Table 2. EFFECT OF TRYPTOPHAN DEFICIENCY ON ONSET OF EGG PRODUCTION

| | Control | Experimental |
|---|---|---|
| No. of hens | 9 | 10 |
| Days fed deficient diet | 10 | 180 |
| Weight at: day 204 | 2,080 g | 111 g |
| day 397 | — | 2,130 g |
| Average No. of days to lay 10 eggs/hen | 204 | 397 |
| Net days after repletion for 10 eggs/hen | 180 | 193 |

After 10 days, 10 pullets were fed the tryptophan-supplemented diet. They immediately began growing at a rate (14 g gain/day) similar to the rate observed in the first experiment. After 14 days, when they weighed 280 g, these birds were fed commercial rations and observed until they had produced 10 normal eggs each. This took an additional 180 days, 204 days after the experiment was started (the 9 surviving hens thus averaged 212 days of age when they had laid 10 eggs each).

During this time the remaining 14 pullets (1 had died of the remaining 15) were fed the tryptophan-deficient diet only. On the 204th experimental day these birds weighed, on the average, 111 g; they had thus gained some 16 g during this period. When fed the tryptophan-supplemented diet, they immediately began growing at the rate previously observed for the control group of chicks, about 14 g/day. After 14 days (the 218th experimental day) they weighed 302 g. At this time, 10 of the chicks were fed the commercial growing ration and four were returned to the basal diet. After 20 days, the chicks fed the basal diet had gained only 60 g, while the pullets receiving the commercial ration had gained 180 g. The 4 chicks fed this basal diet were then discarded, and the remainder were observed until they, too, had laid 10 eggs each. This took 193 days (the 397th experimental day), on the average, after they had been permitted to resume growth. Table 2 summarizes this experiment.

In subsequent experiments with other strains of chickens, diets containing lower levels of tryptophan than diet 3 (see Table 1) had to be used in order to obtain similar results, that is, baby chicks from early-feathering broiler strains (some of which actually have well-developed feathers at the time of hatching) fed diet 3 exhibited some feather development, cartilage formation and connective tissue growth, although they did not gain in body-weight. Investigations are in progress to see if birds of this type are adversely affected by being held six months at the 100 g stage. We are finding with such early-maturing strains that successful stasis is attained by feeding the deficient diets very shortly after hatching.

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## Symbiotic Association between Zooxanthellae and Two Marine Sponges of the Genus *Cliona*

THE association between Zoochlorellae and some fresh-water sponges of the family Spongillidae is well known for its constancy and has been well studied[1]. In the case of similar associations of Zoochlorellae with the fresh-water hydroid *Clorohydra viridissima*[2] and of Zooxanthellae with the sea-anemone *Anthopleura elegantissima*[3], the occurrence of a direct transfer of material from the autotrophic symbiont to the tissues of the Coelenterates has been demonstrated.

On the contrary, the occurrence of Zooxanthellae in marine sponges is a rare event and up to now it has not been sufficiently studied. Zooxanthellae have been found only occasionally in the superficial parenchyma layers of *Ircinia variabilis*, *Myxilla* sp., *Merlia normanni*, *Reniera* sp. and in tubes of *Clathrina* sp.[4].

Our observations have been performed on two species of marine and boring sponges of the genus *Cliona*, *C. viridis* and *C. copiosa*. *C. viridis* generally lives at a depth of some metres while *C. copiosa* is an allied species living in lightened caves near the surface. The external colour of these two species is variable; in general, *C. viridis* shows a dark green colour which changes to brown in the case of *C. copiosa*. The internal part of both sponges is yellowish to greenish. Specimens of both species were collected in different Mediterranean stations (Bay of Naples and along the coast of Ligury and Puglie) as well as at different depths and at different times of the year. In all cases a great number of Zooxanthellae were found embedded in extracellular arrangement in the sponge parenchyma (Fig. 1) and more densely near the surface of the sponges. These Zooxanthellae exhibit a yellow-greenish colour with a blood-red fluorescence under Wood's light. In addition, they possess two flagellæ and measure 7·5–9μ in diameter.

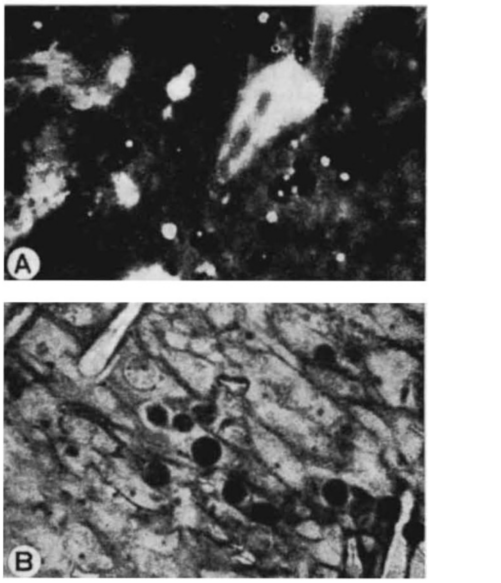


Fig. 1. Zooxanthellae in the sponge tissue observed (*A*) in Wood's light and (*B*) after fixation in formol and staining in Heidenhain hæmatoxylin–eosin

In the case of the associations between Zooxanthellae and Coelenterates, many investigators have considered that carbon dioxide, as well as other animal catabolites, may be essential for the metabolism of the autotrophic symbiont and that, on the other hand, the removal of carbon dioxide may be of some use for the associated animal[5]. The possibility of relationships between the occurrence of Zooxanthellae and the behaviour of *Clionidae*, boring in calcareous rocks and shells, must, therefore, be taken into consideration and deserves to be further investigated in greater details.

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