of sunlight. The regions of unusual craters such as Tycho, Copernicus, Theophilus and those around Mare Serenitatis and Mare Imbrium are described more fully in the final chapter of the book. The whole text is in the form of a dialog between the author and a friend who starts with no knowledge of the subject.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE DISSECTION OF THE SPIRAL VALVE OF SQUALUS ACANTHIAS

A SATISFACTORY dissection of the spiral valve of *Squalus acanthias* usually proves to be a difficult task for students of comparative anatomy. In order to expose enough of the valve to make its analysis possible, a considerable portion of the intestinal wall must be removed. If the method of dissection employed involves the removal of a single longitudinal strip of the intestinal wall extending the length of the intestine, it follows that the spiral valve must suffer serious mutilation.

Fortunately, the lines of attachment of the spiral valve are approximately indicated at the surface of the intestine by branches of the anterior mesenteric artery. This anatomical arrangement makes it possible to remove portions of the intestinal wall without danger of damage to the spiral valve. There follows a brief description of one method of dissection which has proved quite satisfactory.

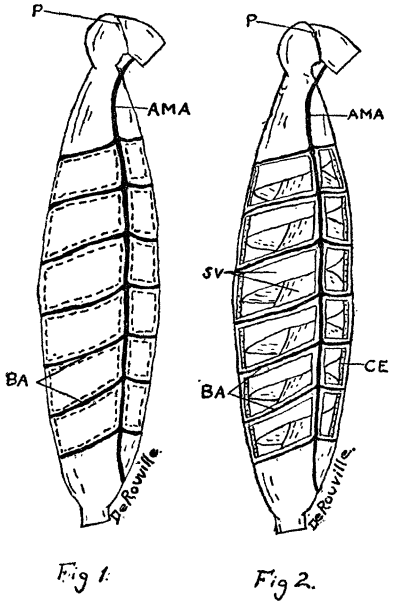

Fig 1. Fig 2.

AMA, anterior mesenteric artery; BA, branch arteries; CE, cut edge of the spiral valve; SV, spiral valve; P, pylorus.

Fig. 1 shows an undissected intestine with broken lines outlining portions of the intestinal wall to be excised. Fig. 2 shows the appearance of the intestine after dissection. By this method of dissection the intestinal wall is reduced to a mere skeletal support for the spiral valve which is left intact and sufficiently exposed so that its structure can be easily studied.

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SPECIAL ARTICLES

X-RAYS AND MUTATIONS

ONE of the paragraphs in the article entitled "Biological Effects of X-rays," by H. K. Svenson in SCIENCE 69: 361, March 29, 1929, may lead to a misunderstanding of the experiments to which reference is made. The results of the experiments were published jointly by the present writer and H. K. Svenson in three papers: "An Effect of X-rays on the Linkage of Mendelian Characters in the Second Chromosome of *Drosophila Melanogaster*,"[1] "Crossing over in the Second Chromosome of *Drosophila Melanogaster* in the F_1 Generation of X-rayed Females"[2] and "A Comparison of the Effects of X-Rays and Temperature on Linkage and Fertility in *Drosophila*."[3] The aims of the experiments are correctly expressed in the above titles of the papers describing them. Mutations were, of course, not to be ignored if they were found; on the other hand the experiments were not planned with a view to testing the possiblity of producing mutations by X-ray treatment. Nor were the experiments as carried out particularly favorable to the discovery of mutations.

Records of the four experiments referred to are given in two papers.[1, 3] In these experiments the female parent only was X-rayed, and the experiments were followed only to the F_1. In these F_1 only one, that from the mother, of any two homologous genes could have been exposed to X-rays except in the rare cases of non-disjunction. A recessive mutation if produced by the X-rays could, therefore, be observed only in the males and then only if it occurred in the X-chromosome. Dominant mutations, although on the whole rarer than recessive mutations, could be observed in either the male or the female F_1. The records of the experiments given in the papers referred to showed that there was observed a total of 49,360 F_1 males, of which 20,069 were the offspring of X-rayed mothers; of these 20,069 males, 5,513 came

[1] *Genetics*, 9:70–89. 1923.
[2] *American Naturalist*, 58: 311–315. 1924.
[3] *Genetics*, 9: 588–608. 1924.

from germ cells which had been exposed during the more sensitive period, *i.e.*, from one to six days previous to laying. The number of flies observed in which visible X-ray mutations might be expected to occur was therefore not large.

In the experiments reported in the other paper[2] sibs which were F_1 of X-rayed females were mated and the resulting F_2 of the X-rayed observed. Eleven fertile matings were made of the F_1 of the X-rayed females and five of the F_1 of the control. It has already been stated that a visible recessive mutation in an X-rayed X-chromosome would appear in the male F_1. A visible recessive mutation in an autosome, on the other hand, would not appear even in the F_2 unless the mating was between two F_1 individuals each carrying the mutated gene. Such a mating is altogether beyond probability under the conditions of the experiment, since it would involve the occurrence of the mutation twice in a small number of eggs and then the accidental mating of the two individuals. So far, then, as a test for the occurrence of visible mutations the experiment involving the F_2 of the X-rayed has little to commend it over an experiment involving only the F_1. Furthermore, as the F_2 were the offspring of eleven F_1 of X-rayed parents the observations in this case involve really only eleven X-rayed germ cells.

Of more importance is the fact that all three experiments, dealing as they did with crossing over, involved the counting of large numbers of flies and therefore offered little opportunity for critical scrutiny of the individual flies except as regards the mutant characters involved in the crossing over determinations.

The data of the experiments described in the second paper[2] do, however, give some information regarding the possible occurrence of lethal mutations, a matter which, not being part of the original plan of the experiments, did not come up for consideration at the time. Going over the data from this point of view the present writer finds in the counts of the offspring of the eleven fertile F_1 of the X-rayed females three cases of irregular viability ratios suggestive of lethals in the second chromosome and in the counts of the offspring of the five control F_1 one case strongly indicating a sex-linked lethal.

The experiments referred to by Dr. Svenson in his article which were carried on in collaboration with the present writer and have been discussed above can, therefore, in no way be regarded as giving evidence against the possibility of inducing mutations by X-rays.

From time to time in experiments conducted by the present writer in this laboratory and at the Marine Biological Laboratory at Woods Hole mutations have appeared among the offspring of X-rayed females, a notable case being that of "yellow" which occurred twice in one experiment among 2,692 gray males which were the F_1 of X-rayed females and not among the 1,042 F_1 of control females which were sisters of the X-rayed females. The association of the yellow body color with the other mutant characters involved in the experiment rendered contamination very unlikely, and the fact that one of the yellow flies was a white miniature and the other an eosin miniature and the fact that they occurred in different culture bottles and one only in each culture bottle makes it extremely probable that they arose independently. The yellow males were mated to gray females and yellow stocks extracted which were bred for several generations. However, as statistical evidence of the induction of a mutation, two in the F_1 of the X-rayed as against none in the F_1 of the control is not significant. In a subsequent experiment performed, however, under somewhat different conditions no yellow flies occurred.

The above discussion has been limited to gene mutations or at least to intra-chromosomal mutations. It may properly be said, however, that the induction of non-disjunction of the sex-chromosome which the present writer had shown can be produced by X-rays[4] is in effect the induction of a chromosomal mutation.

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THE OCCURRENCE OF PODSOL SOILS IN QUEBEC PROVINCE

RUSSIAN soil scientists apply the term *podsol* to soils occurring in cool, humid climates which, due to deficiency of calcium carbonate and the formation of organic acids, have suffered leaching of aluminum and iron sesquioxides from their A horizons. Typical podsol soils have a high accumulation of semi-decomposed carbonaceous material in the surface soil, an "ashes-like" layer below this which is very low in organic matter, and are ill-drained. More or less well-defined hardpan formation is characteristic.

Work with Quebec surface soils and subsoils in this laboratory during the last fifteen months has shown a prevalence of the podsol type in certain districts. The great accumulation of semi-decomposed organic matter in the surface six to eight inches of the podsol soils studied is especially noteworthy. The soils of limestone origin studied, which contain a fair amount of calcium and magnesium, as a rule do not show nearly so high an amount of carbon in their surface soils as do the soils originating from igneous rocks. Those limestone origin soils which do have a rather high amount of organic carbon in their surface soils

[4] SCIENCE, N. S., Vol. LV, pp. 295–297; SCIENCE, N. S., Vol. LVII, pp. 503–504; *Jour. Exp. Zool*, Vol. 39, pp. 381–432.