colonies on blood agar plates have been produced from the A, B and C cultures by growth in broth to which specific anti-serum had been added. After 23 transfers in serum broth, none of the cultures were completely converted to the rough varieties. Organisms of both the S and R varieties could be recovered. Some of the S varieties, which were recovered after 23 transfers in broth containing anti-serum, showed the virulence and the electrophoretic potential characteristic of the original cultures. Some of the S varieties show reduced virulence and potential. The rough varieties recovered after 12 transfers of B and C strains in broth plus anti-serum showed the same virulence and potential as the original B and C cultures. Hence, it appears that strains of pneumococci which differ significantly in virulence are not necessarily correspondently separable into S and R categories.

The original A strain gives a prompt precipitation reaction with specific anti-serum. The original B and C strains and the "rough" derivatives of A, B and C strains give only a slight, delayed reaction after 24 hours.

The A and B strains showed no significant changes in virulence, potential or agglutination after 4 and 8 passages through mice. Passage of the C strain through mice resulted in a reversion of its characteristics to those of the A strain.

In all cases studied, alterations in the virulence of pneumococci for white mice are accompanied by parallel alterations in electrophoretic potential and by reciprocal alterations in agglutinability.

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Modification of development in chick embryos induced by ultra-violet radiation.

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This is the sixth of a series of studies on radiation, four of which have concerned themselves with differential modification

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of embryonic development. The previous work includes experiments on Arbacia eggs and sperm, and on Fundulus eggs. The results in all the experiments agree in their more general features, namely, those regions which at the time of exposure have the highest rates of physiological activity, are the most readily modified in their development. Such modifications may be brought about by exposures made at various intervals after fertilization, as well as before fertilization. Experiments with hens' eggs yield the same general results, when exposed before and after incubation.

The complete spectrum of the Hg vapor arc (running at 110 v. D. C. at a distance of 10 inches) served as a source of radiation. Eggs were exposed at intervals, up to 64 hr. after incubation, as well as before incubation. Since it was found that exposures through the shell were entirely without effect, it was necessary to remove a small part of the shell and underlying membrane, and thus expose the blastoderm directly to radiation through the very thin layer of albumen which covered the surface of the yolk of the egg. Such a thin layer does not screen off the effective radiation. Exposures were from 1/5 min. to 10 min. in duration. It was found that later stages of development required less radiation to produce a given result, and would be killed with doses of 5 to 10 min. which produce only developmental modifications when exposures are made before incubation.

Before incubation, or reincubation, the piece of shell which had been removed was replaced, and the egg sealed with paraffin. Development was usually allowed to continue for three days, although some eggs were removed from the incubator after 24 or 48 hours.

Results. Among unoperated unexposed controls the percentage of normal eggs which developed to the three-day stage was from 85 to 90. Operated controls yielded about 60 per cent normality, while operated exposed eggs yielded only about 10 per cent normal embryos. These calculations are based on totals of 117, 114, and 493 eggs respectively. Exposure of operated eggs through plate glass one cm. thick produced a normality of 75 per cent, indicating that the effective radiation did not get through the glass.

The experimentally produced abnormalities are typically differential, that is to say, the regions which at the time of exposure had the highest rates of physiological activity, are most

readily modified. Accordingly, the fore-brain, particularly the anterior median region, is extremely susceptible to modification in the early stages of development. In later stages, other regions of the brain are also modifiable, particularly the hind-brain at the time of flexure and turning of the head. As the embryonic axis elongates posteriorly, the neural fold and somite region cease to develop normally in a large percentage of the cases indicating a double gradient of differences in susceptibility relations along the axis.

From these results we may conclude that there is a difference in susceptibility to modification of development by means of ultraviolet radiation along the axis of the chick embryo. The difference is in general coincident with an anteroposterior gradient in early stages, although in later stages, such a gradient is complicated by the appearance of highly susceptible regions which express local rapid development or differentiation, as for example, in the region of the hind-brain or in the posterior somite region. The fact that eggs exposed before incubation show in their later development the same axial differences in susceptibility to developmental modification as they do later, indicates the early presence of an axiate organization in the egg, even before it can be detected morphologically.

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The nutritional value of chlorophyll as related to hemoglobin formation.

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A study of the problem of organic precursors of the hematin part of hemoglobin shows that no attention has been directed toward the possible relation of vitamines therein, whether this be as a direct precursor, or as involved in the use of such possible precursors as chlorophyll.

The problem was to determine whether rats could be rendered anemic by the absence of one or more vitamines in a synthetic diet