty white colour, indicative of the presence of pus, and that pus may have been circulating in the blood during this disease.

The peculiarity which caused each

virus to produce a distinct disease, cannot yet be demonstrated by chemical analysis. Thus the virus of smallpox and of vaccinia cannot be seen to differ, though each produced a disease essentially different from the other. This does not militate against the theory I advocate, for it can not be shown to what peculiar agent the sausage

Histoire anatomique des inflammations.
poison owes its power of producing a disease different from that produced by ordinary putrid meat. But it can be supposed that a different arrangement of particles exists, in the same manner as in several chemical compounds which, although possessing the same ultimate elements, possess entirely different properties. These isomeric compounds are only met with in the organic kingdom and the animal body furnishes instances of such. Thus albumen and fibrine cannot be chemically distinguished. Muller in the Proteini theory has supposed some distinction to exist, but this can not be demonstrated by analysis. When these anomalies, as it were, are to be frequently met with in the organic kingdom, animal as well as vegetable, it is not difficult to conceive that these poisons may of themselves form a group of isomeric compounds. Each may thus act on the constituent of the blood, capable of receiving their action, and reproduce from its bodies identical with themselves, without possessing any distinctive properties capable of demonstration by analysis. This hypothesis derives support from the fact that one disease, which may rather be considered the connecting link
between the contagious exanthemata and the other febrile diseases produced by noxious poisons, is often generated from apparently incongruous materials and afterwards propagated by contagion. Heldenbrand considered the cause of Typhus to be the overcharging of the air with human exhalations. Thomson held that Typhus could be produced without necessary exposure to infection. Sir J. Blane says that contaminated air is the ascertain'd cause of Typhus. Wardmaids caught Typhus from patients labouring under puerperal fever. The surgeon of the Diamond reported that, in a cruise in the West Indies, forty of the men were taken ill with Typhus fever, at a time when none of the circumstances were present which commonly produce that disease; and he thought that it probably arose from some of the men being affected with small-pox at that time. One, in whom it was confluent, died. According to the report of the same surgeon, a solitary instance of scarlet fever appeared at the same time. Many other causes have been stated to be the originators of Typhus, and most of not all of them, on just grounds.

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* On Inflammation. 1 Select Medical Dissertations. Diseases of Skins. and other works. 2 Dublin Hospital reports, vol. XIV. 3 Sir J. Blane on Infection.
It can be supposed then, that a different arrangement of the atoms takes place, during the passage of the contagious agent through the blood, rendering it readily transmissible from man to man. In the same manner as yeast, which, when rubbed on a stone till all trace of organic structure has disappeared, produces a different result from the normal yeast, so may this agent, by change into another arrangement of particles produce an entirely different disease, as seen in the report quoted. As it is probable that the volatile poison is only a higher form of development, the same arrangement of particles will generally exist in this, as in the former state.

Now the poison when thus reproduced is thrown out of the blood in another question difficult of solution. Being deposited in certain tissues, it may act there as a foreign body, and excite inflammation by which it is expelled. Why it should be deposited generally over the body in some cases, and only select certain tissues for its nidus in others, it is difficult to determine. Nor, on the other hand, can it be explained why Uric acid in gums should be only deposited in certain situations, unless
Mr. Soulman's explanation be received, that it is placed there to be out of the way of the general operations of nature. It is not contrary to experience to suppose that the poison may be deposited by exudation and act as a foreign body, thereby exciting inflammation and contributing to its own expulsion, in the same manner as a thorn would act. In the eruption of small-pox all the stages of inflammation are exhibited. At the completion of the action there is the central pus, surrounded by fibrine, and that again by the serum; and in the progress there is the true inflammation in the centre, bordered by the active congestion which gradually merges into the simple vascular excitement.

* Vide Soulman on Gout.*
The Paludal Poison is virtually the same as that of the Contagious Exanthemata. Its chief habitat is in marshy and woody districts, where it is generated by the decay of vegetable matter excited by the presence of a moist atmosphere. That the presence of moisture is essential to the generation of this poison, is exemplified in the fact, that villages, standing on dry bottoms, though bordering on marshes, are almost exempt from the diseases usually excited by it. Several illustrative facts might be related of the influence of chalk and analogous soils in preventing the spread of this poison. So its action are due the intermittent fevers, as exemplified by those of New Zealand of the back woods of America, and of the eastern counties of England; and the remittent fevers, as exemplified by the jungle fever of India, the Malignant fever of Batavia, and the simple Yellow fever of the Carribbean Islands.

The great difference between this poison and that of the Contagious Exanthemata is, that it is not communicable from one person to another, that it can not act beyond
its atmospheric range, and that being equally diffused through the air, in the district where it is generated, several individuals may be attacked at the same time; whereas the converse is true of the latter poison in all these cases. The Paludal poison is acted on by the same, external causes as the ferment in a similar manner, and, without again going over the arguments to establish this, it may be assumed that its action is developed in the blood similarly to the Contagious poison. But it remains longer in the system than the latter mentioned poison, and its resulting phenomena differ greatly from those of Contagious disease. Its action has peculiar periods of relaxation and exacerbation. Thus, according to the variation in duration of these periods, are produced the quotidain, tertian, quartan, etc., agues. The periods of recurrence are similar to a process capable of being generated in the lactic fermentation. This form of fermentation, when excited, gradually progresses until the whole of the fermenting fluid becomes acid, and then ceases. If lime be now added, to neutralise the acid, fermentation again commences and again, on reaching the acid point, ceases; and this can be often repeated.

The spleen, in diseases of the intermittent type, becomes greatly enlarged, constituting what is
termed the aque eate. Now it is known that this organ has some intimate connection with the blood, but its proper function has not yet been clearly determined. May it not act in these diseases by producing a secretion to neutralise the poison in the blood? It is well known that excessive action produces hypertrophy, and it is equally well known that the spleen gradually enlarges with the duration of the disease. The action of Quinine, when medicinally exhibited, may serve to diminish the necessity for the excessive action of the spleen, which then, as in the case of every other secreting organ, diminishes in size when the call for overexertion ceases. And this last is one of the best tests of the cessation of the disease.

Drs. Watson in speaking of Liebig’s theory, says: “Do you ask me whether I adopt it with implicit credence in its truth? I answer, “By no means.”” 

“...I entertain this theory (therefore) till a better one is found. It has this incidental merit, that it involves no risk of practical error.” Now with...
all allusion to Dr. Watson I submit, that this is not
calculated to stimulate inquiry in this direction. For
is the subject devoid of importance. For correct
views respecting it, will lead to the adoption of means
for the protection of the system, both at the time of
exposure to contagion and in the period which im-
mEDIATELY follows it, that will often be effectual in
counteracting its influence or at least in predisposing
the course of the consequent disease more mild.
For example, I do not see anything to prevent the
exposure of the clothes and bedding of those who
have died of Contagious Disease to a temperature of
212° which, if the theory advanced be correct, will
effectually destroy the Contagion, without entailing
the loss of property. Many Prophylactic medicines
may be discovered. One has already received ample
testimony to its efficacy. I allude to the action of
Belladonna in Scarlatina. Dr. P. Newbigging made
a trial of this remedy in the epidemic of Scarlatina
which occurred in this city. Sixty nine children
inmates of “Watson’s Institution” were found to have
been unaffected previously. Belladonna, in the dose of
one sixth to one fourth of a grain, according to age, twice
a day. Three new cases only, occurred in the four
subsequent days, after this time none, nor have any occurred since. Another opportunity occurred in which Dr. Newbigging was again perfectly successful in demonstrating its peculiar power. Dr. Schneeman has found Belladonna beneficial as a prophylactic in this disease. Dr. Ferton, by its use, preserved from scarlatina all the children in certain sections of the circle of Bayeux, who had not been previously attacked. Near balancies 400 cases were treated with Belladonna and not one was subsequently attacked by scarlatina. Jordan, Böttmiller, Hufeland, Thaer, Hedenn, and Lumper, bear testimony to the valuable property possessed by this medicine. Other prophylactic remedies may be discovered for other contagious diseases. Doubtless there are many articles in the Materia Medica, which need only investigation to prove them possessed of this property.

The imperfection of Organic Chemistry does not yet permit of shewing what transformations such medicines effect in the human body. But rapid strides are being made in this direction, and the day may shortly dawn when, with the

*See Lancet, September 15th 1849.*
cooperation of Pathology and Physiology, all these alterations will be rendered clear and the means by which they are affected, demonstrated.