

deals with necessarily variable material. Mineralogy and petrology are concerned with minerals which normally possess definite chemical compositions. The mineralogist would indeed be faced with the biological problem if his minerals were always members of isomorphous series, vastly more numerous than they actually are, and if they changed composition from horizon to horizon throughout the succession.

The palaeontologist is necessarily at a disadvantage as compared with the student of living material where the species concept is concerned. The biologist can test a questionable case whereas the palaeontologist can but judge the taxonomic value of observable characters.

It seems improbable that geological science will ever become popular, but better early education in general science, revision of university curricula and more flexible teaching at the university stage would do much to satisfy any future demand for geologists. Additionally, it would seem advisable to establish a Central Bureau of Geological Research, where research could be registered to obviate wasteful overlapping, and to which workers contemplating original views or institution of new names could state their reasons before publication is allowed.

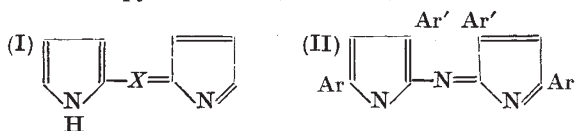
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<sup>1</sup> NATURE, 151, 294 (1943).

### Tetra-arylazadipyrrromethines: a New Class of Synthetic Colouring Matter

WHEN two resonant systems can be linked by a methine bridge to form a single degenerate system, it is usually found that the methine bridge can be replaced by a bridge consisting of a single nitrogen atom, the resulting *aza* compound being at least as stable as the methine itself; the progressive replacement of the methine bridges in the porphins to form *aza*-porphins, and finally phthalocyanines, being an interesting example. It is therefore surprising that, despite the numerous examples of the class 5:5'-dipyrrromethine (I, X = CH), there is no record of a 5:5'-*aza*-dipyrrromethine (I, X = N).



Examples of this class of compound have now been made, the pyrrole rings being substituted by aryl radicals in the 2:4-positions (II). Two general methods have been used. In the first, the 2:4-diarylpyrroles (made by dehydrogenation of the pyrrolines, methods of preparing which are described in the literature) were converted into their 5-nitroso compounds, which condensed readily with the  $\alpha$ -position of a second molecule of the pyrrole. The second method is a very remarkable one, the *aza*-methine being obtained by the action of formamide, or certain other simple ammonia-donating substances, on compounds of the type:

$\text{ArCH}(\text{CH}_2\text{NO}_2)\text{CH}_2\text{COAr}'$  or  $\text{ArCH}(\text{CN})\text{CH}_2\text{COAr}'$ . The reaction is complex, but some insight has been obtained as to the steps involved, which will be published elsewhere with the full details of this work<sup>1</sup>.

The *aza*-dipyrrromethines fulfil expectations as to

colour and stability. The simplest member of the series which has been made is 2:2':4:4'-tetraphenyl-*aza*-dipyrrromethine (II, Ar = Ar' = Ph), an intensely blue compound which sublimes with but little decomposition when heated in air, and with no decomposition when heated *in vacuo*. The *aza*-methines form metallic complexes analogous to those formed by the true methines, including 2:2':4:4'-tetraphenylidipyrrromethine itself, which is, as would be expected, red.

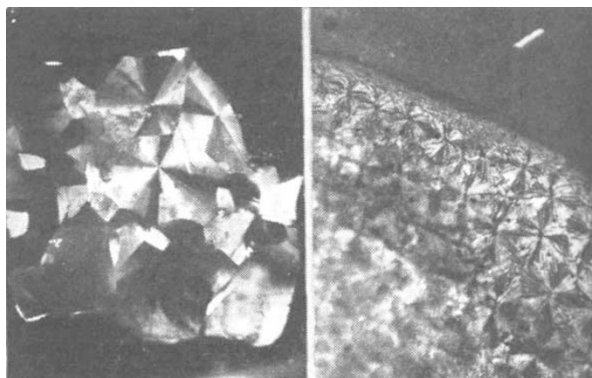
My thanks are due to I.C.I. (Dyestuffs), Ltd., for permission to publish this letter.

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<sup>1</sup> Patent applications pending.

### Occurrence of Crystals in the Skin of Amphipoda

THE difficulty in distinguishing some of the species of Amphipoda suggested that some means other than the usual ones of comparison of parts might be tried; after trying various chemical and physical tests I examined the skins in polarized light. The results achieved seemed at first sight to indicate that the method might be of considerable value. Unfortunately it was not found possible to separate species by this method.



Crystal development in the skin of *Leucothoe spinicarpa*.  
(a) Crystals at posterior end of body 5 min. after moulting;  
(b) Arborescent pattern.

In general, the Amphipoda load their skins with crystals of calcium carbonate, which is laid down in the form of radiating needles. These crystals do not always give the same effect in polarized light so that it is possible to separate some families thereby, for example, the Gammaridæ and the Leucothoidæ. The crystals in the skin of the former between crossed Nicols show alternate dark and light wedges meeting at their apices (Fig. a). In the latter, the dark and light wedges are broken up into an arborescent pattern of dark and light lines (Fig. b).

More surprising still is the fact that though crystals are found in the skin of Gammaridæ taken from such extremes of environment as the sea and water of pH 4.8 (as in Lough Sure, Donegal), the Talitridæ contain no crystals at all, yet many of them live under conditions apparently similar to those of the gammarids.