3. On a Hæmogregarine from the Blood of a Himalayan Lizard (*Agama tuberculata*). By E. A. Minchin, M.A., F.Z.S.

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(Plates LV. & LVI.)

The material upon which the following description is based consists of four slides, bearing smears of the blood of the common rock-lizard of the Himalayas, which were prepared and sent to me from Kasauli by Lt.-Col. F. Wyville-Thomson, I.M.S., to whom my best thanks are due for his kindness in sending me the specimens and entrusting me with the description of them. I shall refer to the slides by the letters A–D. An examination of the slides shows at once that they fall into two pairs, A and B being one pair, C and D the other. While the parasites are very similar, both as regards structure and occurrence, in both the slides of each pair, those of one pair are so different from those found in the other pair of slides that they might easily be taken for distinct species of parasites. At this distance from the habitat of the host and its parasite, and with limited material at my disposal, I can only record these differences, and cannot attempt to explain them.

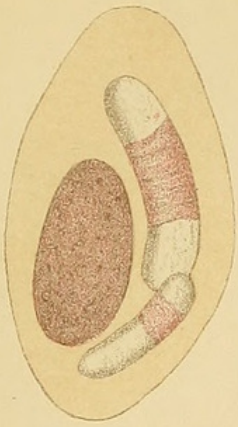
Preparation of the Slides.—Slide A, alone of the four, was sent to me unfixed; my assistant Dr. Woodcock fixed it in the usual way with methyl alcohol, and stained it for me with Giemsa's modification of the Romanowsky stain, subsequently differentiated with Unna's tannin-orange solution. The other three slides were sent to me already fixed and stained with Leishman's stain, by Lt.-Col. Wyville-Thomson. It is important to note, therefore, that, for aught I know to the contrary, slide B was prepared in the same manner as slides C and D, but in a different way from slide A; so that the resemblances and differences, presently to be described, exhibited by the four slides, cannot be ascribed to like or unlike methods of preparation in each case. The only differences that can be attributed to the action of the stains used are, that in slide A the ground-colour of the red blood-corpuscles is lighter and more yellowish in tint, in B, C, and D darker and more greyish, and that in slide A the nuclei of the red blood-corpuscles and of the parasites scarcely differ in tint, but in B, C, and D the nuclei of the red blood-corpuscles have a distinctly purplish tinge, while the nuclei of the parasites show a more pronounced red colour.

Description of the Parasite.—In all the slides there are to be found both intra-corpuscular forms and free forms, so-called vermicules. The free forms are sufficiently similar to the largest intra-corpuscular forms to warrant the assumption that they have escaped from the corpuscle, and I have twice found parasites apparently in the act of escaping from the corpuscle (Pl. LV. fig. 9).

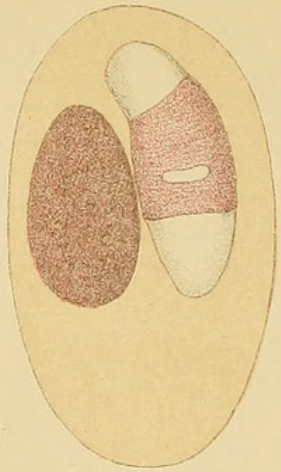
E.A.M. ad nat. del.

West, Newman chr.

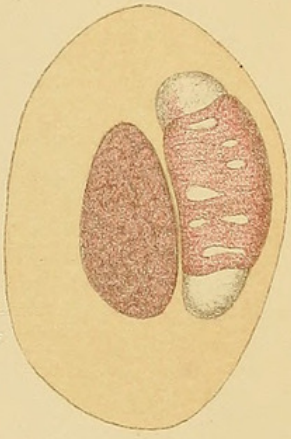
HÆMOGREGARINE OF AGAMA TUBERCULATA *x 2000.*



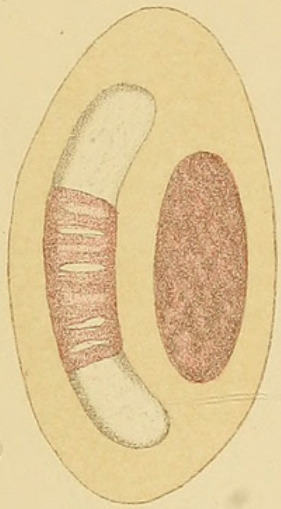
16



17



18



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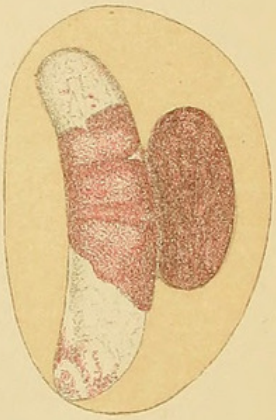

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E.A.M. ad nat. del.

West, Newman chr.

HÆMOGREGARINE OF AGAMA TUBERCULATA *x 2000.*

The intra-corpuscular forms, in their youngest stages, are placed at the side of the nucleus of the blood-corpuscle, which is then normal in appearance, with the nucleus occupying its proper central position. When the parasite is full-grown, however, the nucleus of the corpuscle is more or less pushed to one side, and may become somewhat irregular in outline; but in no case have I seen the corpuscular nucleus at all broken up, as is known to occur in many cases of reptilian hæmogregarines, hence classed by some authors as a distinct genus *Karyolysus*. I have observed, however, a peculiar relation between the shape of the parasite and the displacement of the corpuscular nucleus. The intra-corpuscular parasite is always distinctly sausage-shaped, and slightly bowed in the plane of the corpuscle. It is reasonable to attribute this curvature to the fact that the parasite, being situated to the side of the corpuscular nucleus, accommodates itself to the space in which it lies (compare figs. 5 & 6, Pl. LV.). We may speak of this as the normal curve of the parasite. But in a few cases we find the curve of the parasite entirely reversed, and its convexity turned towards the nucleus of the corpuscle (Pl. LV. fig. 8, Pl. LVI. figs. 20, 21). In such cases two points are noticeable: first, that the parasites resemble the free forms very closely; secondly, that the corpuscular nucleus is much more displaced than usual, being sometimes pressed quite against the side of the corpuscle (figs. 8 & 20). This point has also been noticed by Lt.-Col. Wyville-Thomson, who has sent me four sketches of the parasite, representing one free and three intra-corpuscular forms: two of the latter show the normal curvature of the parasite, like my fig. 19 on Pl. LVI.; the third, however, shows a reversed curve, with the nucleus of the corpuscle pushed far to the side, as in my fig. 20. I think we shall not be far wrong in attributing these cases of reversed curvature to the commencing activity of a parasite about to become free from the corpuscle, in which the movements of the contractile body not only alter its curvature, but also may have the effect of forcing the nucleus of the corpuscle away to one side.

I will now proceed to describe the structure of the parasite in more detail. Beginning with slides A and B, we find forms of the parasite which may be classified as young intra-corpuscular forms, full-grown intra-corpuscular forms, and free forms or vermicules.

The young intra-corpuscular forms (Pl. LV. figs. 1–5) vary in length from about $\frac{1}{2}$–$\frac{2}{3}$ of the blood-corpuscle; *i. e.*, from about 9–11 μ in length *. They were remarkable in two points: first, their very clear cytoplasm, hyaline and free from granulations, so that they often have the appearance of a space in the blood-corpuscle; and, secondly, their delicate nucleus, which appears to consist of faintly-staining granules and strands of chromatin,

* Since all the figures which accompany this memoir are drawn to a magnification of 2000 linear, it follows that a length of 2 mm. in the drawings corresponds to an actual length of 1 μ in the objects.

forming, so to speak, a band round the waist of the parasite; in many cases, however, it is an "Empire" waist, placed much nearer one end of the body than the other. As I have laboured to reproduce the appearance of the objects in my illustrations, I need not enter into longer descriptions. While, as is shown, some parasites have slightly more chromatin than others, there is nothing that can be said to be in the least transitional to the forms next to be described.

The full-grown intra-corpuscular parasites are at least $\frac{3}{4}$ the length of the blood-corpuscle, *i. e.* about 15–17 μ in length by about 5 μ in breadth. They contrast sharply with the young forms in the characters both of the body and nucleus, but especially the latter (Pl. LV. figs. 6–8). The body appears distinctly contoured and shaded, standing well off from the blood-corpuscle; it sometimes lies in a distinct clear space (figs. 6 & 7), but I could not make out anything of the nature of a capsule surrounding it. The cytoplasm is finely granular and takes a distinct bluish stain; only in one instance did I observe in the cytoplasm what appeared to be a grain of chromatin distinct from the nucleus, in a parasite which appeared to be ripe for escape from the corpuscle (fig. 8). But the nucleus is the most remarkable feature of the parasite at this stage, as compared with the forms described in the preceding paragraph; it is exceedingly rich in chromatin, which forms a deeply staining mass of irregularly spongy texture, occupying the middle region of the body for practically its whole width and nearly one-third of its length. Here, again, I must leave my illustrations to speak for themselves; I think they make the contrast between the young and old forms of the parasite sufficiently plain.

Of the free vermicules, it can be said that they resemble closely the full-grown intra-corpuscular forms. Their principal variations of form and structure are shown on Pl. LV. figs. 10–15; we can distinguish in a general way stumpy forms (fig. 10), medium forms (figs. 11–13), and long forms (figs. 14, 15), the last-named being by far the most abundant. One end of the body is always slightly clubbed, and the nucleus may be nearer to the stouter end, or to the narrower end, or to the middle of the body. The nucleus shows the same spongy structure described above for the intra-corpuscular parasites; it may vary in texture from a coarse to a more finely-knitted texture. Only in one case did I observe a tendency for the chromatin to take the form of more or less distinct masses (fig. 13).

I have figured (Pl. LV. fig. 9) one of the two cases in which I found the vermicule in the act, apparently, of escaping from the corpuscle. But even after examining the preparation by the aid of different objectives and various methods of illumination, I was not able to make up my mind exactly as to how the appearances seen should be interpreted in some points. My impression is that the projecting extremity of the parasite is rounded off, and that the conical pointed end seen in my figure represents something of