existence of any and every degree of even organic disease of the heart.

In asthenic cases exposure for from fifteen to thirty minutes to a temperature of 115° to 120° F. in the tepidarium—the thermometer hanging three feet from the floor level—will usually induce mild but sufficient diaphoresis without distress of any kind, and may be followed by some appropriate ablution, any intense thermal or mechanical stimulation being, of course, out of the question. Even this modified form of bath is probably inadmissible in severe cases of aortic regurgitation, compound valvular lesions, dilatation from adherent pericardium, or fatty degeneration, but in simple cases of aortic and mitral stenosis and mitral regurgitation it is often beneficial in many ways.

An important subject, to which a mere cursory reference is alone possible at present, is that of the properties and uses of the so-called excitant or heating compresses—cold, wet compresses covered in such a way as to preclude evaporation. The powerful influence of their continued application, in promoting the resolution of chronic inflammations and catarrhs, the absorption of old and hardened exudations, and the relief of various neuralgic and spastic affections, is one of the best-ascertained facts, and its precise *modus operandi* one of the most interesting problems of hydrotherapy. Fortunately, however, the fact itself of the efficacy in question of this apparently trifling procedure is one which can be readily tested by any practitioner.

A few words must be devoted to the subject of the methodical drinking of cold water. As collated and in part discovered by Winternitz, the effects of this procedure may be briefly summarised as follows:

1. Immediately after the drinking of cold water the pulse-rate is lowered, probably by stimulation of the pneumogastric fibres, but soon returns to the normal.

2. The temperature falls in the stomach and also, to a noticeable degree, in the rectum, a fact which may find clinical application in inflammatory conditions of the pelvic organs; conversely, cold enemata reduce the temperature of the stomach.

3. Catabolic processes are stimulated, and there is true diuresis, the excretion of urea, as also of the other urinary constituents, being markedly increased.

4. Peristalsis and the portal circulation are stimulated, and also (in consequence, perhaps, of the latter effect) the excretion of bile.

5. Böcker has attributed to water drinking an improvement in the respiratory qualities of the red blood corpuscles.

Most of the above effects are more marked when the water taken is imbibed gradually, rather than in larger quantities at a time but with longer intervals. The value of pure water as a diuretic is perhaps hardly yet sufficiently appreciated. Dropsical effusions may sometimes be relieved by its free administration, alternated with periods of nearly complete abstinence. I would suggest also that in view of the proofs advanced by Dr. Haig of the tendency of alkalies to induce chronic uric-acidæmia, their routine administration in cases of gout and rheumatism, except, perhaps, in the hope of dissolving actual calculi, is hardly justifiable, and in pure water we possess at least one available substitute. Its power of increasing tissue waste indicates water drinking as a remedy for obesity.

What place, then, are we to assign to hydropathic procedures as a class in the modern therapeutic armamentarium? Obviously their scope is far wider than that of any individual drug. The modern renaissance of hydrotherapy was contemporaneous with the final close of the reign of authority and tradition in the healing art and the dawn of the epoch of science. A wave of therapeutic pessimism had swept over Europe, and sectarian hydropathy was the outcome of an instinctive return to first principles, a feeling that it would be necessary to begin over again and to build upon surer foundations. But Priessnitzian hydropathy was no less arbitrary and empirical than the system it pretended to supersede, and it was not until the attention of scientific observers had been secured that the extravagant claims of fanaticism were replaced by the sober assertions of reason. In France this was the case almost from the first, but it occurred later in Germany and England. Meanwhile the new science of pharmacology had stolen into being, and it began

to be perceived that the so-called rival systems were not necessarily rivals at all, but complementary factors of the one true method, their apparent antagonism being due to an imperfect understanding of their respective functions. In practice there can be no doubt that the benefits of really appropriate medication are augmented by the simultaneous employment of hydropathic procedures.

To such other elements of rational treatment as are constituted by massage, medical gymnastics, the scientific regulation of diet, æro-therapeutics, and the various electrical methods, the natural relationship of hydrotherapy is sufficiently obvious. Its amalgamation with these has already proceeded far, and is destined, probably, to proceed much further in course of the construction of that concrete and organised system which we dimly apprehend as the goal of therapeutic endeavour.

ON THE NATURE AND SIGNIFICANCE OF THE CRESCENTIC AND FLAGELLATED BODIES IN MALARIAL BLOOD.

By PATRICK MANSON, M.D., LL.D.,
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In malarial blood certain forms of a parasitic organism are invariably present, singly or in association. The bodies referred to consist principally of a pale hyaline substance with or without granules of dark pigment, and are (1) minute nucleated bodies, or spores, which are free in the blood; (2) small epi- or intracorpuseular bodies, presumed to be these spores which have become attached to or have attacked the red blood corpuscles; (3) larger intracorpuseular, pigmented, amœboid bodies; (4) sporulating intracorpuseular forms, known as "corps en rosette," or "rosette bodies"; (5) the last mentioned outside the blood corpuscles, breaking up and becoming resolved into the first mentioned or free spores; (6) intermediate forms which serve to connect these types and suggest, if not prove, that together they form a complete vital cycle.

The presence of this parasite in the blood precedes and accompanies a special type of fever; the cycle of its development coincides in the main with the cycle of the fever; and it disappears from the blood with spontaneous recovery from or cure of the fever.

The intravenous injection of blood containing this parasite into a healthy individual is followed by the multiplication of the parasite in the blood of the person inoculated, and also by the occurrence in him of the characteristic fever. On these grounds the conclusion that malarial fever is caused by this organism is justified, if not absolutely proved.

Unless in the unnatural way by direct transfusion of blood, the malaria organism and malarial disease are not directly communicable; that is to say, the malaria parasite cannot be acquired by simple proximity to or by contact with an infected individual.

Apart from communication by transfusion of blood, the malaria organism and malarial diseases can be acquired only indirectly either through the air, the water, by food, or by other unknown way.

Malaria can be acquired, and its germ is therefore present, in places where there are few or no inhabitants, and where human beings rarely reside or pass through.

These propositions are all of them fully established facts.

Considering the frequency of the presence of the malaria organism in the human body, that in malarial countries at one time or another almost every individual harbours it in his blood, that it manifestly flourishes and propagates there, it is unreasonable to suppose that its presence in the human blood is a purely accidental circumstance in the sense that it is an organism which has strayed from its proper habitat, or to suppose that being in the blood, as regards itself, it is in

any way abnormally located. On the contrary, it is reasonable to believe that it is present there as being in its *normal* habitat, in its own interests, in furtherance of its own vital necessities, and as a necessary, or perhaps alternative, condition in the evolution of its life-history as a living propagating organism.

That it can sustain itself and multiply in the blood is proved by its appearance therein in vastly increased numbers after intravenous injection of malaria blood, as well as by direct observation of the process of development and reproduction. But as it has been shown that the malaria organism is not directly communicable (in a normal way) by one individual to another, that it can be acquired in places where there is no human population, it follows that it has a second life, one outside and independent of the human body.

Provision, therefore, must be made in the biological arrangements and economy of this organism, for (1) the life inside the human body, (2) the life outside the human body, (3) for the parasite quitting the human body, and (4) for its entrance into the human body.

The life *inside* the human body is provided for by the forms and developmental changes which culminate in the rosette or sporulating form, and already described.

WHAT IS THE PROVISION MADE FOR THE LIFE OUTSIDE THE BODY?

In certain types of malarial disease, in addition to the forms of malaria parasite already mentioned, another and very different looking form is found—namely, the “crescent” form. The materials entering into the structure of this body are identical in appearance with those composing several of the previously mentioned parasitic forms—namely, a pale hyaline substance forming the matrix and particles of black pigment imbedded in this. The crescentic body, like the above-mentioned forms, with the exception of the free spores, lies inside the red blood corpuscles.

If malaria blood be observed some time after it has been withdrawn from the blood vessels, yet another form is seen—namely, the “flagellated body.”

It is important to note that the *flagellated body never appears or comes into view on the microscope field immediately after the withdrawal of the blood from the vessels of the body, but only after the blood has been on the slide for some minutes—generally not before a quarter of an hour.*

The flagellated body, therefore, cannot exist as such in the circulation, although, potentially, it must be represented there by some of the forms already described as present in freshly-drawn blood.

The flagellated body, if properly and sufficiently searched for, is to be found in all cases of malarial infection; it is, therefore, a constant feature of the parasitism.

The flagellated body has been observed to be evolved in two ways: First, from the crescentic body; second, from certain of the large intracorpuseular amoeboid bodies.

1. Under the microscope the crescentic body can be seen to develop into the flagellated body, thus: first, the crescent becomes straight, next it becomes oval, then spherical, then the centrally-collected pigment becomes arranged as a capsulated ring before being scattered through the sphere, and acquiring peculiar swarming, agitated movements; next the

sphere undergoes rapid changes of shape; finally, flagella in varying number burst through the periphery of the sphere. The flagella remain attached to the sphere for some time

by one of their extremities, like the tentacles of an octopus, and indulge in rapid, waving, and in peculiar shivering movements.

2. In those forms of malarial infection in which there are no crescents present in the blood the flagellated body can be seen to develop from certain large, pigmented, intracorpuseular forms. Such intracorpuseular forms have been seen to squeeze themselves through an invisible opening in the limiting membrane of the blood corpuscle, very much after the fashion of a leucocyte in diapedesis. When they have effected their escape in this way the pigment they contain becomes agitated, and flagella are subsequently thrown out, as in the corresponding stage of the crescent-derived flagellated body.

Shortly after the appearance of the flagella they break away from the central body and swim about as free parasites in the liquor sanguinis.

The free flagella, as the attached flagella, have two styles of movement—one a waving, undulating movement, like that of an eel in swimming, which is manifestly subservient to locomotion; the other a rapid, vibrating, shivering movement, indulged in particularly when the flagellum meets with an obstacle, as when it impinges against a blood corpuscle. During the latter movement the flagellum is in the main straight and appears to be more or less rigid.

The crescentic bodies persist in the blood for several days or weeks after the other forms of intracorpuseular bodies and the fever they are associated with have disappeared, whether spontaneously or as a consequence of the action of quinine.

Although some may present signs of degeneration, in freshly-drawn blood the crescentic body never appears as if it had undergone developmental change.

The crescentic body is not attacked by the phagocytes.

These, too, are all well-ascertained facts.

Seeing that the crescentic body is so frequent a feature in malaria blood, so persistent, and so resistant to the physiological agency for removing foreign bodies from the circulation, its presence cannot be regarded as accidental or as the result of some caprice or freak of Nature. On the contrary, the crescentic body must be regarded as in some way subservient to the interest of the organism to which it evidently belongs.

As it is not observed to undergo development in the circulating blood, its destiny cannot be the propagation of the parasite inside the human body—a requirement sufficiently secured by the rosette form of the parasite.

As the crescentic body is observed to undergo development after it has been removed from the human body, and only then, this circumstance, together with other considerations to be mentioned, points to the conclusion that the crescentic body is intended to carry on the life of the species *outside* the human body.

If this proposition be correct, then the flagellated organism which proceeds from the crescentic body is the first stage in the life of the malaria organism outside the human body, and the living moving flagella, into which it breaks up, the second stage. The central sphere, to which the flagella are at first attached and from which they are derived, must be looked on as residual.

Those intracorpuseular bodies which, in certain types of

malarial disease, on the withdrawal of the blood from the blood vessels develop into flagellated bodies are to be regarded as analogous to the crescentic bodies, and on the same grounds as bodies destined for the continuation of the species outside the human body. The flagellated organisms which proceed from them have, therefore, a similar destiny to those which proceed from the crescentic bodies.

As the malaria organism has not been found in the physiological or in pathological discharges or excretions from the human body, and as hæmorrhage is a very rare occurrence in malarial infection, it may be concluded that those forms of the parasite which have been shown to be destined for the continuation of the species outside the human body do not leave the human body in any of these ways or in such media. The crescentic body, and the analogous intracorporeal flagellated-organism-producing form, so long as they remain in the blood vessels are perfectly passive, enclosed in blood corpuscles, and manifestly incapable of spontaneously bringing about or actively conducing to their own escape from the body.

Therefore, seeing that neither the physiological arrangements of the human body, nor pathological processes, nor the inherent powers and organisation of the parasite itself provide for its escape from the human body, and seeing that such escape is necessary, some extraneous agency, such as is likely to be frequently, if not constantly, supplied in natural conditions, must come to the assistance of the parasite. What is this extraneous agent which assists the malaria organism to escape from the human body?

A similar problem presented itself to the writer many years ago in connection with the filaria of the blood—*filaria nocturna*. Like the malaria organism, the filaria is at one time of its existence parasitic and circulating in the blood. Like the malaria organism, the filaria, in order to complete its life-cycle and preserve the species, has to pass from one human being to another, and, in order to do this, has to leave the blood vessels. Like the malaria organism, the filaria is not extruded in the secretions, and pathological discharges containing it are not a normal or usual accompaniment of the parasitism. Like the malaria organism the filaria is incapable of quitting the vessels by its own efforts. As the malaria organism is enclosed in a blood corpuscle so the filaria is enclosed in a sheath—the former to escape the phagocytes, the latter to prevent its leaving the blood vessels. As the malaria organism on being removed artificially from the blood vessels commences, under certain conditions, to enter on its evolutionary cycle by first escaping from the enclosing blood corpuscle, so the filaria, under certain conditions, commences to enter on its cycle of development when it is removed artificially from the blood vessels by first escaping from its sheath.¹ In both parasites this first step in development can be brought about experimentally on the microscope slide, and in both parasites a lowering of temperature favours or is associated with the conditions which eventuate in successful experiment.

The parallel is very complete; the conditions, the requirements, and the problem to be solved are apparently identical for both parasites. As the problem and conditions are the same for both organisms, the solution of the problem may also be the same for both. If this be the case, the mosquito having been shown to be the agent by which the filaria is removed from the human blood vessels, this, or a similar suctorial insect must be the agent which removes from the human blood vessels those forms of the malaria organism which are destined to continue the existence of this organism outside the body. It must, therefore, be in this or in a similar suctorial insect or insects that the first stages of the extracorporeal life of the malaria organism are passed.

The two classes of movement indulged in by the flagella—the undulating and the vibrating—suggest that these bodies, on breaking away from the residual body or pigment-containing sphere, move in virtue of the locomotive faculty for some distance—say, traverse the blood contained in the insect's stomach—and then in virtue of the vibratory movement penetrate the cells of some organ of the insect. The malaria organism in the human body is an intracellular parasite like a gregarine or a coccidium, and it is probable

that outside the human body it retains this habit. It would be idle to attempt to follow the parasite further without the assistance of direct observations; so many possibilities are open to it once clear of the human body. It may, for all we know, comport itself like the pebrine corpuscle and continue in endless succession parasitic in the tissues and ova of the insect, then in the larva, and so again in the mature insect. This it is impossible to say. But the hypothesis I have ventured to formulate seems so well grounded that I for one, did circumstances permit, would approach its experimental demonstration with confidence. The necessary experiments cannot for obvious reasons be carried out in England, but I would commend my hypothesis to the attention of medical men in India and elsewhere, where malarial patients and suctorial insects abound.

MEMORANDA:

MEDICAL, SURGICAL, OBSTETRICAL, THERAPEUTICAL, PATHOLOGICAL, Etc.

CASE OF CHLOROSIS TREATED BY RED MARROW TABLOIDS.

THE success in a case of progressive pernicious anæmia treated by Dr. Fraser¹ with red bone marrow (raw) encouraged me to employ the same substance in the shape of tabloids in allied disorders. I quote a case which will illustrate the results I have gained.

B. H., a young lady, aged 18 years, first came under treatment on July 10th, 1894, complaining of amenorrhœa, dyspnœa, palpitation, constipation, œdema of ankles and loss of flesh. I ordered her ℞ liq. ferri ℥x, liq. arsenicalis ℥ij, aq. ad ʒj, t. d. s., and an aloin compound tabloid every other morning.

By August 2nd, 1894, the above treatment had caused but little improvement. She was still suffering from severe cephalalgia, nausea, and faintness on rising in the morning; weakness, anorexia; pallor of face and lips was marked. She was still habitually constipated, highly nervous, and the menses never more than a "show." The pulse was small, quick and sometimes irregular. There was a venous hum over the great veins and a systolic bruit at base. The red cells numbered 2,800,000 per c.cm. The hæmoglobin was 40 per cent., many of the corpuscles were irregular in shape, not many blood plaques were seen. On August 30th, 1894, after taking four red marrow "tabloids" a day the subjective symptoms and abnormal cardiac bruit had almost disappeared, she looked brighter, appetite was fair, there was no œdema of ankles, the bowels were regular, the menses almost normal. The red corpuscles numbered 3,200,000 per c.cm., very few irregularly shaped hæmocytes were seen. The hæmoglobin was 70 per cent, and the blood plaques more numerous.

The above case justifies me in recommending these agents (tabloids) in the following conditions: anæmia; oligæmia from loss of blood (wounds, hæmorrhoids, hæmoptysis, hæmatemesis, etc.); anæmia following acute diseases (typhoid, etc.); tropical anæmia (parasitic or malarial); anæmia of toxic origin; leukæmia or lieno-leukæmia (acute or chronic); and progressive pernicious anæmia.

CHARLES FORBES, M.D., etc.,

London. late Surgeon, Wassa Gold Mines, West Africa, etc.

¹ BRITISH MEDICAL JOURNAL, June 2nd, 1894, p. 1172.

A MEETING of the South Western division of the Medico-Psychological Association will be held at Bailbrook House-Bath, on Thursday next, at 3 P.M. Papers will be read by Drs. Goodall and Bristowe, and Dr. Maury Deas will open a discussion on the Uses and Limitations of Mechanical Restraint as a means of Treatment.

THE MEDICAL FACULTY OF BORDEAUX.—The Medical Faculty of Bordeaux has received from the son of a former practitioner of the town, who had exercised his profession there for more than fifty years, a donation of 100,000 francs (£4,000) towards the establishment of a Chair of Gynæcology.

¹ BRITISH MEDICAL JOURNAL, April 15th, 1893.