TABLE 1

Average energy in fillet and food and the fillet/food calorie ratios (cal/g dry weight) in some freshwater fish

Species	Calories in: Fillet	Calories in: Food	Fillet/food calorie ratio
P. stigma	3791.7 ± 75.97	4014.1 ± 23.04	0.944 ± 0.001
L. rohita	3830.8 ± 48.08	4073.2 ± 77.41	0.942 ± 0.009
C. mrigala	4067.6 ± 176.74	4383.5 ± 172.63	0.924 ± 0.008
C. catla	3757.7 ± 160.74	4828.4 ± 129.81	0.770 ± 0.034

± Standard error of mean.

Inter-specific differences were observed in the total ratio of the calorific content of fillet to food in the gut. The highest ratio was encountered in *P. stigma* (0.944) and the lowest in *C. catla* (0.77). In *L. rohita* and *C. mrigala* the ratios were 0.942 and 0.924 respectively. Evidently, the assimilation of energy nutrients in the body was in the order: *P. stigma, L. rohita, C. mrigala* and *C. catla*. The results show that despite larger intake of food, the energy actually assimilated was smaller in *C. catla*. However, in *P. stigma, L. rohita* and *C. mrigala* the efficiency of conversion of food into flesh was higher and comparatively larger proportion of the foraged items was incorporated in the body. Detailed studies on these aspects are in progress.

23 August 1982

1. Qasim, S. Z., *Indian J. Fish*, 1972, **19**, 11.
2. Qasim, S. Z. and Jacob, P. G., *Indian J. Fish*, 1972, **19**, 29.
3. Qasim, S. Z., Vivekanandan, S. and Easterson, D. C. V., *Indian J. Fish*, 1973, **20**, 318.
4. Sumitra, V., Wafer, M. V. M., Jacob, P. G., Balasubramanian, T., Rajagopal, M. D. and Krishna Kumari, L., *Mahasagar—Bull. Natl. Inst. Oceanogr.* 1975, **8**, 9.
5. Karzinkin, G. S. and Tarkovaskaya, O. I., In *Techniques for the investigations of fish physiology*, (ed. E. N. Pavlovskii), Israel Program for Scientific Translations, 1964, 122.

NEUROENDOCRINE CONTROL OF OOCYTE DEVELOPMENT IN *POECILOCERUS PICTUS* FABR. (ACRIDIDAE, ORTHOPTERA)

SMITA BANERJEE AND Y. N. SAHAI
Department of Zoology, University of Saugar, Sagar 470 003, India.

YOLK proteins in *Poeciloceurs pictus* are synthesised by the fat body, transported through the haemolymph and sequestered by developing oöcytes[1-3]. The neurosecretory cells and the corpus allatum are involved in this process[4] as in the majority of insects. According to Highnam[5,6] and Girardie[7,8] the cerebral neurosecretory cells as well as the corpora allata are necessary for oöcyte development in orthoptera. In *Schistocerca* it has been shown that the cerebral neurosecretory cells control general protein synthesis of female specific protein or vitellogenin[9-11]. According to Saini[4] cerebral neurosecretory cells control the growth of oöctye whereas the yolk synthesis or vitellogenesis is controlled by corpora allata in *P. pictus*. The median neurosecretory cells have a gonadotrophic effect in *Locusta* according to Girardie[7,12] and Bentz[11] whereas corpora allata exert a gonadotrophic effect in *Melanoplus* according to Dogra *et al*[13,14] These conflicting results arose from experiments in which only one operation *i.e.* either allatectomy or neurosecretory cells cautery has been performed. Interpretations also become difficult because of hormonal interactions rendered by reimplantation or injection of active compounds or extracts[15]. Saini[4] has suggested that cerebral neurosecretory cells stimulate the corpora allata whereas McCaffery and Highnam[15] suggest that the CA hormone stimulates neurosecretory cell activity. Whatever the hypothesis, it is obvious that both the endocrine centres are active at a time.

An attempt has been made in the present paper to explore the extent to which the corpora allata (CA) and median neurosecretory cells (mNSC) affect oögenesis in *P. pictus*. *P. pictus* was reared[16], CA were removed from 15–25 day old females containing vitellogenic terminal oöcytes (4.9 to 5 mm long) and kept in saline prior to implantation. The glands were implanted into the head capsule of a newly emerged or 3-day old anaesthetised female and the wound was sealed[16]. In another set of experiments the females were anaesthetised and a square flap of cutcle cut in the frons. The anterior surface of the brain was exposed and the area of mNSC pricked by a fine sterilised needle. The wound was then sealed off as usual. CA were implanted in some NSC cauterised females also by the method described above. The terminal oöcyte, which is the first oöcyte to undergo vitellogenesis was mainly studied for growth and yolk deposition. The ovaries were removed from females at different intervals of time and placed in saline. The length of the terminal oöcyte was measured against a dark background. The yolk proteins in oöcytes was determined on the basis of the presence of yellow pigment in them.

The implantation of active CA into newly emerged or 3 day-old females results in rapid vitellogenesis and penultimate or subterminal oöcytes (Figure 1). This there is a period of previtellogenic growth of oocytes before vitellogenesis[3] and during vitellogenesis (7–12 days); there is also a slight deposition of yolk in the penultimate or subterminal oöcytes (figure 1). This may go on independently of endocrine regulations but the implantation experiments as stated above clearly shows an acceleration of yolk deposition even during the previtellogenic growth period (figure 2). Quick

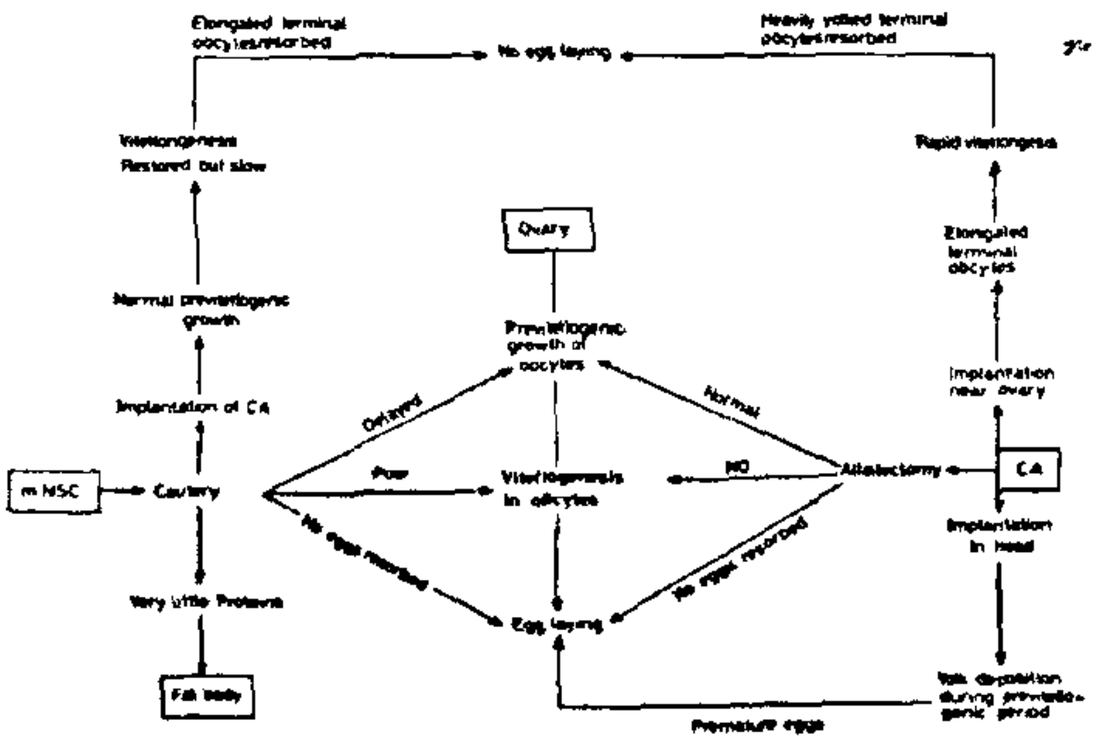

Figure 1. A diagram showing a possible relationship between CA, mNSC, fat body & oocyte development in *P. pictus*.

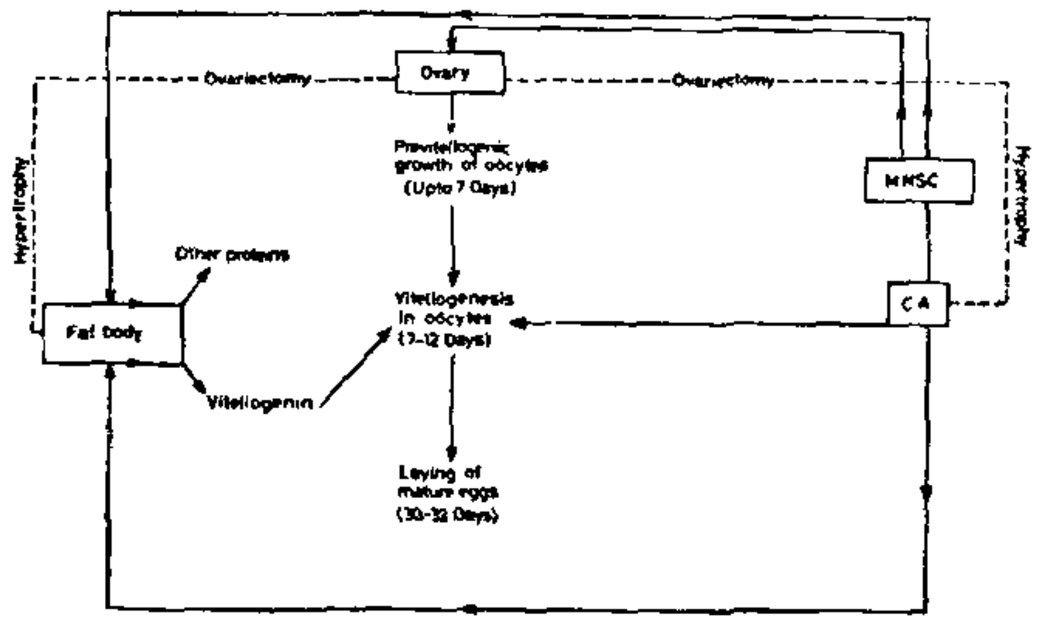

Figure 2. A diagram showing effect of cautery, allatectomy and implantation of CA in normal or cauterised individuals on oocyte development in *P. pictus*.

initiation of vitellogenesis by implantation of CA has also been observed[17,18]. The first egg pod in normal females is laid at 30–32 days[3] but in CA implanted females (when implanted at a newly emerged stage) this occurs in 25 days (Figure 2). When CA are implanted at 3 day-old stage, the first egg is laid even earlier *i.e.* 20–22 days. It has been observed in *P. pictus* that in allatectomised females the fat body proteins as well as haemolymph proteins are in very low concentrations[2]. On the other hand in ovariectomised females both the CA and fat body are hypertrophied and inactive[19,20] (Figure 1). It is suggested that the CA act to induce production of vitellogenic proteins by the fat body and its uptake by oöcytes. The implantation of CA near the ovaries results in increase in the size of, and deposition of yolk in terminal oöcytes of the particular ovarioles. The terminal oöcytes in the ovary where CA are implanted are particularly long and after attaining a maximum size (5.2–5.5 mm as against maximum 5 mm of normal females) they are resobred leaving the subterminal oöcytes to elongate and deposite yolk (figures 1 and 2). Egg laying in such females could not be observed. Such an experiment clearly shows a gonadotrophic effect of the CA in *P pictus* and its effect on precoccious growth of the oöcytes. This experiment was first performed by McCaffery (1976) in *Locusta*[17].

Cautery of neurosecretory cells affects the previttellogenic growth of oocytes. In normal females this growth occurs upto about 7 days[3] (Figure 1) but in mNSC cauterised females this is delayed by 5 6 days. The oocytes are smaller (1.5–1.6 mm at 12–15 days) than those of normal females (2.25 5 mm during 12–15 days). There is very little deposition of yolk even after 15 days *i.e.* vitellogenesis does not take place properly. However, if cautery is done at a late

stage *i.e.* 7–10 days, the effect on vitellogenesis is negligible. In any case, egg laying does not take place in such females. Thus cautery of mNSC does not stop but delays previtellogenic growth; however it stops vitellogenesis and mature oocyte production (Figure 2). It has also been observed histochemically the mNSC cautentered females have very little deposition of proteins in the fat body.

By implantation of CA in mNSC cauterised females previtellogenic growth as well as vitellogenesis is accelerated. However vitellogenesis is slower than that in normal females. In these females also elongated terminal oocytes are resorbed and there is no egg laying (Figure 2). It is clear that both the CA and mNSC are necessary for successful oocyte development and egg laying (Figure 2). It is clear that both the CA and mNSC are necessary for successful oocyte development and egg laying in *P. pictus* just as in the case of *Schistocera*[5,6] and *Locusta*[7,9,17]. The NSC hormone affects previtellogenic growth of oocytes, general protein synthesis in the fat body and oviposition whereas the CA affects vitellogenic protein synthesis in the fat body and yolk deposition in the oocyte. Egg laying of mature oocytes is assisted by NSC although the CA is also necessary for this phenomenon. In allatectomised females vitellogenesis does not occur and the oocytes after maximum previtellogenic growth are resorbed (Figure 2). It is presumed that a factor from CA maintains the activity of mNSC. On the other hand, failure to produce mature oocytes after CA implantation in mNSC cauterised females show that a factor from mNSC might control and maintain the activity of CA.

We are grateful to Prof. R. S. Saini for his valuable advice from time to time.

2 February 1982; Revised 7 December 1982.

1. Banerjee, S., In *Histochemical and cytological observation on the fat body of Poeciliocerus pictus*, Ph.D. Thesis, University of Saugar, Sagar, 1971.
2. Gupta, U. S., *Biochem. Exp. Biol.*, 1977, **13**, 159.
3. Sahai, Y. N. and Banerjee, S., *A histochemical study of oocyte development in P. pictus in relation to fat body metabolism* (in press).
4. Saini, R. S., *J. Zool. London.*, 1971, **165**, 275.
5. Highnam, K. C., Lusis, O. and Hill, L., *J. Insect Physiol.*, 1963a, **9**, 587.
6. Highnam, K. C., Lusis, O. and Hill L., *J. Insect Physiol.*, 1963b, **9**, 827.
7. Girardie, A., *Bull. Soc. Zool. Fr.*, 1966, **91**, 423.
8. Girardie, A., *Bull. Soc. Zool. Fr.*, 1967, **101**, 79.
9. Minks, A. K., *Arch. Neerl. Zool.*, 1967, **17**, 175.
10. Bentz, F., *C. R. Acad. Sci. Paris.*, (D), 1969, **269**, 2014.
11. Rentz, F., *J. Insect. Physiol.* 1970, **16**, 2257.
12. Girardie A., *Arch. Zool. Exp. Gen.*, 1971, **112**, 635.
13. Dogra, G. S.and Ewen, A. B., *J. Insect Physiol.*, 1970, **16**, 461.
14. Dogra, G. S.and Ewen, A. B., *J. Insect Physiol.*, 1970, **17**, 483.
15. McCaffery, A. R.and Highnam, K. C., *Gen. Comp. Endocrinol.*, 1975a **25**, 358.
16. Banerjee, S., *Zool. Anz Jena.*, 1977, **199**, 143.
17. Wajc, E., Ph.D. Thesis, *J. Insect Physiol.*, 1976, (ed. McCaffery, A. R.) **22**, 1081.
18. McCaffery, A. R., *J. Insect. Physiol.*, 1976, **22**, 1081.
19. Banerjee, S., *Zool. J. Anat. Bd.*, 1977, **97**, 45.
20. Banerjee, S., *J. Sci. Res.*, 1981, **3**, 83.

AUXIN INDUCED REGENERATION OF FOREST TREE — *DALBERGIA SISSOO* ROXB. THROUGH TISSUE CULTURE

S K DATTA AND K DATTA
Department of Botany, Visva-Bharati University, Santiniketan 731 235, India.

TISSUE culture techniques are becoming useful tools for rapid clonal multiplication of plants. The commercial feasibility of this technique has been demonstrated in many diversed genera including a few forest trees[1-11]. The advantage of tissue culture cloning over conventional propagation technique is in the reduction in the time needed to achieve large scale propagation. It is well established that auxin-cytokinin balance in the medium promotes the organogenesis[3,10,11]. Multiple shoots of *Dalbergia sissoo* were obtained in MS_1 medium (MS, Murashige and Skoog medium[12] + vitamins of Gamborg B_5 medium[13]). In the present paper it has been demonstrated that auxin induces rhizogenesis as well as rooted shoots in the MS_1 medium.

Nodal explants (1-1.5 cm) were excised from healthy growing mature tree of *D. sissoo*, growing in the University garden. The explants were cultured in the MS_1 medium following the procedure mentioned earlier[14,15]. MS medium was supplemented with vitamins of B_5 medium with sucrose 20 g^{-1}, agar 0.90%, AA 5 mg, l (ascorbic acid) and various concentrations of auxins (IAA, Indole acetic acid; IPA, indole propionic acid; NAA napthaleneacetic acid; 2,4-D, 2,4-dichlorophenoxyacetic acid). The cultures were main-