that of Stone's "Super-Bar," 1930, then Dobzhansky's "Baroid," 1931, then two "moderate-Bar" inversions of the author and many rearrangements recently reported by Volotoff). The phenotypic change is therefore solely a result of the "position effect," and this effect must be sharply distinguished from the effect of dosage change, even though in many individual cases in genetics it has not yet been possible to judge with which class of effect we are dealing.

We consider the point of chief interest in the Bar case to be its illustration of the manner of origination of extra genes in evolution. Bar had for a long time offered the best case yet known for the idea that genes could arise *de novo*. Its interpretation as some sort of duplication met with difficulties, in our ignorance of the real existence of a "position effect" of non-allelomorphic genes upon one another. Now these difficulties are resolved and there remains no reason to doubt the application of the dictum "all life from pre-existing life" and "every cell from a pre-existing cell," to the gene: "every gene from a pre-existing gene." We need at present make an exception here only of those very special conditions under which life itself, as a naked gene, originates.

That the addition of genes by duplicational processes, such as the insertion of small pieces and primary unequal crossing over, is still a factor in evolution, has previously been urged by us. We have discussed the matter recently in connection with the case of achaete and scute, in which the functional similarity found to exist between these neighboring genes suggested that a duplication had occurred in the ancestry of the normal form,[5] and we have discussed it again in the case of a small insertion (scute 19) produced by x-rays, in which a stock of individuals homozygous for the extra section is viable and fertile.[6] It was pointed out in the latter paper that the twin regions would more commonly lie near to one another, in the same chromosome, rather than far apart, as they did in this case. These papers were independent of the recent paper of Bridges[7] on "Salivary Chromosome Maps," which gives cytological evidence of the repetition of at least two sections in the normal second chromosome, and which, on the basis of these, arrives at the same general conclusions. Another case of this kind (that of the "bulb" in the normal X chromosome) has, independently of the cases of Bridges, been discovered by Offermann,[8] who again draws similar conclusions. And most recently Kossikov has found still another case, as yet unpublished. The Bar case fits in with all this convergent evidence and constitutes the first case actually observed in Drosophila of the spontaneous origination of a minute duplication capable of maintaining itself in the homozygous condition.

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[5] H. J. Muller, *Jour. Hered.*, 26: 469–478 (see p. 476), 1935.

[6] H. J. Muller, *Genetica*, xvii, 237–252 (see p. 249–250), 1935.

[7] C. B. Bridges, *Jour. Hered.*, 26: 60–64, 1935.

[8] C. O. Offermann, *Jour. Genet.*, 32: 103–116, 1936.

LIVER AS A SOURCE OF VITAMIN G

IN studies relating to the effects of diet on coccidian infections, one of the problems is that of determining the rôle of vitamins. Our previous published results[1] showed that "vitamin G" in autoclaved yeast favored the multiplication of *Eimeria miyairii* in the white rat, as indicated by oocyst counts. In a report now in press,[2] we have shown that when dried powdered liver or liver extract were employed as the sole source of vitamin G, the numbers of oocysts passed by the rats were still only a fraction of those passed by the controls, which received a basal diet plus 10 per cent. yeast. Since the growth of the rats receiving liver was considerably less than that of the reference series receiving yeast, further study on the relation of the amount of liver fed to the growth of the host and the numerical increase of the coccidium was indicated.

Nine rats having a mean weight of 76 gm were fed the basal diet made up to 10 per cent. with powdered dried liver prepared by us as a source of vitamin G and to 4 per cent. with rice polish as a source of vitamin B. Nine rats with a mean weight of 78 gm received the basal diet made up to 10 per cent. with powdered yeast (unautoclaved). During the 22 succeeding days, the test rats gained 70 gm each; the reference rats, 72 gm. It is evident that the animals receiving liver made "normal" growth. All were infected with 1,500 oocysts of *Eimeria miyairii* on the eleventh, thirteenth and fifteenth days on the diets. Subsequently, the test series eliminated a mean of 39.5 million oocysts; the reference series, 137.6 million. It is evident that the addition of liver and rice polish conditioned normal growth, but did not favor the parasite to the extent that yeast did. Furthermore, all the rats were immune to reinfection.

Nine two-week chicks were fed the growing ration we feed rats (Steenbock's), and nine the liver ration described in the preceding paragraph. After twelve days on these diets, each chicken was given 40,000 oocysts of *Eimeria tenella* from a four-month-old culture kept in a refrigerator. During the subsequent infections, the birds on the growing ration for rats eliminated a mean of 67.75 million oocysts; those on the liver diet, a mean of 4.55 million oocysts. In this case also the addition of liver to the diet as the sole source of vitamin G resulted in a much lower oocyst count. These data, however, are not so reliable as

[1] E. R. Becker and N. F. Morehouse, *Proc. Soc. Exp. Biol. and Med.*, 33: 487, 1936.

[2] *Ibid.*, in press.

those for the rats, because after sacrifice some of the caeca in both series of chicks were found plugged. The chick infections did not result in immunity.

At the present time it is not possible to say how liver acts in retarding the development of coccidian infections. The two possibilities that seem most plausible are that liver lacks the coccidium-growth-promoting substances and that liver contains a coccidicidal, or at least coccidistatic, material. Further investigation will be conducted along these suggested lines.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF HOLLOW GROUND SLIDES MADE WITH THE DENTAL ENGINE

THE method so aptly described by Dr. Marshall Hertig in a recent issue of SCIENCE[1] for making hollow ground slides with the dental engine has been in use in part by the present writer for several years in preparing slides for the mounting of diatoms, but the possibility of its more general application was not recognized. It is thought that the following supplementary suggestions and critical analysis from his own experience might add somewhat to the usefulness of the method.

Dr. Hertig mentions as part of the necessary equipment a flexible shaft or hand piece, normally part of the dental engine. This should be emphasized as essential. Slides first prepared by the writer were made with a drill press, using spherical carborundum points. Besides the greater difficulty of controlling the work, the constant angle maintained between the tool and the slide causes the carborundum point to wear unevenly, which produces an annular surface to the slide depression, visible and consequently detrimental under the lower powers of the microscope. Changing this angle while cutting the cavity produces a smooth curvature to the bottom of the depression, giving a clear and evenly lighted field, which can be done with a flexible shaft.

On first using such slides a question occurred to the writer, which may cause some misgivings in the minds of others also. Despite almost complete obliteration of the cavity when filled with balsam, due to similarity of refractive index of the balsam and the glass, there is usually enough difference in index to give some slight effect, and the question was to what extent the spurious deflection of light from a ground surface so close to the object might interfere with a critical image or produce artifacts under certain conditions.

To test possible undesirable effects various objects were examined under different powers and conditions, more significant being a critical examination of the classical test object, *Amphipleura pellucida,* under oil immersion with oblique illumination. It was thought that with a narrow beam of great obliquity, any spurious extraneous light from the ground surface of the cavity might diminish the resolution or definition of so critical an object. There proved to be no noticeable effect in any case, probably explainable by the overwhelming intensity of the controlled as compared with the diffused light, incident to any particular point on the object. It is recommended, however, that the object be fixed to the cover (as pertains in the work here described), and hence suspended over the cavity, which should be ground reasonably deep; for where the object and the bottom of the cavity fall simultaneously within the visible range of focus of the objective used the ground surface is detrimental. Also, no noticeable effects obtained in photographing objects mounted in this way, barring possible uneven lighting if the cavity was not sufficiently deep. Fortunately for this purpose the depth of focus in the higher power objectives is very shallow. With higher index media, of course, obvious and more unsatisfactory effects are produced. These tests should dispel the doubts of any who contemplate using the method according to the conditions here presented.

Some benefits may accrue from the ground surface in a possible slight whitening and brightening of the field, and in sharpness of image from diffuse rays incident to the object more close to the critical angle.

In the production of hollow ground slides with the carborundum point the writer finds very advantageous the use of a shield in the form of a block of hard wood or metal, slightly larger than a slide and about one quarter of an inch in thickness. This has on the under side a 3 by 1 inch depression into which a slide may fit. In the center of this depression there is a hole through the block one fourth to three eighths inch in diameter, countersunk from the top. This tool has the following advantages: (1) It makes it easier to hold the slide while drilling; (2) it facilitates centering the cavity on the slide; (3) it restrains the lubricant from running off the slide while drilling, and (4) it protects the slide from unsightly scratches across it if the point should slip, as well may happen, especially when first starting the cavity.

[1] Marshall Hertig, SCIENCE, 83: 2144, 110, January 31, 1936.