

Nevertheless, it has to be underlined that typical twitching activities do not entirely disappear, since they remain as an essential component of paradoxical sleep in adult subjects. Our data involving the early postnatal development of the rat represent a continuity of the studies of Narayanan and Fox<sup>11</sup> during the fetal development of the rat (16–20 days

of prenatal life) relating to intrauterine motility. Muscular twitching activities are, therefore, a useful parameter to be included in our neurobehavioral model in the developing rat, both with regards to the total amount of localized and regional muscle activities, as well as the frequency and quantity of gross movements of the entire body.

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## Changes in free amino acid level due to physical and chemical agents in ageing *Drosophila*

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**Summary.** The effects of gamma rays and caffeine on total free amino acids were assessed in unirradiated and irradiated ageing *Drosophila*. As age advances, there is a rise in the quantity of free amino acids in untreated males and females. Gamma rays and caffeine strongly reduce the level of free amino acids in both the sexes.

Insects are known to possess a higher amount of free amino acids. 293–2430 mg/100 ml<sup>1</sup> as compared to mammals which have 42 and 35 mg/100 ml in sheep and humans<sup>2</sup> respectively. This difference makes insects more radio-resistant than mammals. The LD<sub>50</sub> values range from 10 to 300 kR in adult insects whereas for animals it is between 0.5 and 1.0 kR<sup>3</sup>. The present study was undertaken to study the changes in the level of free amino acids induced by gamma-rays and caffeine in 12-, 24-, 36-, 48-, 60-, 72-, 84- and 96-h-old males and females of adult *Drosophila*. Caffeine (1,3,7-trimethylxanthine) which acts as a radiosensitizer<sup>4,5</sup> of biological damage induced by radiations is gaining importance because of its presence in tea, coffee and coca-cola.

**Materials and methods.** The flies used in the present studies were the wild type (ORK) of *Drosophila melanogaster*. Adult flies were exposed to 60 kR of gamma irradiation in a 5500 Ci <sup>60</sup>Co gamma cell. The dose rate was approximately 60 R/sec. For caffeine feeding, tissue papers were soaked with a solution of 0.2% caffeine and 5% sucrose in water. The adult flies (0–8-h-old) were allowed to feed on this solution. The tissue papers were changed once every 12 h and the entire duration varied from 12 to 96 h depending upon the experiment. Estimation of the free amino acids followed the method of Clark<sup>6</sup>. A standard curve was drawn by using glycine.

**Results and discussion.** With the increase in age of untreated flies, there is an increase in the quantity of free amino acids

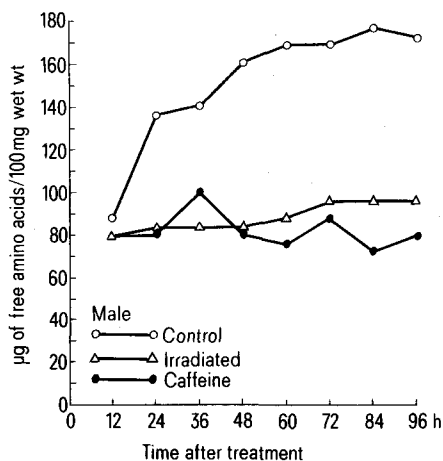


Fig. 1. Changes in free amino acids induced by irradiation and caffeine in adult male *Drosophila melanogaster*.

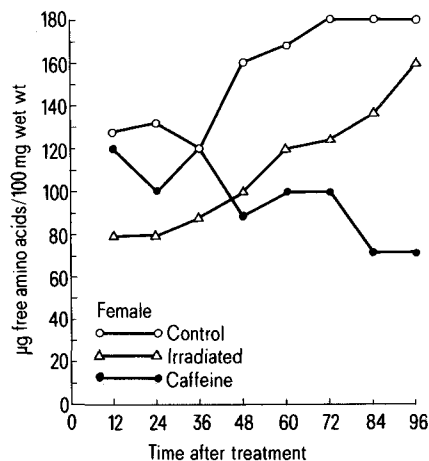


Fig. 2. Changes in free amino acids induced by irradiation and caffeine in adult female *Drosophila melanogaster*.

(figures 1 and 2). At the 12th h of measurement, however, females are exhibiting a higher quantity than males. Female flies in general contain twice the amount of methionine as males<sup>7</sup>. Methionine is one of the essential amino acids which serves as a methylating agent in intermediary pathways. In *Aedes*<sup>8,9</sup> and the boll weevil *Anthonomus grandis*<sup>10</sup>, it has the ability to promote egg production. Gamma rays induce a reduction in the level of free amino acids in both the sexes (figures 1 and 2). In rice moth larvae also, whole-body irradiation reduced the tyrosine pool considerably<sup>11</sup>. Richardson and Myser<sup>12</sup> have shown that large doses of radiation increased the total concentra-

tion of amino acids in the haemolymph pool of prepupae and last instar larvae of the greater wax moth *Galleria mellonella*. In contrast to these data, there was no influence of irradiation on total concentration of amino acids in adult horn flies *Haematobia irritans*<sup>13</sup>. The increase in free amino acids may be derived from the radiation-induced degradation of protein<sup>14</sup>. Flies treated with caffeine show a strong reduction in free amino acids contents. This may be due to inhibition of macromolecular synthesis<sup>15,16</sup>. Since caffeine interferes with hormone-mediated responses, the lowered level of free amino acids may be due to the failure of protein synthesis associated with ovary development.

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## Spatial distribution of the adaptation field of the surround response mechanism in type X cat retinal ganglion cells<sup>1</sup>

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**Summary.** The surround response mechanism in on-center X-cells in cat retina was found to be bimodally distributed and weak or nonexistent in the receptive field middle. An on-inhibition measure was used to assess surround mechanism gain.

According to Rodieck and Stone<sup>3</sup> the activity of retinal ganglion cells is controlled by 2 spatially overlapping processes. These processes were referred to as the center and surround response mechanisms and each was described by Gaussian curves with peaks in the receptive field middle. Recent studies have suggested that the spatial distribution of the surround mechanism in X-cells may differ markedly from the distribution described in the Rodieck and Stone model. Both Hickey, Winters and Pollack<sup>4</sup> and Hammond<sup>5</sup> present evidence for a receptive field model for X-cells in which the surround mechanism is bimodally distributed and is very weak or nonexistent in the middle of the receptive field center.

1 way to assess the spatial distribution of a response mechanism is to characterize the mechanism's adaptation field. In this type of experiment the size or location of a field adapting target is varied and the effect of these manipulations upon the gain of the mechanism is determined. In order to use this method it must be assumed that the mechanism's adaptive receptive field corresponds to its signal receptive field. This method was used in the present study to assess the spatial distribution of the surround mechanism in X-cells. Specifically, we examined the effect of variations in the size of unmodulated, field adapting

stimuli upon the gain of the surround response mechanism. Lacquer coated tungsten microelectrodes, connected in a conventional capacitance-coupled recording system were used to record the action potentials of 38 on-center optic tract fibres from lightly anesthetized (Nembutal) adult cats. Details of the animal preparation, recording system and optical system are described elsewhere<sup>6</sup>. Single units were classified as X-cells if they showed a null position for a contrast reversal stimulus<sup>7,8</sup>. All stimuli in the study were rectangular in time and had a duration of 500 msec and frequency of 0.3 Hz; they were superimposed upon a steady background whose luminance was 0.5 log candles/m<sup>2</sup>.

3 experiments were conducted. The 1st experiment examined the effect of varying the size of centrally located, equiluminous adapting spots upon the gain of the surround mechanism. In the 2nd experiment the adapting targets were equiluminous adapting annuli whose outside diameter was 6.0 and whose inside diameter was variable. The 3rd experiment assessed the effect on the gain of the surround mechanism of variable size, centrally located spots whose luminance was adjusted to keep the gain of the center mechanism constant. In all 3 experiments the gain of the surround mechanism was assessed by measuring the ability of flashing annulus (4.0° × 10.5°) placed in the periphery of