and figured an earthworm six feet two inches in length, which was obtained from the neighbourhood of Port Elizabeth, but since that time there does not appear to have been any further description of the animal. Being anxious to secure a specimen for dissection, I applied to the Rev. G. R. Fisk, who most kindly sent me a living one; it is the same species as that described by Rapp, but is not quite so large; it measured between four and five feet in length, and about half an inch in diameter; these measurements are, however, rather under than over-stated; it is not easy to get an exact idea of the length of the animal, since it expands and contracts within such very wide limits. The general appearance is much like that of the common British species, the bristles being disposed in four series of pairs to each segment; this outward resemblance is not borne out by the internal structure, which is very different from that of *Lumbricus* or any other genus.

These monstrous worms appear to be fairly abundant in the neighbourhood of Port Elizabeth and other parts of the Cape Colony (see the *Cape Times* for May 29, 1884), but are only rarely seen; they do not seem to move about at night like our British worms; only heavy and prolonged rains drive them to the surface from their underground burrows; on such occasions, as I am informed by a correspondent at Kleinpoort, which only take place a few times a year, the ground is often covered by hundreds of these creatures slowly crawling about in all directions; they must present a most remarkable sight; as a general rule they do not return into the earth after the rain has ceased, but remain above ground, and are shortly killed by the sun. The same gentleman states that the soil in which he has observed them is of a hard clayey nature, and retains a considerable amount of water, which is invariably brackish. This fact has some significance in connection with the geographical distribution of earthworms. It was formerly believed that earthworms and their eggs were killed by immersion in salt water, and consequently the presence of similar or closely-allied species in two regions now separated by the sea would be a strong indication of a previous land connection, setting aside, of course, those cases evidently due to man's interference (*i.e.* the importation of earthworms from tropical countries among the roots of plants). The fact that this earthworm from the Cape, and presumably its eggs, are unaffected by brackish water, and still more the occurrence of another genus, *Pontodrilus* (cf. Perrier, *Arch. de Zool. Exp.*, t. ix.), among decaying seaweed cast up by the sea, shows plainly that the greatest caution must be observed in drawing any such conclusions.

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THE ACTION OF AMMONIA UPON SOME LEPIDOPTEROUS PIGMENTS

TWO or three years back, some entomological friends induced me to kill all my insects with ammonia, instead of employing potassium cyanide, and I have never regretted the change I then made. Nearly the first species so treated was *Melanargia galathea*, and on opening the pill-boxes I was much surprised to find every one of them of a beautiful primrose-yellow colour. In a few moments the primrose-yellow had vanished and the insects were of their normal white again. Evidently this phenomenon was due to the volatile ammonia, so I held a specimen over the bottle, and instantly the primrose colour returned, only to disappear again with the departure of the pungent ammoniacal fumes. The reagent employed was a saturated aqueous solution of ammonia, and the black pigment of the wings remained unchanged throughout. Now here was something of great interest and well worth investigation, so I determined to follow it up, and since that time have never lost an opportunity for experiment or study. Many of my friends are now familiar with the results obtained, but as they appeared to be previously unknown to all those with whom I have communicated on the subject, I have thought it best to place them on record. They may be well known and authenticated, but to ascertain this a careful search through the vast mass of the chemical and microscopical literature both of this country and the Continent would be required, and for this my spare time is quite inadequate. I must therefore crave the indulgence of those who may be familiar with the facts herein recorded. Naturally, the first species selected for experiment was *Melanargia galathea*. As before, ammonia gave the primrose coloration. The next reagent employed was a solution of potassium hydrate, in which pieces of the wing were placed, and they immediately turned yellow. Other alkalis, such as solutions of sodium hydrate and barium hydrate, were tried, and gave similar results, the only difference being that with the fixed alkalis the primrose coloration was permanent, whereas with ammonia it was necessarily fleeting.

As alkali turned the pigment yellow, acids I thought might prevent this, or even produce another colour. Accordingly the wings were treated with a great many acids, the chief being sulphuric, nitric, sulphurous, hydrochloric, phosphoric, and acetic. With all these, when used in excess of the alkali, the pigment was restored to its natural white colour. I also found, that whenever the liquid employed was exactly neutral to both red and blue litmus, the pigment remained unchanged, whilst the slightest addition of alkali produced the primrose-yellow, and when acid predominated the normal colour prevailed. Thus, we see, this pigment is a good test for alkalinity.

To enumerate all the species experimented upon would occupy too much space, so I will only give the most important. As some Continental species are mentioned, I have followed Staudinger's arrangement. *Papilio machaon* and other Papilios were unchanged, and the same may be said of the genus *Thais*. *Parnassius apollo*, *P. delius*, and *P. mnemosyne* turned a pale yellow. With such semi-transparent species a deeper coloration could not be expected, from the small amount of pigment present.

None of the species of *Aporia*, *Pieris*, or *Anthocharis* showed any alteration with ammonia, but *Leucophasia sinapis* and its vars. *lathyri*, &c., exhibited a delicate primrose colour. Not a single species in *Colias*, *Rhodocera*, *Thecla*, or *Polyommatus* was changed; but the behaviour of the species of *Lycæna* was extremely curious and somewhat unexpected. *L. argiades*, *L. argiolus*, *minima* (= *alsus*), *semiargus* (= *acis*), *alcon*, *arion*, and *euphemus* remained unaltered. *L. bætica*, *argyrotoxus* (= *ægon*), *argus*, *opilete*, *orbitulus*, *eros*, *icarus* (= *alexis*), *eumedon*, *amanda*, *bellargus* (= *adonis*), *meleager*, *jolas*, and especially *astrarche* (= *agestis*), *corydon*, and *damon* were beautifully suffused with primrose on the under side and cilia, wherever the white pigment occurs. It is difficult to say why some of the species in this genus are unaffected, whilst others exhibit the most gorgeous colouring; but in the case of *L. argiolus*, at least, this may be accounted for. The pale bluish white of the under side is not the result of white pigment at all, but is due to reflected light from the almost pigmentless scales, in which a change could not be looked for. All the species which were examined in *Nemeobius*, *Charaxes*, *Apatura*, *Limenitis*, *Vanessa*, *Melitæa*, and *Argynnis* exhibited no change. In the Satyridæ, besides *Melanargia*, *Œnis ælla* is clearly suffused with primrose beneath. In *Satyrus*, *S. circe* and *S. briseis* have the white bands changed, but *S. alcyone* and *S. semele* are not affected. *Erebia* and *Pararge* are alike unchanged. *Cœnonympha hero*, *C. arcania* (and vars.), *C. pamphilus*, and *typhon* (= *davus*), have the cilia and under side deeply suffused with yellow. Of the Hesperidæ, *Spilothyrus alceæ*, *Syrichthus alveolus*, *S. serratulæ*, and *malvæ* (= *alveolus*), all have the whites changed to primrose, but *Nisoniades*, *Hesperia*, and *Carterocephalus* are not affected.

With the *Heterocera* I have obtained but negative results, although the number of species operated upon are to be counted by hundreds. It would be unsafe to generalise with such scanty data to go upon, but a few remarks may be ventured. The white pigmentary deposits of *Pieris* and *Melanargia*, although to the eye the same, must have a very different chemical constitution, and at one time I thought the negative ammonia results would be a good character of the Pieridæ, in contradistinction to *Melanargia*, &c.; but facts would not support this speculation, for *Leucophasia* proved refractory, and the Satyridæ gave results by no means uniform. Many more experiments must be performed. Nature must be thoughtfully questioned again and again before we can possess a firm basis for speculation.

Hitherto changes of colour only have been dealt with, and few reagents employed, but by recent experiments on the solubility of the various pigments in different media, most interesting facts have been brought to light, which in the future I hope to communicate. What a wonderful and lovely sight is the under side of *Vanessa atalanta!* It has at least a dozen shades of colour, most exquisitely mingled. Some day these colours will be analysed and their constitution made known. The results herein recorded may then be of service.

GEORGE COVERDALE

24, Fleming Road, Lorrimore Square, S.E., August 16