

The acid thus obtained had all the properties of ψ -opianic acid obtained by Perkin. For confirmation of its identity it was reduced to ψ -meconine m.p. 124, and also converted into its oxime, m.p. 124 and hemipinimide. The mixed melting point of these derivatives with the corresponding authentic specimens caused no depression.

The oxidation of several other homophthalic acids to the corresponding phthalonic acids by means of Selenium dioxide has also been studied. In every case an excellent yield of the phthalonic acid is obtained. Homophthalic acids being readily available substances, this new method of synthesis should prove to be a valuable one.

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May 2, 1934.

Changes in the Charge on Colloidal Particles during Dialysis of Sols.

IN papers* published from our laboratory we have put forward the view, on the basis of experimental evidence, that a colloidal solution when subjected to dialysis will show first an increase and then a decrease or a continuous decrease in the cataphoretic speed according as the amount of the peptising electrolyte initially present is more, or equal to or less than the amount corresponding to the maximum in the cataphoretic speed-concentration curve of that sol with the particular (peptising) electrolyte. Colloidal solutions of gold, ferric hydroxide and thorium hydroxide have been found to conform to this behaviour. S. G. Chaudhury† has also observed in the case of colloidal solution of copper ferrocyanide containing very high concentrations of potassium ferrocyanide that with the progress of dialysis the cataphoretic speed first increases and reaches a maximum after which it decreases.

We have been investigating other colloidal solutions from the point of view stated above and have observed that the prussian blue sol (peptised with oxalic acid solution) when subjected to dialysis shows a behaviour similar to the colloidal solutions of gold, ferric hydroxide, thorium hydroxide and

copper ferrocyanide. In the case of arsenious sulphide, however, on subjecting the sol to dialysis, the cataphoretic speed first decreases and reaches a minimum, then increases and reaches a maximum and afterwards again decreases. The sol was so prepared that it did not contain initially any free arsenious acid. The dialysis was carried out in a dark place to avoid effect of light on the sol. On analysing the various samples of the sol used in cataphoretic speed determinations, it was found that the amount of arsenious acid increased with the progress of dialysis till the cataphoretic speed decreased; after the minimum value of cataphoretic speed was reached the amount of arsenious acid began to decrease, apparently due to further hydrolysis stopping and arsenious acid passing out in the dialysate. S. N. Mukherjee‡ has observed that the cataphoretic speed of arsenious sulphide decreases on the addition of arsenious oxide to the sol. The initial decrease in the cataphoretic speed with an increase in the amount of arsenious acid due to hydrolysis of the sol noticed by us therefore agrees with the observations of S. N. Mukherjee. The subsequent increase in the cataphoretic speed may be due to a decrease in the amount of arsenious acid as well as the peptising sulphid-ions and hydrosulphid-ions and the final decrease due to a considerable decrease in the amount of the peptising ions. Detailed results will be published elsewhere in due course.

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Development of Vertebral Column in Fishes.

PROF. MACBRIDE¹ reviewing my work² on the "Development of the Vertebral Column in Fish" expressed a doubt as to the correctness of my view in regard to the origin of the zygapophyses in the fish. He wrote: "Ramanujam describes these (the zygapophyses) as vertical outgrowths of the 'outer

‡ S. N. Mukherjee, *Kolloid Z.*, **53**, 159, 1930.

¹ MacBride, E. W., "Recent Work on the Development of the Vertebral Column," *Biological Reviews*, Cambridge, **VII**, 1932, pp. 108-148.

² Ramanujam, S. G. M., "The Study of the Development of the Vertebral Column in Teleosts, etc.," *Proc. Zool. Soc.*, 1929, pp. 365-414.

* Desai, Nabar and Barve, *J. Ind. Chem. Soc.*, **9**, 463, 1932; Desai and Borkar, *Trans. Faraday Soc.*, **29**, 1269, 1933; and B. N. Desai and A. K. Desai, *ibid.*, **30**, 265, 1934.

† S. G. Chaudhury, *J. Ind. Chem. Soc.*, **10**, 431, 1933.

bony ring', *i.e.*, the perichordal centra 'formed directly from connective tissue' and later he states that the basi-dorsals of each segment is connected with its zygapophyses by a 'bony ridge'. The whole matter requires re-examination and restatement. The strong probability is that Ramanujam is mistaken as to the origin of the zygapophyses. If, as seems probable, they are formed as extensions of the supradorsals then these pieces will correspond to the so-called 'dorsal inter-dorsals' of the higher forms." (pp. 120-121.)

A re-examination of my preparations only served to confirm me in my views. I was therefore glad to receive a communication a little later from Prof. MacBride confirming my view. As it is of zoological interest, I give below the relevant portion of his letter:

"We have found that you are quite right about the zygapophyses which you described as outgrowths from the centra. This is true and in my judgment these outgrowths are the missing intercalaria. They have nothing whatever to do with the zygapophyses of the higher forms which are outgrowths from the arches and correspond to what Prof. Piiper called the dorsal inter-dorsals. This is a remarkable example of parallel evolution and one which I did not expect to find."

I am afraid I have also to adhere to my view that the paired cartilages adhering to the inner sides of the basi-dorsals and supporting the dorsal longitudinal ligament are probably equivalent to the supradorsals of other forms, a view which Prof. MacBride regards as requiring further investigation. (p. 120.) Their unusual position has naturally given room to some scepticism as to the correctness of my view. This unusual position is due to the enormous development, dorsal to the spinal cord, of a longitudinal ligament which is rarely so well developed, if at all, in most other forms. This has necessitated a structure to separate and protect the spinal cord from the dorsal longitudinal ligament. This need has been met by the supradorsals which in higher forms form the neural spine being shifted to a more ventral position and the basidorsals themselves being continued up, instead, to form the spine. The supra-dorsals shifted to a more ventral position still form the roof—a protecting roof—for the soft spinal cord as in other and higher forms. At the same time, they serve as props on which the enormously developed ligament rests. The supra-dorsals

which in higher forms, *e.g.*, Amphibia, are single and median retain here in *Clupea* the primitive paired condition. It will be noted that the neural cavity which in most forms is single is here in *Clupea* divided into two channels—an upper vertebral channel enclosing the ligament and a lower larger canal enclosing the spinal cord—by the development of these paired cartilages inner to the basi-dorsals and at the level between the ligament and the spinal cord.

More recently, Mookerjee³ has sought to question the accuracy of my observations on the development of the intervertebral ligament, as they do not coincide with his observations in *Ophiocephalus*. *Ophiocephalus* is a specialised form and as I pointed out at the commencement of my paper,² the interest of my investigation lay in the fact that I took a generalised form which naturally has shown conditions more primitive and of phylogenetic importance than the work of previous authors which, like Mookerjee's observations now on *Ophiocephalus* were all on specialised forms which have "relatively large eggs and shortened development¹".

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May 14, 1934.

Vitamin B₂ and a New Flavin in Ox-Kidney Extracts.

DURING recent years we have been trying to get a highly concentrated preparation of Vitamin B₂ from ox-liver and ox-kidney.* Meanwhile, R. Kuhn *et al*† (*cf.* also Ellinger and Koschara‡) have succeeded in the isolation of two water-soluble, crystalline pigments, which they have termed ovoidflavin and lactoflavin, from egg-white and whey respectively. These are yellow-red substances, exhibiting strong green fluorescence in aqueous and acid solutions and are said to be the most active preparations of Vitamin

² Mookerjee, H. K., "On the Development of the Intervertebral Ligament in Teleostean Fishes," *Curr. Sci.*, pp. 342-343, 1934.

* Guha, *Biochem. J.*, **25**, 945, 1931; Guha and Chakravorty, *Ind. J. Med. Res.*, **21**, 211, 1932; Guha and Chakravorty, *J. Ind. Chem. Soc.*, **11**, 295, 1934.

† *Ber.*, **66B**, 576, 1034, 1950 (1933).

‡ *Ber.*, **66B**, 808, 1933.