Morphology of the Mitotic Chromosomes of Embryos and of Adults of Italian Alpine Newt *Triturus alpestris apuanus* (Bonaparte)[1]

Triturus alpestris apuanus (Bonaparte, 1839) is a subspecies of *T. alpestris* that lives in the Apuan Alps, the Tuscan-Emilian Apennines and the Ligurian Apennines. Its diploid number ($2n = 24$) is identical with that of *T. a. alpestris*, which, since the last century, has been the subject of a long series of karyological works[2-6]. The individual elements of the karyotype may be classified as metacentric and submetacentric[7] and, on the basis of their lengths and the centromere indices (Table), may be arranged in 3 groups: in the first group are included the longest chromosomes in the set (I–IV) comprising 3 pairs of metacentric (I–III) and 1 pair of submetacentric (IV) chromosomes; the second group contains the 4 pairs of medium-length chromosomes (V–VIII), of which VI and VII are metacentric while V and VIII are submetacentric; to the third group belong the shortest chromosomes (IX–XII), which include 1 pair of metacentric (XII) and 3 pairs of submetacentric (IX, X and XI) chromosomes. This arrangement is found to be identical for embryonic cells and for somatic cells of the adult (Figures 1a) and b); 2a) and b). On the other hand, what considerably differentiates the karyotype of the mitotic chromosomes of adult specimens from that of embryos is the number of the secondary constrictions. In fact, in the adults, there is always a heterochromatic tract situated in the median region of the long arm of chromosome VIII; less frequently there is also a second heterochromatic tract in the subterminal region of the long arm of chromosome X. These secondary constrictions have the meaning of the nucleolus-organizing regions and their number is in agreement with the number of nucleoli in interphase somatic cells (Figure 3). In the embryo cells, on the other hand, the heterochromatic areas observed constantly are more numerous: in addition to the two also to be observed on chromosomes VIII and X of the adult, there are others present on various elements of the set: namely, 2 left subterminal secondary constrictions and 1 on the mid-region of the right arm of chromosome I; 3 tracts, 2 of which are very close to each other, on the right arm of chromosome II; 1 subterminal heterochromatic tract on chromosomes IV and VI and, finally, 2 tracts, very close to each other, on the long arm of chromosome IX. Other secondary constrictions peculiar to the chromosomes of embryo cells are the 2 proximal tracts

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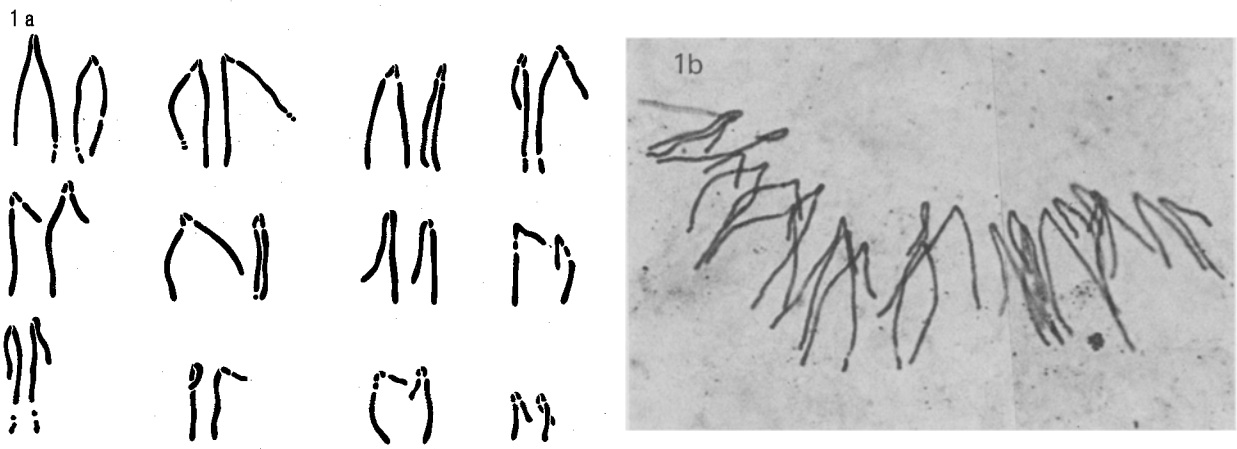

Fig. 1. The 24 mitotic chromosomes of the diploid complement of *T. a. apuanus* from an embryonic cell squashed in aceto-orcein. a) Camera lucida drawings; b) microphotograph ×1,000.

Mean values of absolute lengths and centromere indices of the 12 mitotic chromosomes of the complement

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Embryos	al	54	49	50	44	39	45	38	29	34	27	26	20
	ci	0.476	0.443	0.489	0.326	0.289	0.468	0.453	0.333	0.358	0.312	0.270	0.385
Adults	al	29	29	27	24	22	24	22	17	20	16	15	11
	ci	0.466	0.412	0.444	0.340	0.324	0.468	0.419	0.324	0.395	0.382	0.311	0.383

al = absolute lengths; ci = centromere indices.

Fig. 2. The 24 mitotic chromosomes from a hepatocyte of an adult specimen. a) Camera lucida drawings; b) microphotograph at phase contrast. The arrows indicate the secondary constrictions of chromosomes VIII. ×1,300.

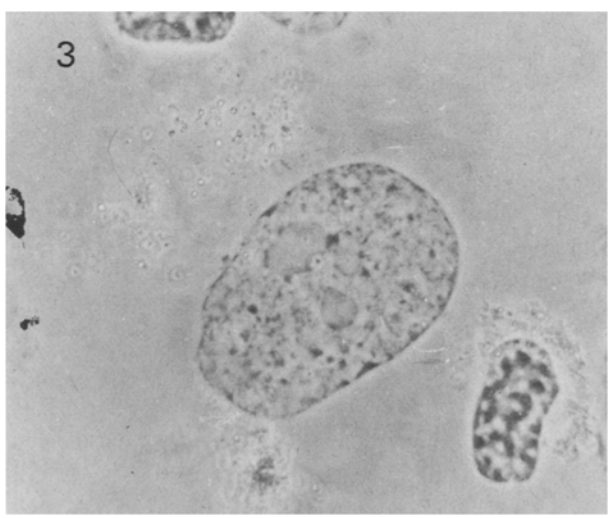

Fig. 3. Phase-contrast microphotograph of an interphasic somatic cell showing 3 nucleoli; the biggest one derives from the fusion of 2 nucleoli. ×1,300.

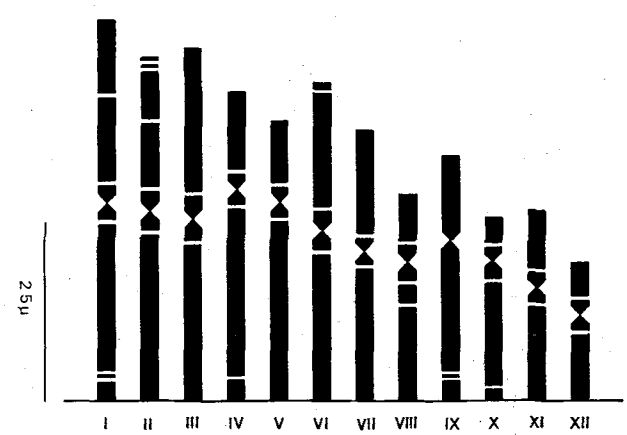

Fig. 4. Idiogram of the 12 mitotic chromosomes of the haploid set, based upon the karyotype of embryonic cells. The serial alignment of the chromosomes does not strictly follow the criterion of the decreasing length order to permit an easier comparison with the lampbrush karyotype to be made in another paper.

situated on every element of the set on both sides of the centromere and at equal distances from it: only chromosome IX has not clearly revealed these heterochromatic areas, at least in the preparations studied (Figure 4).

The morphology described here recalls that given for chromosomes of blastulae of *T. a. alpestris*[6]: in this case, however, the blastulae had been previously subjected to prolonged thermal shock (0 °C for 24 h), which, as is well known, has appreciable effect upon the specific stainability of certain chromosome segments[8–15]. The blastulae that form the object of the present study, on the contrary, have undergone no shock from cold but only a short treatment in distilled H_2O before being fixed in Carnoy and stained and squashed in aceto-orcein. The secondary constrictions observed on blastulae chromosomes represent important markers for the certain identification of the individual elements of the set and their precise arrangement in the karyotype, thus allowing a profitable comparison to be made between the euchromatic and heterochromatic areas of the mitotic chromosomes and the lateral differentiations of the corresponding lampbrush chromosomes.

Riassunto. E' stata descritta la diversa morfologia dei cromosomi mitotici di *Triturus alpestris apuanus*, studiati in blastomeri e in cellule somatiche di individui adulti.

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