Table III. Effects of fractionated exposures of accelerated electrons on different types of aberrations (2×2 krads)

	Time intervals (sec)								
	0	10	20	30	40	50	60	70	120
Breaks	10.5	15.5	14.0	11.5	8.5	11.0	7.5	8.5	7.5
Asymmetrical exchanges									
Interchanges	16.5	18.0	17.0	10.5	11.0	13.5	11.5	10.5	16.5
Intrachanges	7.5	7.5	7.0	5.5	2.5	3.5	4.0	2.0	4.5
Minutes	14.0	12.5	10.5	5.5	10.0	5.5	9.5	10.0	4.5

Percentages of aberrations (10 root meristems/20 metaphases per meristem).

The results of the third series are given in the Table II. This shows that decrease occurs between 20 and 30 sec time interval (F 20–30 sec = 21.7**) and no decrease appears after chelating agent treatments (contrariwise, a slight increase for DIECA is seen between the same time intervals).

Table III shows that all kinds of aberrations: breaks and exchanges are involved in the decrease. Minutes (fragments smaller than 0.5 μ) were classified separately, owing to the uncertainty of their origin. Symmetrical exchanges were not taken into consideration on account of the difficulty of detection of such lesions. In the class of dicentric chromosomes, the proportion of dicentrics accompanied with 2 acentric fragments can be generally considered as an index of incomplete rejoining. This proportion was significantly much lower after the critical interval. A score of 100 dicentrics yielded the proportion 20% before, against 4% after ($\chi^2 = 10.7$, $p \simeq 0.001$).

Discussion and conclusion. The time interval after γ-rays (2 min 10 sec) is the minimum delay necessary for the suppression of interaction between both exposures due to fast rejoining processes[1]. In the present experiments, we proved that these processes also operate after accelerated electrons. The fact that the minimum delay before the drop is shorter than after γ-rays (20 sec instead of 2 min 10 sec) could be due to differences of experimental conditions, especially the higher dose rate in the case of accelerated electrons.

The two chelating agents react in the same manner as after γ-irradiations i.e. by suppressing the decrease obtained in the series without chelating agents. The decrease of the damage is generally thought to be due to the preponderance of restitutions. Some of those 'restituted breaks' could not participate in exchanges, which explains the decrease of the number of aberrations. In the present experiments, this statement was confirmed since the proportion of incomplete exchanges was considerably decreased after the critical time interval. This relative decrease of incompleteness would be a biased estimate of the chromosome break restitution.

Résumé. Des graines «sèches» de nigelles ont été irradiées par des doses fractionnées (2×2 krads) d'électrons accélérés (34 MeV). Une diminution très significative des taux de toutes les lésions chromosomiques a lieu entre les intervalles de temps 20 et 30 sec. Après un traitement des graines par 2 agents de chélation (DP et DIECA), il y a suppression de l'effet.

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Evolution in a Cosmopolitan Species: Genetic Latitudinal Clines in *Drosophila melanogaster* Wild Populations

Drosophila melanogaster, a widespread cosmopolitan species, if often considered of low interest for evolutionary studies. This is mainly due to the fact that these flies are ecologically linked to human agricultural activities[1,2]. It is generally assumed that *melanogaster* was introduced by man in many countries and that genetic exchanges between foreign populations are still favored by fruit transports. Thus, recent introduction in many countries and permanent mixing of populations should leave little time for the appearance of geographic divergences and the formation of local races. We leave open the question of the extent of man's influence on *melanogaster* genetics, but show that strong latitudinal selection exists among these flies.

TEISSIER et al.[3–8] showed that quantitative biometrical differences distinghish French and Japanese strains. This conclusion resulted from the study of numerous strains, but the frequency distributions of different strains of the same geographic origin overlapped greatly so that it was not possible to determine their individual origins. The reason for this now appears to be a genetic drift which artificially increased variability between strains kept under laboratory conditions for several years[9,10]. For most quantitative biometrical characters, freshly caught flies show less heterogeneity.

More recently, strains from tropical Africa reared in standard 25 °C laboratory conditions were found to be much smaller and to have fewer ovarioles than French

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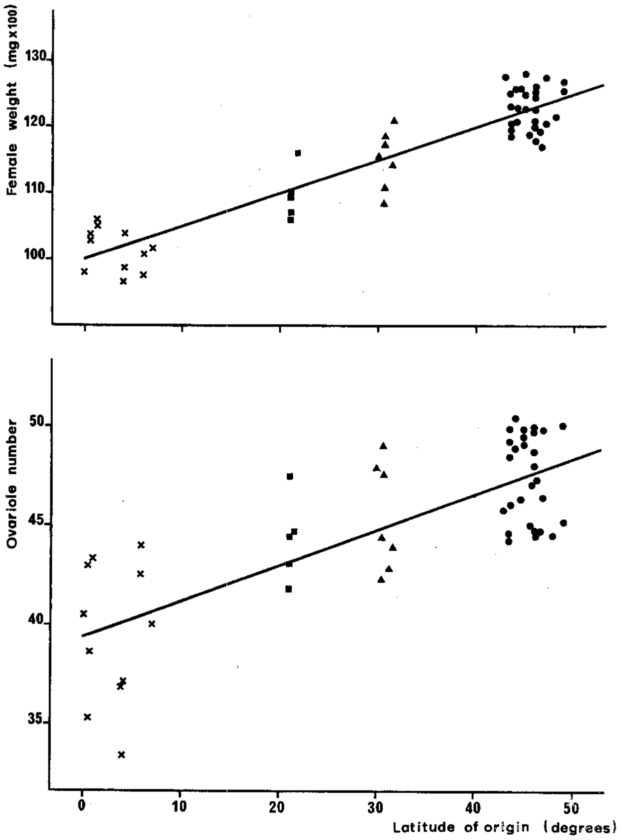
Comparison of quantitative biometrical characters of strains from temperate and tropical countries

Strain origin		Male weight	Female weight	Ovariole number	n
Temperate	France	91.54 ± 0.69	122.99 ± 0.62	47.44 ± 0.41	28
	North America	90.49 ± 2.81	123.39 ± 4.53	48.07 ± 1.26	5
Tropical	Africa	76.51 ± 0.93	101.95 ± 0.95	39.27 ± 0.99	12
	America	75.96 ± 0.97	102.59 ± 1.01	39.59 ± 0.56	6

All differences between strains from temperate and tropical countries are highly significant ($p < 10^{-3}$). Differences between strains from France and North America or from tropical Africa and tropical America are not significant (weight expressed in mg × 100; n, number of strains).

strains[11,12]. Differences were clear and large enough to allow determination of strain origin. These observations raise the question of the genetic properties of strains from intermediate latitudes, that is between the equator and the 45th parallel. Flies were thus collected in south Morocco (30° latitude) and Réunion Island (20° South latitude). Data for 2 biometrical characters, female fresh weight and ovariole number, are given in the Figure.



Regression of female fresh weight and ovariole number on latitude of origin of the strains (strains from: ●, France; ▲, South Morocco; ■, La Réunion; ×, tropical Africa). Regression parameters (r: correlation coefficient; b: slope; a: intercept) are: female weight: r = 0.93; b = 0.503 ± 0.029; a = 100.01 ± 1.05; ovariole number: r = 0.77; b = 0.179 ± 0.021; a = 39.46 ± 0.76; male weight: r = 0.86; b = 0.360 ± 0.030; a = 75.30 ± 1.07 (male curve, which is similar to that for females, is not shown).

Weight and ovariole number increase linearly with latitude. Populations from intermediate latitudes are intermediate between tropical and temperate strains in both characters. Although France and Morroco are in the northern hemisphere, La Réunion is in the southern. The data therefore suggest that the latitudinal cline observed in the Ethiopan region is symmetric with regard to the equator.

The above observations suggest the following question: are latitudinal clines to be found in other parts of the world? Strains from the French West Indies were found to be similar to African tropical strains[13]. More recently, we compared American tropical (Guiana, Columbia, Ecuador) strains to those from North America (USA and Canada). Data in the Table show large and highly significant differences between the two groups, as with strains from France and tropical Africa. These observations indicate that latitudinal clines in American wild populations exist.

The regularity of these latitudinal variations in *D. melanogaster* and the probable existence of a similar phenomenon in the sibling species *D. simulans*[14] show that a climatic adaptation factor operates on the genetics of these flies.

Small ovariole number has been shown to be correlated with a low reproductive potential[11,15]. Sizes of tropical populations are stable all year round, so that selection for reproductive potential may be less important in the tropics. A direct explanation of the weight differences is harder to find. However, as emphasized by PARSONS[16], many physiological parameters showing genetic variability in natural populations are correlated with body weight. Thus weight is undoubtly an important trait in an individual's fitness.

The positive correlation between female weight and ovariole number in the Figure and the Table is not always found, however. For example, wild type populations from Japan are remarkable both by a high weight and a small ovariole number[4,8–10]. Continuing investigation of the influence and significance of this latitudinal selection is therefore necessary.

Available data on *D. melanogaster* show the interest of a cosmopolitan domestic species for evolutionary studies

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on a world scale and the probable adaptative value of traits having a polygenic determinism[17–20].

Résumé. Chez *Drosophila melanogaster*, les souches provenant d'Afrique tropicale sont plus légères et ont moins de tubes ovariens que les souches françaises. Des mouches provenant de latitudes intermédiaires présentent des caractéristiques génétiques intermédiaires pour les deux caractères. Des clines latitudinaux existent donc entre l'Europe et la région éthiopienne. Un phénomène semblable est retrouvé sur le continent américain. La régularité de ces variations prouve qu'elles correspondent très probablement à une adaptation climatique.

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Chromosomes of Three Species of Asian Tree Squirrels, *Callosciurus* (Rodentia: Sciuridae)

Tree squirrels of the genus *Callosciurus* occur widely in southeastern Asia, from Nepal eastward through southern China to Formosa, and southward through Malaysia and Indonesia to the Celebes and the Philippine Islands. 13 species are recognized[1], and according to Ellerman[2], 'This genus is second in number of named forms to *Rattus* only in the order'. Moreover, the tribe Callosciurini[3,4], to which the genus belongs, along with 11 or 12 other genera, is a very diverse one morphologically and ecologically, and relationships to other squirrel tribes within the family Sciuridae are not well understood[4].

The chromosomes of 3 species in the tribe have been described[5]. *Menetes berdmorei* had a diploid number (2*n*) of 62, the largest 2*n*f any sq ouirrel so far described. *Dremomys rufigenis* possessed $2n = 38$, and *Callosciurus flavimanus*, $2n = 40$; *Dremomys* was further characterized by possession of a pair of acrocentric chromosomes with prominent satellites.

Fig. 1. Karyotype of a male *Callosciurus notatus* ($2n = 40$) from Malaysia ($2n = 40$). The sex chromosomes are the pair at the far right, bottom row, and the satellited acrocentric pair is in the middle of the bottom row.

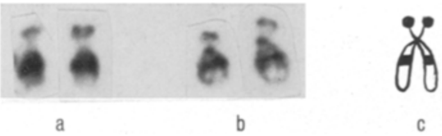

Fig. 2. Giemsa band patterns of satellited acrocentric autosomes from a) *Callosciurus notatus* compared with those of b) *Xerus rutilus* and c) an ideogram derived from both species.

The present paper reports a new specimen of *C. flavimanus* and specimens of previously unreported *C. finlaysoni* and *C. notatus*, and compares Giemsa (G-band) patterns of satellited acrocentrics with those found in *Xerus rutilus* from Africa.

Materials and methods. The following specimens were studied: *Callosciurus notatus* (Boddaert), Malaysia, Kuala Lampur, 2 males; Indonesia, Djakarta, 1 female and 1 male; *Callosciurus flavimanus* (I. Geoffroy), Thailand, 1 male; South Viet Nam: 1 male[5]; *Callosciurus finlaysoni* (Horsfield), Thailand, 1 male. Mitotic chromosomes were examined from marrow cell suspensions[6], or from skin biopsies through the courtesy of Dr. T. C. Hsu, Anderson Hospital, Houston, Texas. G-band preparations were made using the method of Seabright[7]. Voucher specimens are presently in the possession of Dr. W. Prychodko, Wayne State University, Detroit, Michigan.

Results. Callosciurus notatus (Figure 1), *C. flavimanus* from Thailand, and *C finlaysoni* all have $2n = 40$ and karyotypes comprized of 6 pairs of metacentric, 10 pairs of submetacentric, and 3 pairs of acrocentric autosomes, one of which bears satellites. A large submetacentric and a small submetacentric constitute the *X* and *Y* chromosomes respectively. *C. flavimanus* reported previously from South Viet Nam exhibited a karyotype similar to that of the specimen reported here from Thailand except for the fact that satellites were not recognized in the former and the otherwise comparable pair was classified within the submetacentric category.

Efforts to obtain G-band patterns in *C. notatus* from Kuala Lampur and Djakarta were only partially successful, but it was consistently possible to identify the pattern of the satellited acrocentrics. These chromosomes were

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