

ates the structure (III), which would have a spectrum similar to that of diphenyl³. The structure (II) is eliminated because it contains a 1,2,4-substituted benzene ring, which would be expected to have the long wave-length band at about 2790 Å. (ref. 4). Since (I) consists of two tetralin nuclei it should have peaks at positions almost identical with those of tetralin, with about twice the intensity of the tetralin peaks. For comparison, values for tetralin are 2734 Å., $E = 625$; 2662 Å., $E = 537$; 2618 Å., $E = 370$.

The structure (I) was substantiated by dichromate oxidation of the hydrocarbon, which gave only phthalic acid; by nuclear magnetic resonance spectroscopy (aliphatic H/aromatic H, calcd., 1.75; found, 1.8; aliphatic H_a/aliphatic H_β, calcd., 1.33; found, 1.4); and by the infra-red spectrum (absorption maxima at 5.15, 5.22, 5.30, 5.45, 5.53, 5.57, 12.25, 13.36 and 13.52 μ) which is consistent only with (I) (ref. 5).

The structure (I) could exist in both a meso and a racemic form, but only one compound was actually isolated; hence some step in the reaction sequence which fixes the configuration of the product must be stereospecific.

The reaction is under investigation to find other systems which will give dimeric products. Anthracene and phenanthrene have been reduced, but no dinuclear materials have been found. It is of interest that electrolytic reduction of phenanthrene yields 9,10,9',10'-tetrahydro-9,9'-diphenanthryl, but no dinuclear product is obtained by electrolytic reduction of naphthalene⁶. On the other hand, we have found (Sternberg, H. W., Delle Donne, C. L., Reggel, L., and Wender, I., unpublished work) that lithium-ethylene-diamine reduction of naphthalene at 15° gives about 30 per cent of dimeric reduction products, the structures of which have not yet been determined.

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Ionization Potential and Molecular Complex of Benzothiazol with Iodine

THE three aromatic molecules benzophenone, indol and benzothiazol should act as electron donors and, as such, should favour the formation of molecular complexes with electron acceptors such as the halogens¹. A spectroscopic investigation of such a possible effect between these molecules and iodine was therefore undertaken and we briefly report the results here.

For benzophenone and indol, no changes in the spectra of solutions of these compounds were noticed

when adding iodine (solvents were *n*-hexane for indol, and carbon tetrachloride for benzophenone), and neither any colour modification of the iodine solution nor new absorption in the ultra-violet region was observed. No complex thus seems to be formed between benzophenone or indol and iodine; at least none is detectable under the conditions of our experiments.

On the contrary, in the case of a solution of benzothiazol in carbon tetrachloride, a slight colour modification of the iodine solution was noticed when properly chosen proportions of benzothiazol and iodine were used (about 30 times more benzothiazol than iodine). The 517-m μ absorption maximum characteristic of iodine is practically not shifted (new maximum at 516 m μ), but a new absorption occurs in the near ultra-violet region around 300 m μ , as observed with a Zeiss spectrophotometer. Using a Beckman automatic DK II spectrophotometer, a new and intense ultra-violet absorption band characteristic of a new compound was observed at 282 m μ . Its intensity is about that of the usual high ultra-violet absorption of molecular complexes, and may perhaps be ascribed to a charge-transfer phenomenon.

It is well known that charge-transfer maxima are closely related to ionization potentials and a simple expression for this relation has been proposed². A curve relating ionization potentials and ultra-violet charge-transfer maxima was published recently³; from this it is possible to deduce an ionization potential for benzothiazol.

It is found in this way that the 282 m μ maximum corresponds to an ionization potential of 8.65 V. for benzothiazol. This is considerably lower than the ionization potential of benzene⁴, but closer to the ionization potentials of pyrrole⁵ and thiophene⁶, and might indicate that it corresponds to the removal of a non-bonding electron from either the nitrogen or sulphur atom, rather than a π -electron of the benzenic system.

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BIOCHEMISTRY

In vivo Formation of Normorphine in the Rat as a Metabolite of Tritium Nuclear-labelled Morphine

EVIDENCE for the N-demethylation of morphine has been provided by the demonstration *in vivo* of the pulmonary excretion^{1,2} of carbon-14 labelled carbon dioxide from morphine-N-methyl-¹⁴C and *in vitro*^{3,4} by the enzymatic liberation of formaldehyde. The formation of normorphine *in vivo* has not been demonstrated directly, principally because of the low sensitivity and poor specificity of procedures used. The recent preparation of tritium nuclear-labelled