

HABEL²², TÖNDURY²³ and others that in these cases damage to the embryo is brought about by viral invasion and destruction of certain embryonic organs and tissues, it is difficult to conceive of any common developmental denominator between these events and comparable end-effects of mutant conditions, even if the latter should come about by cellular destruction and resorption. The same applies *a fortiori* to the results of destruction by surgery or X-rays of circumscribed embryonic areas. A more complex situation exists in the case of sex reversal of female fowl, to which NACHTSHEIM²⁴ has referred as phenocopies of males. As after viral infection, the primary event is the destruction of an organ (the ovary) by a process (tubercular infection or malignancy) which has no equivalent in genetic conditions, but the physiological events which are initiated thereby are those determined by the residual genetic constitution.

The question whether the reactions of organisms to external insults are, however indirectly, governed by their genetic constitution was not an issue in our discussion. That is an evident fact, based on the inseparability of action and reaction as a consequence of evolutionary integration. The question at issue was whether it is justified to use the term phenocopy with the implication that external sources of modification and genes with similar phenotypic expression reach their goals by developmental routes which are, at least

in part, identical. It has been shown that a considerable amount of genetic evidence is available in support of this conclusion. It should be recognized that in any specific situation the phenocopy concept must remain shadowy until its relevancy is clearly established.

There is no proof that external sources of developmental variation ever produce their results by interference with primary gene functions. It would be a mistake to interpret the phenocopy concept in this manner, and any expectations based on such implications will surely prove illusory. Again, mere similarity between the end-results of mutant action and of those produced by external agencies is not enough to make the phenocopy concept meaningful to geneticists. But if we accept the concept in its restricted meaning, viz. as designating identical or closely similar phenotypes reached by paths which, part of the way, are shared with those of the homologous mutants, then existing evidence validates its reality, and in this sense work on phenocopies may become a valuable tool in our search for some of the developmental mechanisms by which mutant genes produce their phenotypic effects.

Zusammenfassung

Verfasser bespricht den Begriff Phänokopie und dessen Grenzen. Er kommt zum Schluss, dieser Begriff sei nützlich, sofern er sich auf experimentell produzierte Phänokopien bezieht, die mit den Erbphänotypen identisch oder ihnen sehr ähnlich sind und deren Entwicklungsgang zum mindesten teilweise mit demjenigen homologer Mutanten übereinstimmt.

²² V. HAMBURGER and K. HABEL, Proc. Soc. exp. Biol. Med. **66**, 608 (1947).

²³ G. TÖNDURY, Geburtsh. u. Frauenheilk. **112**, 865 (1952); Helv. paedit. Acta **7**, 105 (1952).

²⁴ H. NACHTSHEIM, Exper. **13**, 57 (1957).

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Über die Orientierung bei der Kondensation von Benzil mit monosubstituierten Guanidinen¹

Bekanntlich lässt sich die alte Biltzsche Synthese³ von 5,5-Diaryl-hydantoinen und -2-thiohydantoinen aus Benzilen und Harnstoff bzw. Thioharnstoff in Gegenwart von Alkalien auch auf die Synthese von 5,5-Diaryl-glykocyamidinen (I, $R=R'=H$) anwenden, wenn Harnstoff

bzw. Thioharnstoff durch Guanidin ersetzt wird⁴. Der einzige bisher ausgeführte Versuch zur Übertragung dieser Kondensation auf *substituierte* Guanidine, wie 1,3-Diphenyl-guanidin⁵, blieb erfolglos; ebenso der Versuch der analogen Kondensation des N-Butylguanidins mit Glyoxal⁶.

Wir kondensierten Benzil mit zwei monosubstituierten Guanidinen, dem N-Benzyl- sowie dem N-(β -Morpholino-äthyl)-guanidin durch Kochen der alkoholischen Lösung in Gegenwart von Kaliumhydroxyd. Bei Verwendung von

¹ 5. Mitteilung über Hydantoine, Thiohydantoine und Glykocyamidine².

² 4. Mitteilung siehe K. LEMPert und J. BREUER Chem. Ber. **92**, 1710 (1959).

³ Zusammenfassende Darstellung: E. WARE, Chem. Rev. **46**, 414 (1950).

⁴ CH. HOFFMANN, Bull. Soc. Chim. France **1950**, 659. - C. V. DELIVALA und S. RAJAGOPALAN, Proc. Indian Acad. Sci. (A) **31**, 107 (1950).

⁵ R. G. NEVILLE, J. org. Chem. **23**, 1588 (1958).

⁶ I. S. BENGELSDORF, J. chem. Soc. **75**, 3138 (1953).

⁷ M. STAEHELIN, *Biochem. biophys. Acta* **29**, 410 (1958).