eight-celled, globular and heart-shaped embryoids were observed in the callus. One-month-old cultures showed fully formed embryoids (Fig. 1 A). These consisted of radicle-plumule axis and two (sometimes three) cotyledons, characteristic of the normal embryos. They germinated into normal seedlings both in situ and when transferred to fresh medium (Fig. 1 B, C).

In the remaining 50 per cent of the cultures, the tip of the original explant emerged from the callus and developed numerous spirally arranged carpels.

Our work points to the totipotency of the somatic cells of the floral primordia and suggests that even the floral buds which are usually supposed to have a set pattern of differentiation can manifest other growth activities including the reconstitution of new plants when excised at the sepal initiation stage.

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1) GALUN, E., Y. JUNG, and A. LANG: Nature **194**, 596 (1962). — 2) TEPFER, S. S., R. I. GREYSON, W. R. CRAIG, and J. L. HINDMAN: Am. J. Bot. **50**, 1035 (1963).

## Significance of Morphology and Physiology of *Daphnia* for its Survival in Predator-Prey Experiments

Zooplankton populations are decimated by fish and other enemies to such an extent that their evolution should be significantly influenced by this interspecific relationship[1],[2]. Characteristics of a prey that bear on its success to escape predators should be under severe selection pressure. In the cyclomorphic water flea *Daphnia galeata mendotae* BIRGE environmentally controlled seasonal cycles of pronounced morphological and physiological variations occur in successive generations[3],[4a–d]. For instance, animals grown at high temperatures have longer heads and longer tails but shorter antennal bristles than have animals grown at low temperatures. Swimming horizontally at 20° C, long-headed individuals exhibited higher antennal beat frequencies and beat efficiencies than did short-headed individuals[4e]. Recent studies show that passively sinking long-headed forms are significantly more horizontally inclined than are short-headed forms. The differences of inclination are greater at high than at low sinking temperature, and more so in small than in large animals. Doubtless the parameters mentioned are involved in daphnid locomotion and orientation.

In order to test whether such variables might influence an animal's chance to escape predation, the following experiments were done: In 2-liter glass cylinders of 15 cm diameter, artificial populations of 10 Daphniae composed of 5 individuals of each of two different phenotypes, were exposed to predation by various groups of 3 *Lebistes reticulatus* (guppy) males. Feeding took place at ca. 3 lux and lasted between 2 and 15 minutes (depending on temperature). Survival was tabulated in terms of % animals not eaten.

When young adults reared at 5° competed with equal-sized animals reared at 25°, the "long" 25°-animals survived significantly better than their "short" colleagues: 71.4% vs. 42.1% survival at 25° predation temperature (difference significant with $p < 0.001$; 28 experiments) and 65.5% vs. 46.5% at 15° ($p < 0.006$; 40 exp.). Repetition of the experiments with non-cyclomorphic *Daphnia pulex* DE GEER showed no such difference: 46.9% vs. 53.8% ($p > 0.15$; 32 exp. at 25° C). To check specifically the influence of morphology independent of rearing temperature, we compared adults of *D. g. mendotae* whose tails had been amputated during the 1st juvenile instar, with their intact sisters, together with whom they had been reared at 25° till to the experiment. The amputated animals were at a definite disadvantage: 34.4% vs. 48.7% ($p = 0.003$; 39 exp. at 25°). It is concluded that, under the conditions of the experiments, the cyclomorphic variations have a definite effect on the animals' chance to survive predation by fish.

It is known that natural populations are geneticly polymorphic with respect to cyclomorphic reaction norms [4a]. One may surmise that variations due to genetic rather than environmental background may similarly affect an animal's chance to escape, and hence it seems unlikely that the phenomenon of cyclomorphosis should have evolved without at least some reference to predation rates. If it is correct that summer predation may eliminate daily up to 25% of the standing crop of *D. g. mendotae*[2], then even much smaller genotypical differences of survival than the phenotypical ones recorded could significantly alter a populations's relative gene frequencies within one year. *D. g. mendotae* as well as other cyclomorphic forms reproduce almost entirely by parthenogenesis. In the absence of conventional gene balance mechanisms, the genetic composition of natural populations may be unstable, evolution unusually rapid, and taxonomic unity of the species but a relic of sexually happier past history.

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1) GERKING, S. D.: Ecol. Monographs **32**, 31—78 (1962). — 2) HALL, D. J.: Ecology **45**, 94—112 (1964). — 3) BROOKS, J. L.: a) Ecol. Monographs **16**, 409—447 (1946); — b) Proc. Nat. Acad. Sci. U.S. **33**, 141—148 (1947). — 4) JACOBS, J.: a) Arch. Hydrobiol. **59**, 7—71 (1961); — b) Physiol. Zool. **34**, 202—216 (1961); — c) Intern. Rev. Hydrobiol. **47**, 146—156 (1962); — d) Naturwissenschaften **52**, 92 (1965); — e) Verhandl. internat. Vereinig. Limnolog. **15**, 676—683 (1964).

## Evidences for Inductive Properties of the Micromere-RNA in Sea-urchin Embryos

Immediately before and during the 5th cleavage, only the nuclei in the micromeres synthesize RNA (Fig. 1) as is demonstrated by $^{3}$H-uridine incorporation in pulse experiments and subsequent ribonuclease treatment. Labelling is also found in the cytoplasm of the micromeres 20 minutes after the embryos

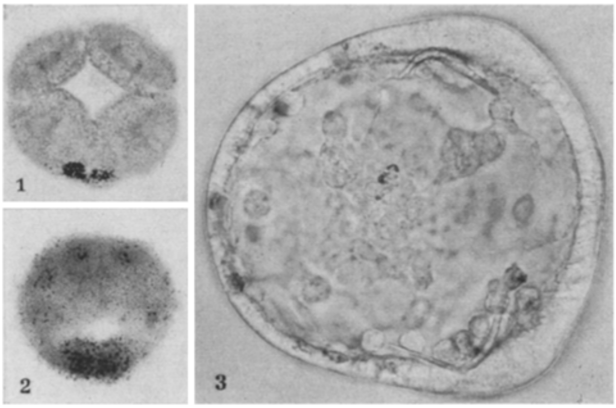

Fig. 1. Meridional section through a 16-cell stage of *Paracentrotus lividus* immediately after incubation with $^{3}$H-uridine

Fig. 2. Analogue section through an embryo transferred into pure sea-water and fixed one hour later: the labelled substance is spreading over the embryo

Fig. 3. 48 hours old embryo (seen from above in optical section) treated for 30 minutes with 8-azaguanine in the 16-cell stage. The archenteron is lacking in the embryo, which is in other respects quite normal (cf. skeleton, pigment cells, thickened oral and lateral ectoderm). Controls are well developed plutei

had been transferred to sea-water containing cold uridine (Fig. 2). Then and one hour later all nuclei of the embryo show incorporation of labelled substance. The labelling of the micromeres decreases gradually. No silver grains can be detected in autoradiographs previously treated with ribonuclease and cold perchloric acid. These facts suggest that it is RNA which is transported from the micromeres to the macro- and mesomeres.

As HÖRSTADIUS[2]) has shown, transplanted micromeres induce the differentiation of a secondary archenteron. One may therefore suppose that RNA from the micromeres has inductive properties. This hypothesis is favoured by experiments with 8-azaguanine which is exclusively incorporated into the embryos RNA[1]). 16-cell stages treated with this antimetabolite at the time when micromere-RNA synthesis occurs, are not able to develop the archenteron (Fig. 3). No influences, defects, or transformations of other parts of the