would have to be of the order of 10,000 km. per second.

Since there is little or no evidence to justify such a high speed for the particles, and since the observed results agree with those predicted for the light eclipse, it seems that ultra-violet light, rather than neutral particles, is the ionizing agency which caused the phenomena observed during the eclipse.

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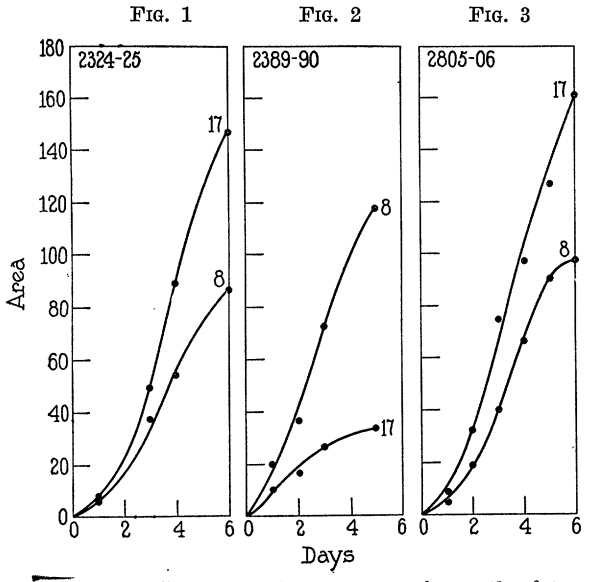
THE STABILITY OF FUNCTIONALLY DISTINCT RACES OF FIBROBLASTS

IT has already been shown[1] that common connective tissue cells, or fibroblasts, do not occur throughout the organism as a separate and distinct type. Fibroblasts, as a group, comprise many different cell types which, according to their origin, can be distinguished by the physiological properties manifested under conditions of cultivation *in vitro*. They differ with respect to the growth energy that they exhibit in a given medium, the amount of acid liberated into that medium, their ability to digest fibrin, etc. Thus, although morphologically similar, a fibroblast from skeletal muscle is as different from a heart muscle fibroblast as a pigment cell of iris epithelium is different from a colloid-producing cell from thyroid epithelium. Furthermore, it has been found[2] that fibroblasts originating from embryos of different ages show different nutritional properties, even when the cells are removed from the same part of the embryo. For example, cell strains derived from a 20-day-old embryo may show, under the same experimental conditions, a rate of cell multiplication that is either higher or lower than that exhibited by similar strains isolated from a 10-day-old embryo, depending upon the particular organ or tissue from which the strains are obtained. In the present communication, it will be shown that, after separation from the body, each cell type retains indefinitely the properties possessed at the moment of isolation.

Two groups of experiments have been made. The first group was designed to test the permanence of differences due to spatial relationships, that is, those determined by the particular organ or tissue supplying the strains; the second, to test the permanence of differences of a temporal nature, or those conditioned by the age of the embryo from which the tissues are taken. The material used in connection with the first set of experiments consisted of two strains of fibroblasts derived from a 13-day-old chick embryo, one being obtained from the ventricle of the heart, the other from the periosteum of bone. Both strains were subjected to the same treatment for 18 passages (97 days), during which time they were cultivated in an appropriate mixture of chick plasma, chick embryonic tissue juice and Tyrode solution. At the 19th passage, the two strains were placed in media of different composition, the heart fibroblasts being cultivated in a medium containing much more than the usual amount of embryonic tissue juice, while the fibroblasts from the periosteum were subjected to a medium in which the percentage of tissue juice was greatly diminished. This treatment, which was continued for 4 passages (26 days), resulted in an increased rate of cell multiplication on the part of the heart fibroblasts with a corresponding retardation in the case of the bone fibroblasts. At the end of four passages, when the heart fibroblasts were dividing at a much higher rate than the starved bone fibroblasts, the two strains were again placed under the same nutritional régime. Almost immediately, they reverted to their original rate of division, and after three passages on a common medium they both displayed the same characteristics that had distinguished them before it was attempted to alter their properties by subjecting them to diverse media.

The second group of experiments, being designed to test the permanent nature of nutritional properties determined by the age of the embryo from which the fibroblasts are derived, were carried out in much the same manner as those described above. Two cell strains were isolated simultaneously from skeletal muscle removed from the lower limbs of 8- and 17-day-old chick embryos. Both strains were cultivated under the same environmental conditions. The cell strain derived from the 17-day-old embryo showed a rate of cell multiplication that was consistently higher than that manifested by the strain derived from the younger embryo. The degree of difference was as great as that found to exist between the heart and bone fibroblasts referred to above. The accompanying diagram shows the division rate of the two strains in their fourth passage (Fig. 1). At the previous transfer, one half of each culture comprising the two strains was placed in an experiment in which the 8-day strain was given access to a larger quantity of embryonic tissue juice than it had previously received, whereas the 17-day strain was placed in a medium containing much less than the usual amount. The result was similar to that obtained with the heart and bone fibroblasts. The rate of cell multiplication of the 8-day strain, that had originally been much lower than that of the 17-day strain, now became the greater of the two (Fig. 2). After this treatment had been

[1] R. C. Parker, SCIENCE, 76, 219, 1932.
[2] Unpublished experiments.



FIGS. 1–3. Curves showing the rate of growth of two strains of fibroblasts isolated simultaneously from the musculature of the lower limb of an 8- and a 17-day-old chick embryo, respectively, and subjected to identical treatment from the beginning until the 26th day. Fig. 1 shows the last 6 days of this treatment. Fig. 2 shows the rate of growth of the same strains for the second of two 5-day periods, during which time the 8-day strain was subjected to more than the usual amount of food substances, and the 17-day strain to less than the usual amount. Fig. 3 shows the rate of growth of the same strains after the previous treatment had been discontinued and both strains had again been cultivated on the same medium for 29 days.

continued for two successive periods of cultivation, they were replaced in media of the same composition. The original characteristics reappeared immediately (Fig. 3), and continued to persist until the termination of the experiment, at which time the strains had been cultivated *in vitro* for a total period of 75 days.

It is clear that the properties characterizing the different races of fibroblasts are real and persistent. They are retained by the cells in an unaltered state in spite of profound alterations in their environment. It is therefore erroneous to suppose that cells removed from the organism revert to an embryonic or indifferent type. While the properties that the cells manifest under various conditions of cultivation outside of the organism are, in part, an expression of the nutritional conditions under which they are placed, they likewise depend upon their origin and upon the age of the animal from which they are removed. The organism is able to effect progressive and irreversible changes in the constituent cells. But when the cells are released from the influence of the organism, they remain permanently stamped with the characters imposed upon them by the peculiar conditions that had existed in the tissues and organs of which they formed a part.

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CONTROL OF THE BLOSSOM BLIGHT STAGE OF FIRE BLIGHT[1]

IN a previous article published in this journal,[2] evidence was presented which indicated that the early blossom blight stage of fire blight was traceable to the dissemination of the germ by honey-bees. If this is true, it would seem that blossom blight might be controlled either by the removal of contaminated beehives and bees or by the application of a germicide to the open blossoms.

Both of these methods are being tried, and the results obtained by the latter appear so promising that it appears desirable to present them, even though the investigations are not complete.

A block of 167 Jonathan apple trees, 21 years old, which had suffered a loss from fire blight of 95 per cent. of its blossom clusters in 1930 and 60 per cent. in 1931, was placed at our disposal by the owner. Four rows, comprising 64 trees, served as controls, receiving the regular early season spray applications common in many of the apple sections of America, consisting of a cluster bud or pink spray, a calyx spray and a first cover spray, the material being one and one half gallons of commercial lime sulphur to 50 gallons of water, to which was added one and one half pounds of arsenate of lead in the calyx spray and in the first cover spray. Seven rows, comprising 103 trees, growing alongside of the check trees, received the experimental spray applications for the control of blossom blight. The material consisted of a weak Bordeaux mixture, made up of one pound of powdered copper sulphate, three pounds of hydrated lime, and 50 gallons of water. To this was added arsenate of lead in the calyx and cover sprays in the same amount used for the checks. The applications were made as follows: First, as a cluster bud or pink spray (April 8 and 9); second, when approximately 25 per cent. of the blossoms were fully open (April 12); third, when approximately 80 per cent. of the blossoms were open (April 16); fourth, when about seven eighths of the petals had fallen (April 20); and fifth (May 9), when the first brood of codling moths was anticipated.

It is to be noted that, aside from chemicals, the main point of difference between the experimental spray program and that of the standard spray schedule is the application of two sprays when the blossoms

[1] Research paper No. 287, Journal Series, University of Arkansas.

[2] SCIENCE, 72: 301–302, 1930.