Überlegungen zur Biosynthese der Lysergsäure führten zur Prephensäure als möglichem Zwischenprodukt von Indolverbindungen. Wie das Formelschema zeigt, können einfache zellmögliche Reaktionen zu Indol und 6-Hydroxy-indol führen. Eine zentrale Stellung nähme danach das Dienon A ein, das durch Dienon-Phenol-Umlagerung unter CO_2-Abspaltung in 6-Hydroxy-indol oder nach Reduktion der Ketogruppe in Indol übergehen könnte. Letztere Umwandlung entspricht dem leichten Übergang der Prephensäure in Phenylbrenztraubensäure, eine Reaktion, die auch an einfacheren Modellen verwirklicht wurde[3].

Besonders brauchbar erscheint die Hypothese zur Erklärung der Verkettung eines Kohlenstoffatoms an das C4-Atom des Indolgerüstes, wie man sie zur Biosynthese der Lysergsäure fordern muss. Die Verbindung A sollte nach Art einer Michael-Addition eine reaktionsfähige Methylengruppe anlagern können; der weitere Aufbau der noch fehlenden Ringe der Lysergsäure könnte sich so abspielen, wie es HARLEY-MASON in seiner bemerkenswerten Hypothese zur Biogenese der Lysergsäure entwickelt hat[4]. Der Carboxylgruppe am quartären Kohlenstoffatom kommt bei diesen Betrachtungen besondere Bedeutung zu; in alkalischem Medium kann, wie bei der Prephensäure, die Aromatisierung blockiert sein und sich die hier aufgezeigte Additionsreaktion abspielen.

Die Beobachtung[2], dass ein vor dem Tryptophan blockierter Neurospora-Stamm Prephensäure anreichert, spricht für diese Hypothese, die experimentell unterbaut werden soll.

H. PLIENINGER

Chemisches Institut der Universität Heidelberg, 24. Oktober 1957.

Summary

Prephenic acid is discussed as a possible precursor of indol derivatives like tryptophane and lysergic acid.

[3] H. PLIENINGER und G. KEILICH, Z. angew. Chem. *68*, 618 (1956).
[4] J. HARLEY-MASON, Chem. and Ind. *1954*, 251.

The Hypothesis of Chromatid Interference [1]

Chromatid interference (especially when designated as either 'positive' or 'negative') was originally conceived in terms of the effect which an exchange can produce on a single strand, specifically, in terms of the manner in which one exchange point on a given strand influences the occurrence of a second exchange point on the same or a different strand. In early linkage studies on *Drosophila* (when it was believed that crossing-over took place at a 2-strand stage) low values for the coincidence index were interpreted as chromosomal interference which was defined as the influence of one exchange point upon the probability that another exchange point will occur in adjacent regions. With BRIDGES'[2] discovery that crossing-over occurs at a 4-strand stage it could not be asserted with confidence that the second exchange point did not occur at *all*, for it might possibly have occurred between the chromatids of the bivalent eliminated in oogenesis. Consequently, chromosomal interference could not be distinguished from chromatid interference in single-strand analysis[3]. On this view, chromosomal interference concerns the probability that a second exchange point occurs at all, whereas chromatid interference concerns the probability that the second exchange point occurs on the same or on a different strand than the first, on the condition that a second exchange point does occur. Chromatid interference when conceived from the point of view of events occurring on a single randomly chosen chromatid is of two kinds: (a) 'positive' chromatid interference, where one exchange point increases the probability that a second exchange point will occur on a different strand (as in a 4-strand double exchange) and (b) 'negative' chromatid interference, where the occurrence of one exchange point increases the probability that it will occur on the same strand (as in a 2-strand double exchange). This conception has been entertained by many writers and sometimes occupies a crucial position in arguments used in drawing interferences from observed data, for example, in certain arguments for sister-strand crossing-over[4]. On this view an excess of 3-strand double exchanges cannot be classified as either 'positive' or 'negative' chromatid interference, although such an excess would represent a specific influence governing the strand position of one exchange relative to another and, hence, must be considered as chromatid interference. An excess or deficiency of 3-strand double exchanges cannot be detected in attached-X analysis since 3-strand double exchanges contribute equally to the two distinguishable arrangements of recombinations which may be observed in 3-point attached-X data. Furthermore, a significant deviation from an equal distribution in the two kinds of 3-strand double exchanges (Fig. 1) must be considered to be chromatid interference even if the total frequency of 3-strand double exchanges is ½. In general, we may define chromatid interference as any ratio of the four kinds of double exchanges different from 1:1:1:1 (or 1:2:1 for the ratio of the probabilities of 2-, 3-, and 4-strand double exchange, if the two kinds of 3-strand double exchanges are not distinguished). It has been proved formally[5] that a ratio of double recombinations differing significantly from 1:1:1:1 is *a priori* evidence of chromatid interference (defined as any deviation from a similar ratio for double exchanges), thus providing chromatid interference with an operational definition.

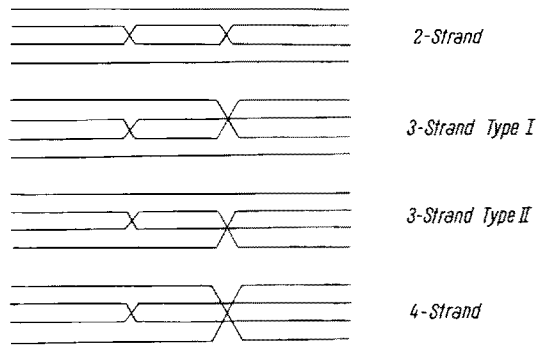

Fig. 1.

[1] This work has been supported by a research grant from the National Cancer Institute of the National Institutes of Health, U.S. Public Health Service, C-1179.
[2] C. B. BRIDGES, Genetics *1*, 1 (1916).
[3] E. E. SHULT, Nature *175*, 507 (1955).
[4] D. SCHWARTZ, J. cell. comp. Physiol. *45*, Suppl. 2 (1955).
[5] E. E. SHULT, In manuscript.

The 'Random' Ratio

Observed double recombinations occur in a wide variety of ratios and the role of the 1:1:1:1 ratio is not as a prediction, but as a normative criterion by which to judge the presence of mechanisms controlling the alignment of adjacent exchanges on the 4-strand set. It is customary, if a set of events is thought to occur at random in a particular context in a conceptual scheme, to set up a hypothesis based on a certain expected frequency of these events. Any significant deviation from these expected frequencies is assumed to indicate the presence of an additional control operating within the context but not a necessary member of it. How are the expected frequencies determined? In what way are they 'random'? And on what basis? If each one of a set of events conceptually distinguished in the model is assigned an equal probability then the set of these probabilities are often said to represent a 'random' expectation. Since probabilities are assigned only on the basis of a conceptual model, it follows that the 'random' ratio depends on the specific conceptual model. There are several conceptual models which may be used to distinguish double exchanges. Consider an array of four chromatids distinguished only as two sets of sister-strands. When two nonsister exchanges occur, three types of double exchanges may be observed although there are four distinguishable arrays (Fig. 1). (Since no further distinction among the chromatids is made, these arrays are drawn with the 'left' exchange occurring between the two center strands without loss of generality.) If these four arrays are assumed to occur with equal probabilities, the ratio of double exchanges is 1:1:1:1. (If all four chromatids are distinguished a single nonsister exchange can occur in 4 ways, making 16 kinds of double exchanges and the resultant ratio becomes 4:4:4:4.)

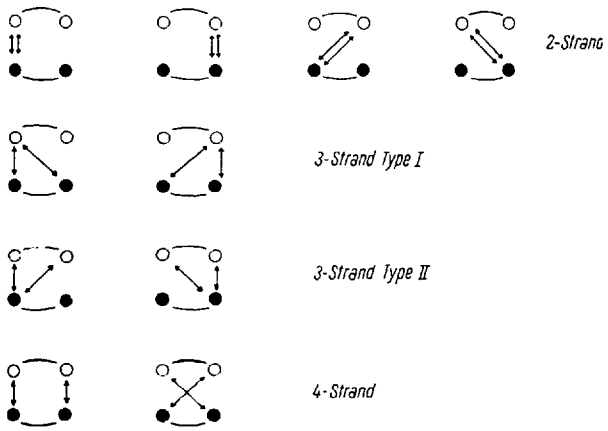

Fig. 2.

If all four chromatids are distinguished but the order of the exchanges is *not* distinguished, it is not possible to tell which is the 'left' exchange. (To avoid the bias of 'ordering' the two exchanges, the chromatids are drawn in cross section (Fig. 2) with sister strands opposite from each other, their ultimate connection to the same centromere being indicated by a thin arc drawn between them.) If each of these arrays is assumed to be equally probable, the random ratio becomes 2:1:1:1. This model is as valid as that in Figure 1. There is no *unique* 'random' ratio. It follows that chromatid interference is defined in terms of a deviation from an *arbitrary* ratio which merely reflects the bias of accepting the first model. There is no 'right' model and it is meaningless to ask whether cross-overs 'really' behave according to the first model or the second, since these models are only utilized to obtain a normative standard from which 'deviant' behavior of crossing-over is measured.

E. E. Shult

Biological Research Laboratory, Southern Illinois University, Carbondale, July 11, 1957.

Zusammenfassung

Der Nachweis des Vorkommens von Chromatideninterferenz erscheint dadurch erschwert, dass sich die bei fehlender Interferenz zu erwartende Häufigkeitsverteilung von Zwei-, Drei- und Vierstrang-Doppelaustausch nicht eindeutig formulieren lässt, indem von verschiedenen Modellvorstellungen ausgegangen werden kann, welche verschiedene Häufigkeitsverhältnisse voraussehen lassen.

A Microradiographic Study of Ovarian Dermoid Teeth

Teeth are common constituents of ovarian dermoid cysts, but although such dermoid teeth have been examined histologically in some detail, and their gross radiographic appearance reported with some frequency, an account of their microradiographic structure appears to be wanting. The present report was prompted by other microradiographic studies dealing in particular with the nature of bone tissue in ovarian dermoid cysts[1], and in general with the calcification of cementum and dentin[2], as well as the vascularity of the developing and adult human tooth[3].

The material studied consisted of ground sections (15–25 μ) made from dermoid teeth. The teeth which were eight in number, were slightly yellowish in colour, and embedded in a bony plate that resembled the body of a miniature mandible. In general appearance, size, and shape they imitated normal oral teeth, so that incisors, canines, premolars and molars could be identified. Even though the general course and symptomatology of ovarian teratoids is usually remarkably poor in specific characteristics it was unfortunate that no history accompanied this specimen.

Both contact and projection methods of microradiography were used to study the sections. In the former case a Matchlet type AEG 50 X-ray tube (1 mm Be filter) was used in conjunction with fine grain Lippman film[4]. The ground tooth sections were placed in direct contact with the photographic emulsion and exposures (60 min) made at 5 kV 21 mA, subsequent enlargement of the plate image being obtained optically. The kilovoltage and filter (Be) here mentioned provided an operating wavelength of the order of 2·4 to 4 Å, this region being selected since the calcium K edge which occurs at 3·07 Å falls within this range. Within this wavelength region the organic components exhibit practically no absorption, hence the micrographs ob-

[1] H. Röckert, Exper. *13*, 142 (1957).

[2] H. Röckert, *Göteborg Tandläkare Sällskaps Årsbok 1955* (Göteborg Universitet, Sverige), p. 55.

[3] R. L. de C. H. Saunders, *Cambridge Symposium on X-ray Microscopy and Microradiography* (Academic Press, New York 1956).

[4] A. Engström and L. Wegstedt, Acta radiol. *35*, 345 (1951).