The Meiotic Behaviour of Autosomal Heterochromatic Segments in Hedgehogs

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Abstract. Male meiosis in the two species of hedgehogs Erinaceus europaeus and Aethechinus algirus, possessing respectively three and two pairs of autosomes with large blocks of heterochromatin, has been studied. The heterochromatic segments pair homologously till the end of pachytene, but separate during diplotene, owing to lack of chiasmata in these regions. They also organize the nucleolus in both species. The sex chromosomes (sex vesicle) are not associated with the nucleolus. The lack of chiasmata in the heterochromatic segments is interpreted as possible mechanism for the conservation of vital genes, such as ribosomal cistrons.

Introduction

Studies pertaining to the behaviour of constitutive heterochromatic chromosomes during meiosis in mammals are few. They usually involve the sex chromosomes possessing blocks of constitutive heterochromatin, as in the cases of hamsters and field vole (Ford and Woollam, 1966; Fredga, 1970; Pogosianz, 1970; Zenzes and Wolf, 1971). The formation of sex vesicles during early prophase stages in these animals, does not allow an accurate evaluation of the pairing behaviour of these chromosomes.

European hedgehogs (Erinaceus species) have been shown to possess large blocks of autosomal heterochromatin, which are distributed differently between species (Gropp et al., 1969). From studies of early diakinesis in males, Gropp et al. (1969) concluded that the heterochromatic regions of the autosomes do not pair and form chiasma. Zenzes and Wolf (1971) studying the behaviour of the sex chromosomes of Microtus agrestis, which possess large blocks of constitutive heterochromatin, during male meiosis, came to a similar conclusion.

In the present contribution, the meiotic behaviour of chromosomes with autosomal heterochromatin is described in two hedgehog species belonging to two different genera, the European Erinaceus europaeus L. 1758 and the Algerian Aethechinus algirus lavaudeni Cabrera, 1928.
both species, it will be shown that (a) these chromosomes pair homolo-
gously during early prophase stages of meiosis, (b) no chiasmata are
formed in the heterochromatic regions, and (c) the autosomal hetro-
chromatin segments are involved in the organisation of the nucleolus.

Material and Methods

Two specimens of *E. europaeus* and three males of *A. algirus* were studied. The European hedgehogs were caught in early summer at the island of Borkum. The Algerian hedgehogs were supplied by a dealer, who imported the animals directly from Morocco; these specimens have been identified by, and registered in, the Zoologische Forschungsinstitut und Museum Alexander Koenig, Bonn.

Meiotic preparations were made from testicular tubules according to the air drying techniques of Evans et al. (1964), or Meredith (1969) or in some cases, the tubules were incubated in colchicine (5 mg/ml) for 3 or 6 hours, before hypotonic treatment and fixation. The slides were stained with acetic-orcein. For the study of the nucleolus, the following modification was adopted, which gave a better resolution of the nucleolus: The air dried preparations were post-fixed in 4% neutral formalin for 10 minutes and washed for 10 minutes in running tap water, and then stained in a mixture of 2% acetic orcein and 1% fast green in 96% alcohol, in a proportion of 4:1, for 4 hours at 37°C.

The location of heterochromatic segments in the chromosome complement was done by labelling primary cultures of somatic cells (kidney, testis or heart) with tritiated thymidine and discerning the late replications, by routine autoradiographic procedures (Citoler and Gropp, 1969).

Results

The Chromosome Complement of the Hedgehogs

The karyotypes of the European hedgehog, have been described earlier (Gropp et al., 1969). They have a chromosome number of $2n = 48$ (Fig. 1 a). There are three pairs of autosomes—two long submetacentrics and one medium sized acrocentric, which possess large blocks of heterochromatin, as determined by their late replicating behaviour, as well as the rate of DNA synthesis (Citoler and Gropp, 1969; Citoler et al., 1971). In female cells these blocks of heterochromatin synthesise their DNA at the same time as the late replicating inactive X (Fig. 1 a). The Algerian hedgehog has also a diploid number of 48, though the karyotype is different from that of the European hedgehog. The details of this karyotype and related characteristics will be published elsewhere. The interesting difference between these two species, however, concerns the distribution of the autosomal heterochromatin. In *A. algirus*, there are two pairs of submetacentric long chromosomes, which, though morphologically different, have large blocks of heterochromatin similar to, the European form. The acrocentric pair of chromosomes with heterochromatin is not present (Fig. 1 b)