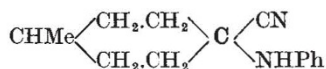


phenomenon in reactions involving the methylcyclohexanones. Attention was directed, therefore, to the condensation of the cyanhydrins of methylcyclohexanones with arylamines, by an extension of the method used by Walther and Hubner in the case of the simple cyclohexanone³.

If, for example, 4-methylcyclohexanone were to react with potassium cyanide and aniline in the stabilised stainless forms, the production of four isomeric 1-cyano-1-anilino-4-methylcyclohexanes



would be anticipated. This reaction was actually studied by Betts and Plant some years ago, from quite another point of view⁴. Fractional crystallisation of the condensation product led, however, to the isolation of a more easily fusible isomer in addition to the 1-cyano-1-anilino-4-methylcyclohexane described by these authors.

The condensation of 4-methylcyclohexanone with *p*-bromoaniline, *o*-, *m*-, and *p*-toluidines, and the α - and β -naphthylamines led, with the exception of the case of *o*-toluidine, to the formation of pairs of isomeric cyanoarylamino-methylcyclohexanes. 3-Methylcyclohexanone behaved similarly towards aniline and gave rise to two isomeric forms of 1-cyano-1-anilino-3-methylcyclohexane, but with *o*- and *p*-toluidines and with the naphthylamines, the presence of only one individual could be detected. The cyanhydrin of 2-methylcyclohexanone also gave rise to pairs of isomerides on condensation with aniline and with β -naphthylamine. In the reactions with *o*-, *m*- and *p*-toluidines, and with α -naphthylamine, however, only one product was isolated.

In all the three methylcyclohexanones, therefore, the formation of two, but of never more than two, isomeric cyanoarylamino-methylcyclohexanes was observed in certain cases. A full report of these experiments will be published elsewhere.

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NATURE, 136, 301; August 24, 1935.

² NATURE, 136, 608; October 12, 1935.

³ J. prakt. Chem., 83, 124; 1916.

⁴ J. Chem. Soc., 2073; 1928.

Breeding in Captivity of the South American Lung-fish

IN view of the advantages of the South American lung-fish, *Lepidosiren paradoxa*, as a laboratory animal on account of the large size of its cells and of its vitality, the first record, so far as I am aware, of a successful attempt to breed the fish is of general interest.

At the suggestion of Professor Graham Kerr, a double tank was installed in this Department in 1929, having a wooden lining fitted to float in a large outer tank of galvanised iron. The latter, erected over gas burners, serves as a water-jacket by means of which the temperature of the water in the inner wooden tank is maintained at 20° C. The inner tank, 9 ft. × 2 ft. 9 in. × 4 ft. 3 in., contains water to the depth of 1 ft. 8 in., and in addition about 30 cwt. of mud which was collected from a nearby loch. The mud is piled on an inclined plane

diminishing in depth from 2 ft. 6 in. to 1 ft. It forms a narrow platform above the water-level on which an extensive growth of ferns has developed in the last eight months, and the water-surface itself supports a carpet of *Salvinia*. The temperature of the mud increases with depth, reaching a maximum of 26° C. at the bottom of the tank.

An adult female *Lepidosiren* has lived in this tank for the past six years. Until the spring of this year, she had as partner a male specimen which showed breeding signs from time to time; for example, enlargement of the filaments on the posterior appendages, burrowing and taking down vegetation to support the burrow walls. Young, however, were not forthcoming. This male died and was replaced in August by another adult which had lived in a separate tank in the Department for several years. Disturbance of the fish was reduced to a minimum. Maintenance of the water-level by means of two large shower sprays permanently mounted over the tank and connected to the main water supply was permitted, and also the regular introduction of food in the form of sliced beef every second day. No other disturbances were allowed and breeding must have begun very soon after the second male had been placed in the tank. On October 21-22, twenty-two post-larval young (that is, older than stage 36¹) appeared at the surface amongst the *Salvinia* and were collected.

The pH of the water is 6.6 and the oxygen content at the surface 2.3 c.c. per litre, diminishing to 2.0 c.c. per litre at the bottom of the tank.

I am indebted to Mr. H. H. Brown for the oxygen estimations.

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¹ J. Graham Kerr, "Normal Plates of the Development of *Lepidosiren paradoxa* and *Protopterus annectens*". Keibel's "Normentafeln zur Entwicklungsgeschichte der Wirbeltiere", 10; 1909.

The Species Problem

MAY I add a few words as a contribution to the species concept discussion which was touched upon in a recent article¹ in NATURE? The ideal species definition has not yet been given, and probably never will be given, the problem being of too complex a nature to be condensed into a single definition.

There is, however, one aspect of the theoretical problem, which I discussed some years ago², to which I wish to direct attention here, as I think that special point has not been sufficiently emphasised. Accepting the evolution theory, as we do to-day, we have definitely precluded the possibility of treating the species as the basal unit of taxonomy. The unit must be the different *lines of evolution*. I defined a line of evolution thus: "A taxonomical-phylogenetic line of evolution is a sequence of generations, the individuals of which descend from the individuals of the preceding generation and within each generation group themselves according to the law of probability with regard to all essential features, and further, form a closed sphere of combinations, reacting avitally or incompatibly with all other spheres of combinations with which it comes into contact". The species is the momentary realisation of such a line.

The great advantage of this view is that all demands for *constancy* are omitted from the species definition,