finding compatible graft donors and for the study of the genetics of histocompatibility in man. Similarly, the findings in the eczema experiments provide hope that this method may be useful in the study of autoimmune disease (*9*).

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Bipolar Planarians in a Stock Culture

Abstract. *Four long bipolar planarians were discovered in a stock culture of asexual* Dugesia dorotocephala. *Such worms have not been previously reported. Eyespots, auricles, and responses to stimuli were normal in each head-end, and functional pharynges were present. Worms in the stock culture had not been subjected to temperature variations, chemicals, or other experimentation. It is suggested that the axial gradient was effectively flattened by a normal head-inhibiting factor being unable to diffuse to the posterior end.*

Bipolar planarians have been produced from extremely short segments (*1, 2*) and, from somewhat larger segments, by the use of chemicals such as lithium chloride plus thiocyanate, colchicine, and deacetylmethylcolchicine (*3, 4*). No reports have been published of the natural occurrence of bipolar heads in long, mature planarians not subjected to experimental conditions.

In the summer of 1962, three long bipolar planarians were discovered in a stock culture of asexual *Dugesia dorotocephala.* The worms had been kept in a constant temperature laboratory for 3 years, and had not been exposed to chemicals or other form of experimentation. In the spring of 1963, a fourth bipolar planarian was discovered in the same group. This animal measured about 30 mm in length (Fig. 1); one head was slightly larger, but both heads were normal in appearance. A functional pharynx was present in each end.

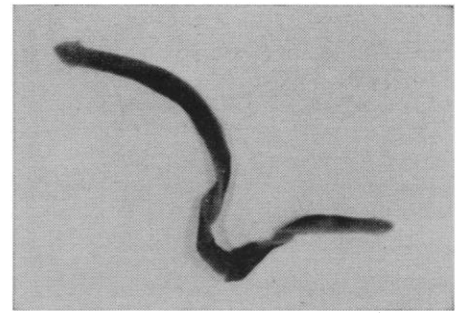

Fig. 1. Bipolar planarian from a stock culture.

Approximately 6 weeks after the animal was found, fission occurred. The fission plane was in the usual position behind the pharynx associated with the larger head. The long mid-piece, which remained attached to the smaller head, was held more or less curled over the back of the worm as it glided about. Viewed with a microscope, no injury of any type was apparent on either worm. Within a short time, the piece with the larger head regenerated a tail, and thereafter gave rise to several normal fission products.

Ten days after fission, the longer piece again became bipolar. Within a few days the two heads were the same size, each with well-developed eyespots and auricles. It was no longer possible to distinguish which was the newer regenerate. At all times, the two head-ends reacted as two individuals, whether ingesting food, crawling over each other, or starting off in separate directions. The connecting mid-piece appeared to be under the control of neither head, but apparently offered no obstacle to movement.

According to Child's theory, axial metabolic gradients constitute the basis of polarity, and bipolarity in short segments of planarians develops because little or no gradient has been established (*2*). Flickinger demonstrated, in intact planarians, an axial anterior-posterior gradient of incorporation of $C^{14}O_2$ and C^{14}-labeled glycine into proteins, and showed that both deacetylmethylcolchicine and chloramphenicol, known inhibitors of protein synthesis, could obliterate this gradient, and were effective in producing reversed polarity and bipolar development (*4*). Apparently, for bipolarity to occur, the slope of the gradient must be flattened by some means. Since, in this case, neither shortness of segment, nor chemicals, can be considered, it would appear that either the excessive length or the somewhat inert mid-piece, or both, must have been a major factor in the differentiation of the posterior head.

That distance may have some effect is shown by Flickinger's report of a slight increase in the tail region of the axial gradient of incorporation of C^{14}-labeled glycine (*4*). Further evidence is provided by Lender's demonstration that in planarians, the differentiation of another brain can be inhibited either by a brain present in the animal, or by a crude homogenate of heads added to water in which decapitated planarians are cultured. This inhibitory substance is diffusible, and its effect decreases with distance (*5*).

It appears probable that the formation of the second head was due to an effective flattening of the gradient, with resultant escape from anterior dominance, and that the means of accomplishing this was the inability of a diffusible inhibiting substance to traverse the distance required. In the absence of such an inhibitor, a secondary head could form in the usual manner (*6*).

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