

STIMULATION OF OOCYTE GROWTH IN FISH BY AMINO ACIDS

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ABSTRACT

A comparative study of the oocyte size frequency distribution in the fish (*Anabas testudineus*) injected with gamma aminobutyric acid (GABA), glycine, and cysteine-methionine (cyst-met) shows that all these amino acids are capable of stimulating the growth of oocytes leading to their earlier maturation. The effect of GABA is more pronounced than those of glycine and cyst-met. The stimulation of oocyte growth is in proportion to the increase of gonado-somatic index.

SEVERAL amino acids have been found to have accelerating effects upon growth of animals; and some of these are glycine, serine, cysteine and methionine¹⁻⁶. Gamma aminobutyric acid (GABA), which is of unique occurrence in vertebrate central nervous system, is one of the neurotransmitters. It is probably involved in the neuronal control of the release of luteinizing hormone from the pituitary gland⁷. These findings have prompted the investigation, whether some of these amino acids could exert an early stimulating effect on the ovarian growth and oocyte maturation in the fish, in which the breeding period is defined. In this report it has been shown that the injection of GABA, glycine and cysteine-methionine have stimulatory effects on the ovarian growth and oocytes of the fish, *Anabas testudineus* (Bloch).

A group of four sexually mature fish of the size 12-16 cm was kept in jars 18 × 12 × 12 inches; 4 such groups were maintained in the laboratory. One group served as the control and the other groups were used for the injection of GABA, glycine, and cysteine-methionine (cyst-met). Each member of the group was injected with 0.5 ml (4 mg/ml) of aqueous solution of one of the amino acids every third day. The fishes

were sacrificed after six weeks (after a total of 15 injections) and the pieces of the ovary were fixed in Carnoy's fluid. They were prepared for histological examination. Oocyte diameter measurements were made from the sections of the ovary. The experiment was carried out from October through June. Six sets of results for both experimental and uninjected normal specimens were obtained. For the analysis of the data, oocytes were grouped into different categories at 50 μ intervals. The total number of oocytes observed in different groups of normal and experimental fishes is given in Table I.

The ratio of experimental (E) and normal (N) indicates an increase or decrease of oocyte number in each category of oocytes ranging from 50 to 500 μ in diameter. Fig. 1 shows the effects of GABA, glycine, and cyst-met on the growth of oocytes.

The effect of GABA (Fig. 1A) appears to be more pronounced than that of glycine (Fig. 1B) and cyst-met (Fig. 1C). Oocytes from 250-500 μ in diameter are in greater frequency in GABA injected fish. The stimulation appears to be greater for oocytes of higher diameter. The oocytes of 400, 450 and 500 μ in diameter are nearly 4, 7, and 9 times greater than those

TABLE I

Oocyte (Diameter μ)	50	100	150	200	250	300	350	400	450	500
Normal	416	281	116	57	46	55	78	45	15	9
GABA	100	93	101	82	72	95	120	163	104	80
Glycine	162	263	149	69	65	83	138	127	57	16
Cyst-met	227	279	82	62	68	82	134	134	48	9

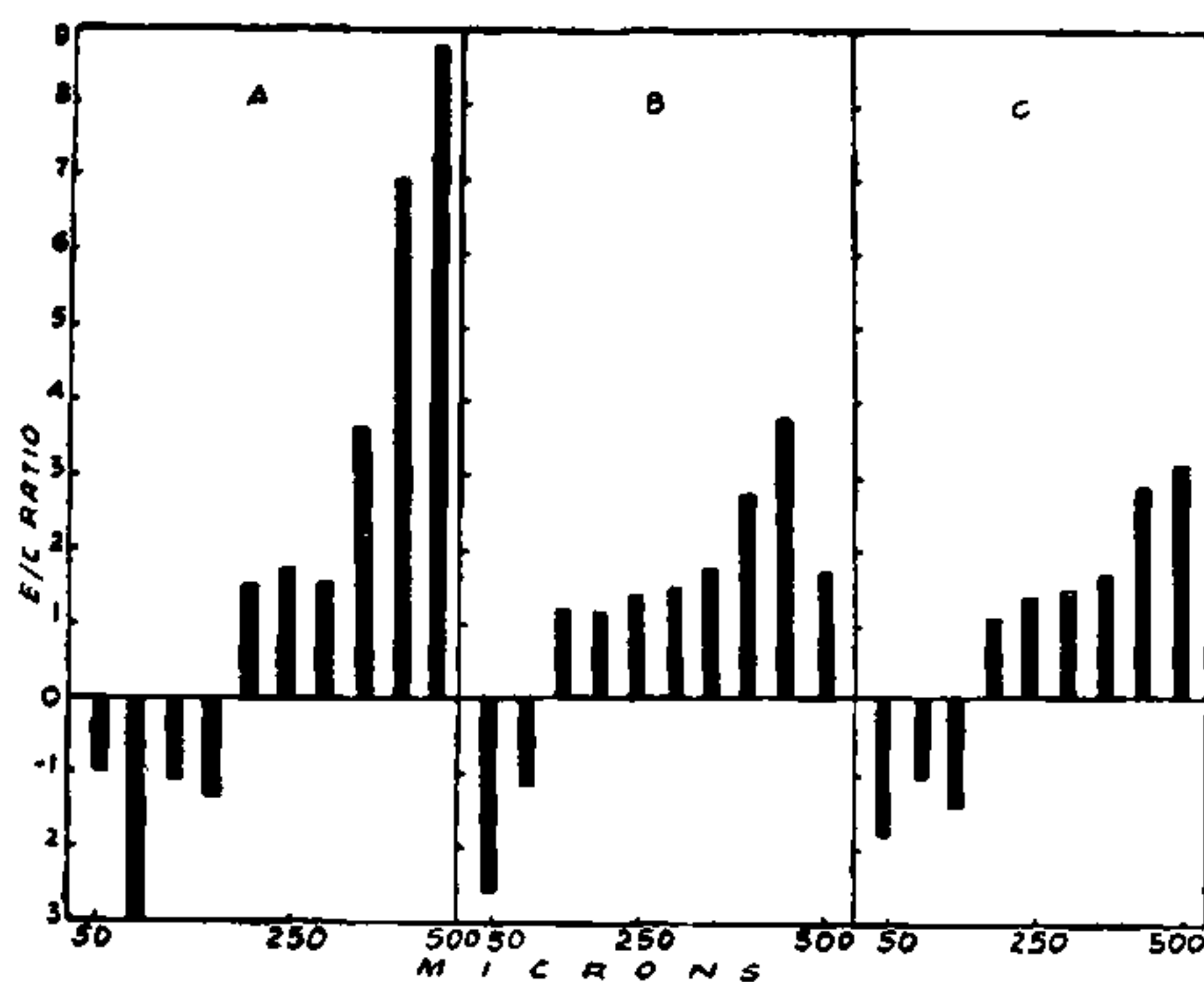


FIG. 1. Oocyte diameter frequency distribution of the fish, *Anabas testudineus*. The ratio of the total number of oocytes of different diameters of experimental (E) and normal (N) fish has been plotted to show the effect of injections of GABA (A), Glycine (B), and cysteine-methionine (C).

of normal. A decrease in the number of oocytes from 10–150 μ in diameter may be due to their transformation into larger ones.

In glycine injected fish, oocytes of 150–500 μ in diameter appear to have been stimulated, although the maximum stimulation is approximately 4-fold in oocytes of 450 μ in diameter. Likewise, in cyst-met injected fish, oocyte size frequency distribution indicates that oocytes of 200–500 μ are in greater number, but the maximum stimulation occurs in oocytes of 500 μ in diameter which is about three times greater than in normal fishes. GABA, glycine, and cyst-met appear to have stimulatory effect on the growth of oocytes to different degrees but the effect of GABA is most pronounced. The effect of glycine is next to GABA.

The spawning period of this fish begins from April through May⁸ but in GABA injected females, mature and extruded oocytes are found from December

onwards. In normal samples mature ova are found in the body cavity in March and April. Gonad weight: Body weight relationship of GABA injected and normal fish also indicate that there is a distinct increase in the gonado-somatic index from December through June⁹. In glycine injected fish, the gonado-somatic index is higher than normal fish from January through June but in cyst-met injected fish the rising trend of the gonado-somatic index is observed from January to April.

Earlier studies have shown that in *A. testudineus* oocytes up to 500 μ in diameter constitute about 35% of the total number of oocytes produced by the ovary⁸. Most of the oocytes of diameter greater than 500 μ are extruded from the ovary and they lie in the body cavity until they are discharged. In the present report, only intraovarian oocytes have been counted and measured. When all the oocytes, extruded as well as those in the ovary, are taken into consideration the effect of these amino acids on oocyte growth may appear to be more accentuated. Presence of a sizable proportion of mature oocytes in the body cavity of GABA injected fish is probably suggestive of the fact that GABA helps in the release of some pituitary gonadotropin, which in turn stimulates growth and maturity of oocytes in *A. testudineus*⁷.

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