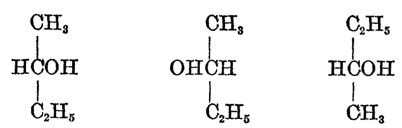
SPECIAL ARTICLES

THE CONFIGURATIONAL RELATIONSHIP OF DEXTRO-METHYLETHYL CARBINOL TO DEXTRO-LACTIC ACID[1]

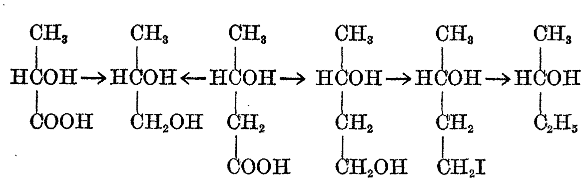
THE configurations of aliphatic substances containing in their molecules several secondary alcoholic groups, or one or more secondary alcoholic groups in addition to a polar radicle as $-COOH$, $-CHO$, or $=C=O$, have been correlated to a single reference substance : lactic acid. Nothing is known, however, regarding the stereochemical relationships of simple secondary alcohols to the same substance of reference, nor is there any definite knowledge as to the stereochemical relationships of individual secondary alcohols among themselves. The case of secondary alcohols is complicated by the following fact. The first member of the series is



I II III

methylethyl carbinol (I). Its enantiomorph (II) may be represented also as ethylmethyl carbinol (III). A question has been raised as to whether or not the higher homologues of the "methyl" and "ethyl" series should rotate in opposite directions as their first members do.

Dextro-methylethyl carbinol and dextro-lactic acid have now been correlated by the following set of reactions:



dextro I, dextro II, dextro III, dextro IV, dextro V, dextro VI

The reactions leading to the correlations of (I) to (IV) were described in previous communications by Levene and Haller and Levene and Walti. Thus dextro-methylethyl carbinol belongs to the *l* series of hydroxyacids, inasmuch as dextro lactic acid belongs to the *l* series.

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ELECTRICAL ACTIVATION OF THE NEREIS EGG

UNFERTILIZED starfish eggs will develop to larval stages after the passage of strong constant currents, but the effect is mainly due to the heat which accompanies the high current densities employed.[1] There is, however, a partial activation by strong currents at temperatures below those which cause heat-activation.

Experiments on the electrical activation of the eggs of *Nereis limbata* were made during the summers of 1925 and 1926 at the Marine Biological Laboratory. Fifty-three experiments, involving 839 dishes of eggs, form the basis of this report.

The same apparatus was used as in the experiments with the starfish eggs. A diagrammatic cross-section of the electrode system is shown in the figure. The bridges, which consisted of agar jelly of about 4 per cent. concentration, were constructed from agar agar which was allowed to solidify after having been liquefied by heat in fresh sea water.

These bridges, having low resistance, conduct currents of high density without becoming unduly heated, and form a type of non-polarizable electrodes having wide application in experiments where it is desired to pass the electric current through cells or tissues immersed in salt solutions.

The electrical circuit consisted of two slide wire rheostats connected in series with the 120-volt direct current supply of the laboratory. A secondary circuit was obtained by taking leads from these rheostats which served as a potential divider; a reversing switch, a milliammeter and the electrode system were connected in series with this second circuit.

The physical conditions were so adjusted that the desired current density was obtained. A female Nereis was then placed in the layer of sea water between the two bridges of agar, and the electrical circuit was closed. As a result of the enforced muscular contraction, the eggs were almost instantaneously ejected through a rupture in the body wall. At known intervals during the flow of the current (every five or ten seconds in the case of currents of high density) several hundred eggs were transferred with a pipette to a Syracuse watch-glass containing fresh sea water. These watch-glasses were then covered and set aside.

The percentages of eggs forming jelly and fertilization membranes and the percentages developing to an actively motile larval stage after about twenty hours were determined. Current densities of from 61 to 606 milliamperes per square centimeter of sectional area

[1] Lillie, R. S., and W. Cattell, *Biol. Bull.*, 1925, Vol. XLIX, No. 2, p. 100.

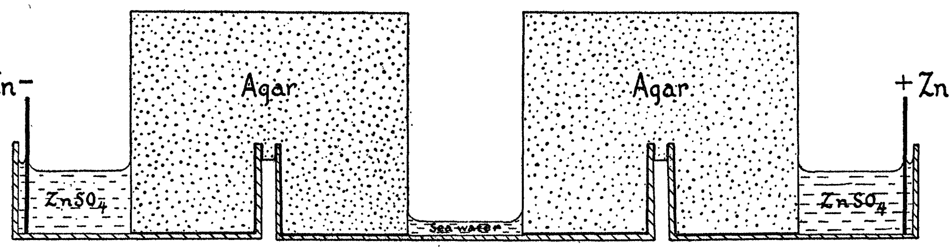

FIG. 1

of the sea-water were used. Little or no activation was obtained when the current density fell outside the range of 125–210 ma./cm.[2] A variation of 12 per cent. from the optimum duration of exposure was found to decrease greatly the resulting proportion of swimming larvae, sometimes preventing their formation. It seems probable that if the ideal current intensity and time of exposure were accurately determined a more complete activation might result than any so far obtained. This is indicated by the very considerable variation in the yield of swimming forms in cases where the variation in experimental conditions was slight. Brief exposures (10 to 20 seconds) to currents of high density, *e.g.*, 500 ma./cm.[2], cause complete cytolysis.

Passage of currents in the manner indicated caused activation in most eggs when the intensity and duration of the current were appropriate. The degree of activation varied according to the conditions, and was most complete in those cases where the eggs were exposed to current densities of about 150 ma./cm.[2] for a period of 70 to 90 seconds.[2] This treatment resulted consistently in the formation of jelly and fertilization membranes in practically all eggs. Of these a certain variable proportion, usually three to ten per cent., formed swimming larvae.

In one instance more than one quarter of the eggs became actively motile. Many eggs actually reached an early larval stage, but did not exhibit definite ciliary movement. For this reason the recorded percentage of "swimmers" is probably considerably lower than the actual percentage of eggs that reached an equivalent developmental stage.

There is a well-defined optimum in regard to both the current intensity and the duration of exposure. There is also a relation between the strength of current and the optimal duration of exposure; in general, the greater the current density, the shorter the exposure required to bring about the same degree of activation.

In most cases the cleavage or fragmentations were irregular and the resulting larvae were abnormal. At times, however, both cleavages and larvae resulted which were so nearly perfect as to be indistinguishable by external examination from the normal forms. A large amount of this material has been preserved and the forthcoming cytological study will, it is hoped, determine the precise degree to which the cleavage and development differ from the normal.

Typically, when the circuit is closed the worm sheds the larger part of its eggs almost instantaneously, but some eggs remain within the body cavity. A slight variation from the regular procedure in a few of the later experiments is worthy of note. After an exposure of from two to four minutes to the usual range of current densities the worm was removed and very thoroughly washed in running sea water. It was then placed in a finger bowl of fresh sea water. After this treatment the worm soon recovered and began swimming. About two hours later the remaining eggs were shed. Many of these were found to have formed jelly and membranes, and in one case five per cent. of the eggs reached the swimming larval stage. The eggs had thus received their activating stimulus while still within the body cavity.

The amount of activation obtained was considerably greater when the intact worm was first placed in position between the electrodes and the circuit then closed, than when the eggs were first shed into a finger bowl of sea water and an interval was allowed to elapse before exposing them to the current. This difference indicates that the susceptibility of the eggs to electrical activation is decreased as a result of simple contact with, or washing in, sea water. In this respect the results with electrical parthenogenesis agree with the observations of Lillie[3] on Arbacia and of Just[4] on Nereis, where also it was found that washing the eggs in sea water lowered their susceptibility to artificial activation, as well as to sperm fertilization.

The fact that the eggs can be activated *in vivo* obviates the possibility of accidental exposure to the

[2] Just (*Biol. Bull.*, 1915, Vol. XXVIII, No. 1, p. 1) found that the length of exposure most favorable for heat activation in the Nereis egg was about twenty-five minutes when exposed to sea-water warmed to 32–35° C. At the same time he found that the optimal exposure for activation by a solution composed of 20 per cent. 2.5 M. KCl in sea-water was about fifty minutes.

[3] Lillie, F. R., SCIENCE, 1912, Vol. XXXVI, p. 527.

[4] *Loc. cit.*

influence of chemical or physical agents other than the direct action of the electric current. The temperature was kept well below that necessary for heat activation. Careful heat controls were carried out, and in all cases a complete record was made of the temperature of the sea water while the eggs were undergoing treatment. That heat played no rôle in the activation obtained in these experiments is further shown by the fact that the eggs could be activated by exposure to the electric current in sea water, the temperature of which was kept constant at 10° C. throughout the exposure.

The critical change induced in the egg by the current is thus seen to be much more rapid than that occurring under the influence of heat or KCl. There does not, however, appear to be much difference in the completeness of the activation produced by these several agents.

A detailed account of these experiments and a more exact description of the apparatus will be given in a later paper. I wish here to express my appreciation to Dr. Ralph S. Lillie for the interest that he has taken throughout the work.

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SOCIETIES AND ACADEMIES

THE SUMMER MEETING OF THE AMERICAN MATHEMATICAL SOCIETY

THE thirty-second summer meeting of the American Mathematical Society was held at the Ohio State University, Columbus, Ohio, on Wednesday and Thursday, September 8–9, 1926, immediately following the summer meeting of the Mathematical Association of America. The attendance at this meeting was probably the largest for any summer meeting at which no colloquium was held, and included one hundred and seventeen members of the society. On Wednesday forenoon a joint session was held with the Mathematical Association at which Professor E. W. Chittenden, of the University of Iowa, gave a lecture on "The Metrization Problem and Related Problems in the Theory of Abstract Sets," and Professor E. T. Bell, California Institute of Technology, spoke on "Successive Generalizations in the Theory of Numbers." At the sessions on Wednesday afternoon, and Thursday forenoon and afternoon seventy papers were read, thus making this program one of the most extensive in the history of the society.

Thirty-three persons have become regular members of the society since the meeting of the council in April. The Bell Telephone Company was elected to patron membership, and Mr. Adolph S. Ochs was elected to sustaining membership.

Future summer meetings of the society have been set as follows: University of Wisconsin, Madison, Wisconsin, 1927; Amherst College, 1928; University of Colorado, Boulder, Colorado, 1929.

At this meeting of the society the following resolution was adopted:

> On recommendation of its council, the American Mathematical Society, in session at Columbus, Ohio, on September 9, 1926, expresses its deep sense of loss in the death of Frank Nelson Cole on May 26, 1926. He was for many years the society's most active executive officer. From an early date in its history until 1920, when he passed his duties on to others, he ably guided the development of the society. As secretary from 1895, as a member of the editorial board of the *Bulletin* from 1898, and as its editor-in-chief from 1900, he led the society from its modest beginnings to a state of solid accomplishment. He exercised his functions with a skill which excited admiration and which gave the American Mathematical Society an established place in the scientific world. When he retired, he could turn over to his successors a healthy structure, which was able to withstand the stresses of the very difficult post-war period.
>
> The society wishes also to place on record at this time its grateful recognition of his devoted service to the ideals of American mathematical science. His memory will remain an inspiration to all who may in the future serve the interests of the society and the cause of mathematics in America.

ARNOLD DRESDEN,
Assistant Secretary of the Society

UTAH ACADEMY OF SCIENCES

THE fall meeting of the Utah Academy of Sciences was held at the Agricultural College, Logan, Utah, on November 5 and 6. Geology, agronomy, physics and chemistry were represented on the program. There were in all fourteen papers.

The meetings were not quite so well attended as usual but the interest was more marked. The papers on geology dealt principally with certain controversial questions regarding faulting in the Wasatch Range; those on agronomy were mostly reports of progress on practical problems and those dealing with physics and chemistry covered a wide range, including agricultural physics, metallurgy and hygrometry.

Dr. Harry N. Eaton, of Syracuse University, who is spending his leave of absence in Utah, delivered an illustrated address on the physiography and structure of the Goshen mountain range in Utah. Dr. Eaton was the guest of the convention.

At the council meeting it was voted to publish abstracts of papers delivered at the fall and annual meetings annually instead of semi-annually.

A number of new members were added to the roster.

C. ARTHUR SMITH,
Permanent Secretary