lation of mutations in the Canton Special stock on which all tests were carried out.

A comparison of the differences in mutation frequencies between experimentals and controls in the chronic experiments (lines 2–5) with the difference in the acute experiment (line 1) should take into account the fact that the difference in the latter experiment is somewhat larger than expected on the basis of all of Spencer and Stern's data. The maximum likelihood calculation yields about 0.002% induced sex-linked mutations per r, which corresponds to an expected difference for the acute 50-r experiment of only 0.1000%. Viewing all experiments together, it appears that irradiation at low dosages, administered at low intensity, induces mutations in *Drosophila* sperm. There is no threshhold below which radiation fails to induce mutations. A more detailed account of the work will be presented later.

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An Electrical Logic Machine

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At the first annual open house meeting at Lewis Institute in 1936, the writer demonstrated an electrical Logic Machine useful for detection and demonstration of fallacies in deductive reasoning. The machine is equipped to test all syllogisms (categorical, hypothetical, and disjunctive), and both conversion and obversion. To facilitate portability, the machine is mounted inside the top half of a sturdy suitcase, with the classified blocks (representing propositions) resting in thin plywood compartments in the bottom half of the case. Total weight of the case, including machine and blocks, is 25 lb.

In order to test a syllogism, it is only necessary to select the blocks representing the major premise, minor premise, and conclusion, and place the blocks onto the three spaces provided on the panel of the machine. If the syllogism contains one or more fallacies, one or more light bulbs will light up. Each light bulb is identified by a printed name of a fallacy, as follows:

1. Undistributed middle.
2. Illicit major.
3. Illicit minor.
4. Two negative premises.
5. Two particular premises.
6. Affirmative conclusion from negative premise.
7. Universal conclusion from particular premise.

For the hypothetical syllogism, there are light bulbs for "Denying the antecedent," "Affirming the consequent," and "Hypothetical *non sequitur.*" For the disjunctive syllogism, there is a light bulb for "Disjunctive *non sequitur.*" There is one bulb for "False conversion," one for "False obversion," and a colored light bulb indicating that electrical current (battery or line) is established.

The principle of operation is that of establishing metal contact areas on the backs of flat wooden blocks, to convey information concerning the proposition printed on the front of the block. For example, the block representing the proposition "Some M is not S" (minor premise) has separate contact areas at selected positions on the back of the block, to represent the following items of information:

1. The middle term (M) is undistributed (that is, it refers to a limited number of its class).
2. The proposition is negative.
3. The proposition is particular (refers to "some").

Since, by definition, the conclusion of a syllogism represents the minor term by the letter S (subject), and the major term by the letter P (predicate), there are four blocks representing possible conclusions: All S is P, No S is P, Some S is P, Some S is not P. Using M for the middle term, there are eight blocks for all the possible combinations with P in the major premise, and eight blocks for the possible combinations with S in the minor premise. Additional blocks provide for testing hypothetical syllogisms, disjunctive syllogisms, conversion, and obversion.

Pairs of banana plugs in the panel receive items of information from the contact areas when the blocks are set onto the panel. Certain combinations of propositions will close one or more electrical circuits wired from the panel to pilot light bulbs. There is a separate circuit for each possible fallacy.

The panel is black hard rubber, 7 in. × 10½ in. × 3/16 in. To insure correspondence, a template was used to drill identically separated holes on both the panel and the wooden blocks, separated 5/16 in. horizontally, ¼ in. vertically. The banana plugs were inserted in the panel holes and secured with nuts behind the panel. The wiring is soldered to the back end of the plugs (behind the panel) and it leads to the pilot light sockets mounted on a vertical strip of black hard rubber. A white card next to the bulbs has a printed title for each kind of fallacy, indicated by the appropriate bulb. A knife switch permits use of either battery or line current; a transformer for line current is attached and wired behind the panel, out of sight. Panel, light sockets, and knife switch are mounted on a pressed cardboard backing, 17 in. × 14½ in. × ½ in. The backing is mounted inside the top of a suitcase.

The blocks are of hard wood, 5½ in. × 2½ in. × ¾ in. The contact areas consist of a pair of adjacent jacks soldered at their point of adjacency. The holes were drilled in the wood through the same template used for the panel, and were then widened to 3/16 in.; depth was ½ in. Then the blocks were sandpapered until they were smooth and easy to handle. The jacks were made from brass tubing, ¼ in. OD, 5/32 in. ID, cut into ⅜ in. lengths. One end of the jacks was trimmed down, to facilitate entry into the blocks. After each pair of jacks was hammered in, flush with surface, a narrow hole was drilled between the two jacks, solder was inserted, and the jacks were countersunk after the solder hardened. Now the blocks could be set onto the banana plugs on the panel and would close certain parts of the circuits involved.

Earlier machines by Stanhope (*8, 1*), Jevons (*3, 4*), Venn (*9*), Marquand (*6*), Pastore (*7*), and Macaulay (*5*) generally indicated the conclusions derivable from given premises. None could identify the fallacy in deductive thinking. However, in an article written in 1935 on the mechanical nature of problem solving, Hull (*2*) mentioned that he once constructed a "simple mechanism of sliding disk-segments of sheet-metal which will solve automatically, i.e., exhibit the conclusions logically flowing from all of the known syllogisms and which will automatically detect all of the formal fallacies . . ." but that ". . . a description has not yet been published."

The logic machine described by the present writer is an electrical device which identifies the formal fallacy (or fallacies) in an invalid syllogism of the categorical, hypothetical, or disjunctive types, or in conversion and obversion. It has been used successfully in logic classes and evokes sharp student interest. As with all such machines, its obvious limitation is that the "argument" must first be put into logical form by a human being.

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The Application of Soybean Inhibitor in Tissue Cultivation

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It is well known that certain types of tissue cells liquefy clots of homologous plasma, thus making their permanent cultivation impossible. Carrel and Ebeling (*1*) attempted unsuccessfully to prevent such liquefaction by adding traces of unsaturated fatty acids, egg yolk and other substances to the medium. The present author (*2*) cultivated permanent strains of the Rous sarcoma cells *in vitro* for many years by putting a small piece of boiled muscle tissue beside the tumor tissue. The dead muscle tissue served as a kind of solid substrate which was invaded by the sarcoma cells and thus it made possible the transfer of the cells from medium to medium. This method of course did not allow quantitative estimations of the rate of growth characteristic for the tumor cells. Later we found that sarcoma cells grow readily on certain heterologous media without liquefaction of the medium, probably because the chicken cells are unable to activate the proteolytic enzymes in the heterologous plasma (*3*).

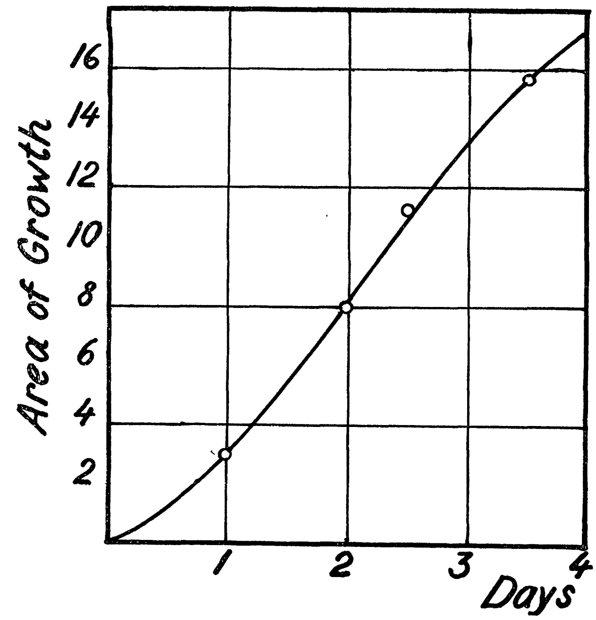

Fig. 1.

In this paper a method will be described for the cultivation of Rous sarcoma cells on clots of homologous plasma in which it was found that liquefaction could be prevented by an addition of the soybean inhibitor first isolated by Kunitz (*4*). In this manner it was possible to measure the rate of growth of the Rous chicken tumor cells in homologous plasma medium. The growth-retarding effect of soybean inhibitor on the growth of myoblasts will likewise be described and discussed.

The plasma medium in Carrel flasks was made up as follows: *Solid phase*—0.5 ml chick plasma, 1.0 ml Tyrode's solution, and 0.2 ml of a 0.35% solution of trypsin inhibitor; this was coagulated by adding 1 drop of embryo juice. *Fluid phase*—0.4 ml mixture of equal volumes of chick serum and Tyrode's solution, and 0.2 ml embryo extract.

Liquefaction of the medium was found to be completely prevented. Fig. 1 demonstrates the regular growth of the Rous sarcoma cells when cultivated in the presence of the inhibitor. The growth rate of the cells under the conditions of this experiment could now be accurately measured and was found to be relatively low. It therefore seems that the soybean inhibitor slows down the growth rate of the tumor cells.

Further it was found that the inhibitor prolongs the coagulation time of the plasma used. In those of our