female from the costal margin to the medial$_2$ vein; the remainder of the wing is male. The left hind wing underside is predominantly female with a few narrow lines of male cells, the principal one being a band in the anal area along the inner margin.

As additional information on the genetics of *A. io* is unraveled we may be able to interpret more fully the behavior of cells from zygote to the mature insect. Controlled breeding is revealing many more unique patterns of this beautiful moth.

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Literature Cited

DONCASTER, L. 1914. On the relation between chromosomes, sex linked transmission and sex-determination in *Abraxas grossulariata*. J. Genet. 4: 1–22.

HESSEL, S. A. 1964. A bilateral gynandromorph of *Automeris io* (Saturniidae) taken at mercury vapor light in Connecticut. J. Lepid. Soc. 18: 27–31.

REMINGTON, C. L. 1954. The genetics of *Colias* (Lepidoptera). Adv. Genet. 6: 404–407.

NEUTRON IRRADIATION IN *ANTHERAEA EUCALYPTI* SCOTT (SATURNIIDAE)

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Considerable attention has been directed at the entomogenetic effects of irradiation with 14.1 MeV neutrons. Measurements of neutron induced anomalies within chromosomes furnishes a biological dosimeter. Moulton and Meyer (1970) have found in *in vivo Drosophila melanogaster* that the frequency of structural abnormalities increases with the radiation exposure level. They demonstrated that the production of dicentrics and rings corresponds closely to a curvilinear dose response curve. Supportive evidence for this has been provided by McFee *et al.* (1970) in *in vivo* swine leukocytes and Gooch *et al.* (1964) in human somatic cells.

The present study offers the results obtained from irradiation of *in vitro Antheraea eucalypti* Scott tissue cells with 14.1 MeV neutrons.

TABLE 1. Chromosome anomalies in *in vitro A. eucalypti* tissue cells irradiated with 14.1 MeV neutrons. Values based upon examinations of 200 cells per exposure level.

Dose rad	Chromatid Anomalies N.	Deletions %	Rings %	Dicentrics %
0	2	0	0	0
100	3	14	1	12
200	6	41	1	28
300	11	78	3	57

Entomogenetic Technique

In a radiation free area, cultures of *A. eucalypti* tissue cells were reared from ovaries of diapausing pupae. The moth tissues were incubated at 27° C in an insect tissue culture medium derived by Grace (1962). Immediately prior to irradiation, samples containing 25 ml of tissue-containing medium were placed in plastic tubes and situated 8 cm from the target of a Cockroft-Walton accelerator utilizing the D,T reaction. Doses of 100, 200, and 300 rads were supplied at a rate of 4 rad/minute.

Following this, the cultures were allowed a 48-hour recovery period. After a one-hour exposure to 8×10^{-7} M colchicine, the cells were rinsed for 15 minutes with distilled water. Cells were fixed for 15 minutes in a solution of 60 per cent acetic acid—0.1 N hydrochloric acid. Staining with 2 per cent acetic orcein preceded examination of squash preparations for chromosome structural changes.

Abnormality scoring was obtained by first scanning the coded slides at low magnification to locate suitable metaphase figures, and then analyzing them at high power. With the exception of translocations, all structural aberrations were counted. Metaphase scoring involved 200 cells at each dosage level.

Results

The neutron irradiation resulted in a pronounced breakage effect, the amount of which varied with the dosage employed. The frequency and localization of these abnormalities are summarized in Table I. As apparent from the data, an increase in the dosage level augments the production rate of anomalies, but the relationship is not linear. Instead, the findings more nearly fit a dose square model.

The mean value for one-hit aberrations per cell per rad was 5.63×10^{-3} while for dicentrics and rings it was 1.44×10^{-3}.

At the 300 rad level, evidence of mitotic ruffling was present in about two per cent of the cells scored. The author believes this to be the first identification of ruffling induced in moth tissue cells by neutrons.

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Literature Cited

GOOCH, P. C., M. A. BENDER, AND M. L. RANDOLPH. 1964. Chromosome aberrations induced in human somatic cells by neutrons. *In* Biological Effects of Neutron and Protron Irradiations, 1: 325–342. International Atomic Energy Agency.

GRACE, T. D. C. 1962. Establishment of four strains of cells from insect tissues grown *in vitro*. Nature 195: 788.

MCFEE, A. F., M. W. BANNER, AND MARY N. SHERRILL. 1970. Chromosome Aberrations in swine leukocytes after *in vivo* or *in vitro* exposure to 14 MeV neutrons. Radiation Research 44: 512–522.

MOULTON, JEAN AND GAIL MEYER. 1970. Neutron irradiation in *Drosophila melanogaster*. British Review of Genetics 17: 367–372.

THE "ARROWHEAD BLUE," *GLAUCOPSYCHE PIASUS* BOISDUVAL (LYCAENIDAE:PLEBEJINAE)

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This started as a short note calling attention to the distribution of *Glaucopsyche piasus* Bdv. in Canada. It has developed into a study of this insect throughout its range. The Arrowhead Blue, like practically all Plebejinae of North America, was originally placed in the genus *Lycaena*, now reserved for the Coppers. Scudder (1876) created the genus *Phaedrotes* with *Lycaena catalina* Reakirt (1866) as the type species. Interestingly, Scudder considered that *catalina* was a synonym of *sagittigera* Felder (1865) yet designated it the type species. I suspect that he did this because the type of *catalina* was known to him and that of *sagittigera* was in Europe. Edwards (1884) did not accept the new genus, nor did Skinner (1898), but Dyar did (1902). Placement in *Phaedrotes* was followed in general from then (1902) until Nabokov (1945) placed the Arrowhead Blue in *Scolitantides* Hübner [1819]. Since then most authors have followed Nabokov.

The Generic Assignment

Mr. Harry Clench called to my attention the fact that *Phaedrotes* is in the tribe Glaucopsychini, and he had demonstrated that *Phaedrotes* is a subjective synonym of *Glaucopsyche!* Huebner's genus *Scolitantides* with *Papilio battus* [Denis & Schiffermuller] 1775 as type is quite different from