

been verified in other species of urodele Amphibians^{7,8}. The structural relationship between secondary constrictions and sphere-organizing regions, already demonstrated in *T. viridescens*⁷ and discarded in the axolotl⁹, assumes a particular importance on account of certain implications of a genetic and functional order: in fact, the spheres are

organites present exclusively in the germinal vesicle of the oocytes, where they form at specific chromosomal sites, later being released into the nuclear sap. Thus, the nucleus of the oocytes of Amphibians contains hundreds of multiple nucleoli and a smaller number of free spheres. Unlike the nucleoli, however, the spheres do not incorporate H³-uridine, at least in medium and large-sized oocytes, and reveal high protein metabolism¹⁰. The inserted spheres are among the last landmarks of the lampbrush chromosomes to disappear in oocytes in the pre-ovulatory period¹¹ and may be replaced by loops when maturation is induced by gonadotropic hormones or by in vitro incubation of oocytes with progesterone¹². An important indication regarding the structural and functional difference between the heterochromatin connected with the formation of the nucleoli and that connected with the formation of the spheres also appears clearly from the results of RNA/DNA molecular hybridization on cytological preparations of lampbrush chromosomes: the segment of the sphere is seen to be intensely labelled, together with the centromere DNA and that of the telomeres, when use is made of radioactive RNA transcribed by DNA deprived of the fractions containing cistrons coding for rRNA; so that also at the level of the sphere-organizing regions a repetitive DNA would be present¹³. It remains to determine the precise significance of these organites in the oocytes, also on account of the fact that in certain urodeles – e.g. in *Triturus marmoratus* – neither inserted spheres nor spheres free in the nuclear sap have been noted¹⁴.

Riassunto. Le regioni nucleolo-e sfera-organizzatrici dei «lampbrush chromosomes» di *Triturus alpestris apuanus* corrispondono a costrizioni secondarie presenti sui rispettivi cromosomi mitotici. Questo dato ripropone l'interesse per lo studio dell'origine e del significato delle sfere negli ovociti in accrescimento.

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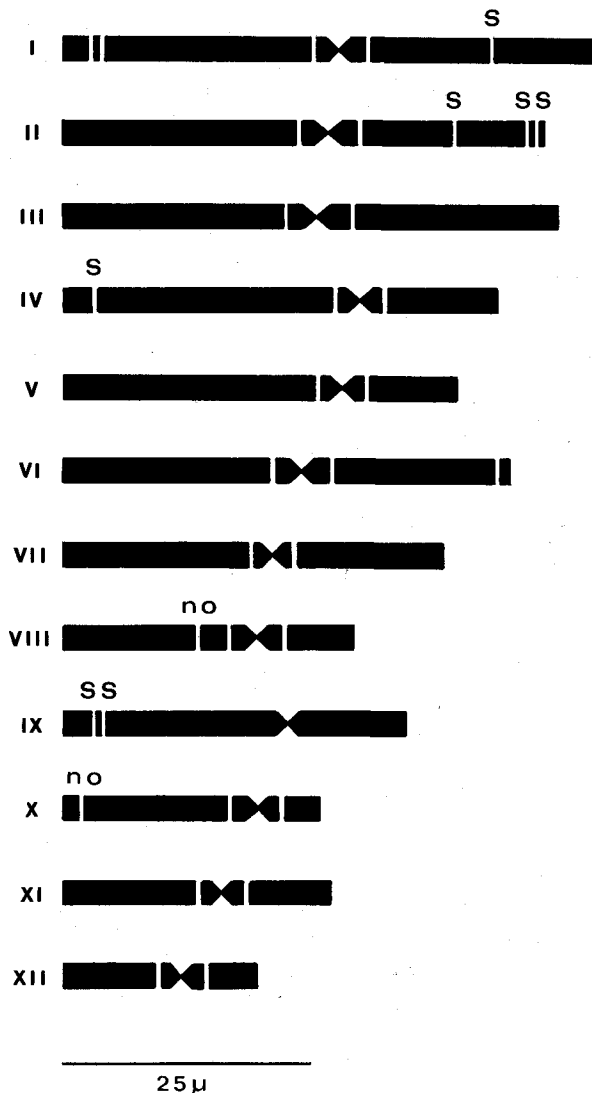


Fig. 2. Idiogram of the 12 mitotic chromosomes of the haploid set. Further explanation in the text.

Completion of the Morphology of the Lampbrush Chromosomes of the Italian Alpine Newt *Triturus alpestris apuanus* Bonaparte¹

The lampbrush chromosomes of the Italian alpine newt *Triturus alpestris apuanus* (Bonaparte, 1839) have already been the subject of a previous karyological study which concluded with the presentation of the first chromosome maps of the species². To that work is now added this new contribution, which completes the morphology of the individual elements with the identification of all the fundamental landmarks – such as the centromeres, the nucleolus-organizing regions and the sphere-organizing regions – that were partly or completely lacking in the previous description (Figure 1).

The centromeres (indicated with arrows) have been identified on each element: they appear as enlarged chromomeres, generally devoid of loops, situated between the 2 regions where there is a preference for chiasmata to form. The nucleolus-organizing regions (*no*) have been identified on the mid-region of chromosomes VIII and on the left subterminal position of chromosomes X. They can be

¹ With financial support by C.N.R., Rome.

² G. MANCINO and G. BARSACCHI, *Caryologia* 18, 637 (1965).

⁷ J. G. GALL, *J. Morph.* 94, 283 (1954).

⁸ G. BARSACCHI, L. BUSSOTTI and G. MANCINO, *Chromosoma* 31, 255 (1970).

⁹ H. G. CALLAN, *J. Cell Sci.* 1, 85 (1966).

¹⁰ G. MANCINO, G. BARSACCHI and I. NARDI, *Atti Accad. naz. Lincei* 44, 102 (1968).

¹¹ G. MANCINO and G. BARSACCHI, *Boll. Soc. tosc. Sci. nat., Mem. B.* 73, 113 (1966).

¹² G. BARSACCHI, *Boll. Zool.* 38 (1971), in press.

¹³ G. BARSACCHI, *Boll. Zool.* 37, 474 (1970).

¹⁴ I. NARDI, M. RAGGHianti and G. MANCINO, *Chromosoma*, in press.

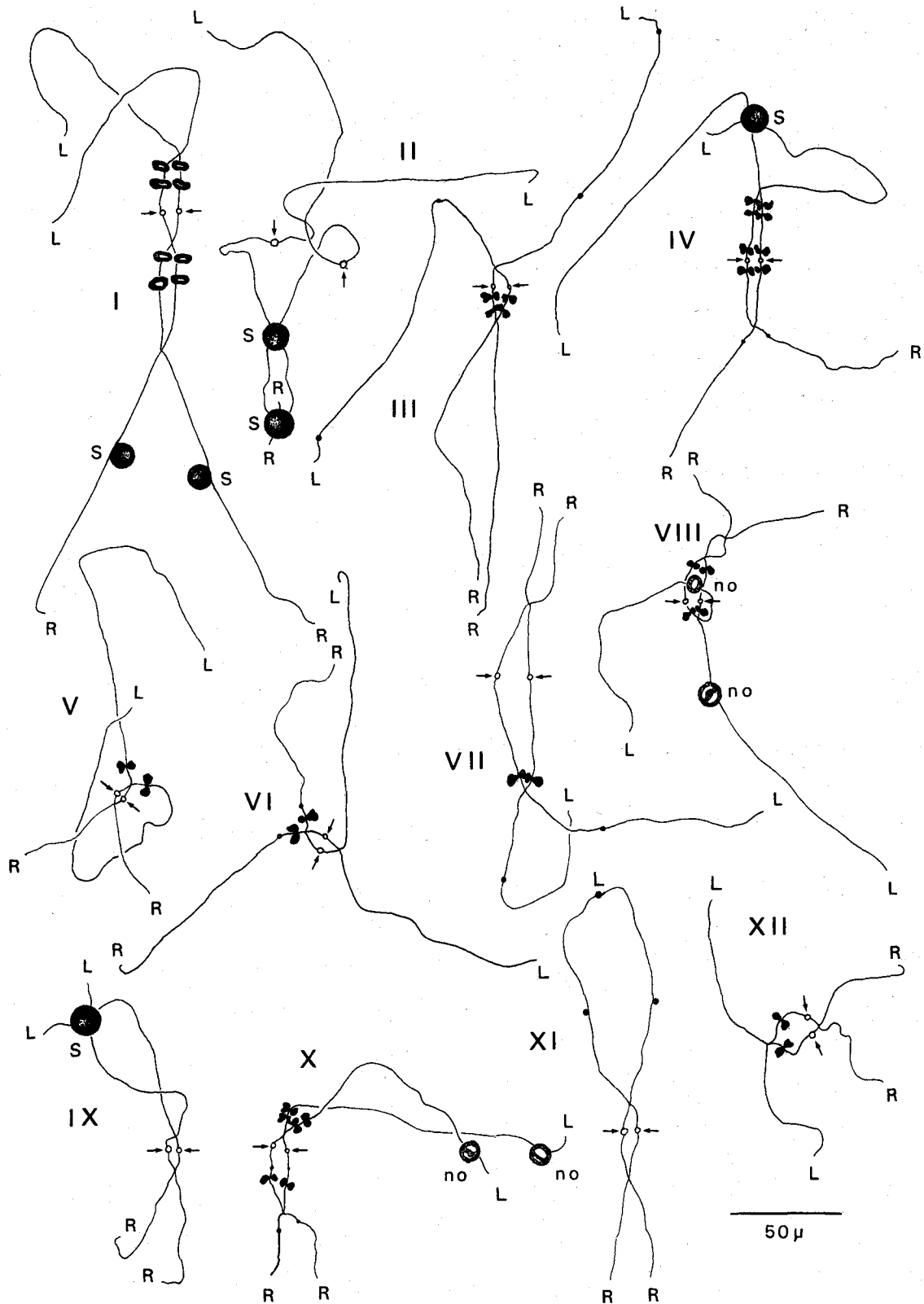


Fig. 1. The 12 lampbrush chromosomes from a medium-size oocyte of *T. alpestris apuanus*. L=left end; R=right end. Further explanation in text.

easily identified when they have a nucleolus inserted on them, or at least a smaller refracting globular object having a morphology similar to that of the nucleoli (Figures 2a and 2b). In all, there are 7 sphere-organizing regions (S) distributed over 4 chromosomes: beside those previ-

ously mapped, another sphere has been frequently found close to the subterminal ones of chromosomes II and IX (Figures 2c and d).

After this careful revision, it is finally possible to study more profitably a possible structural relationship existing

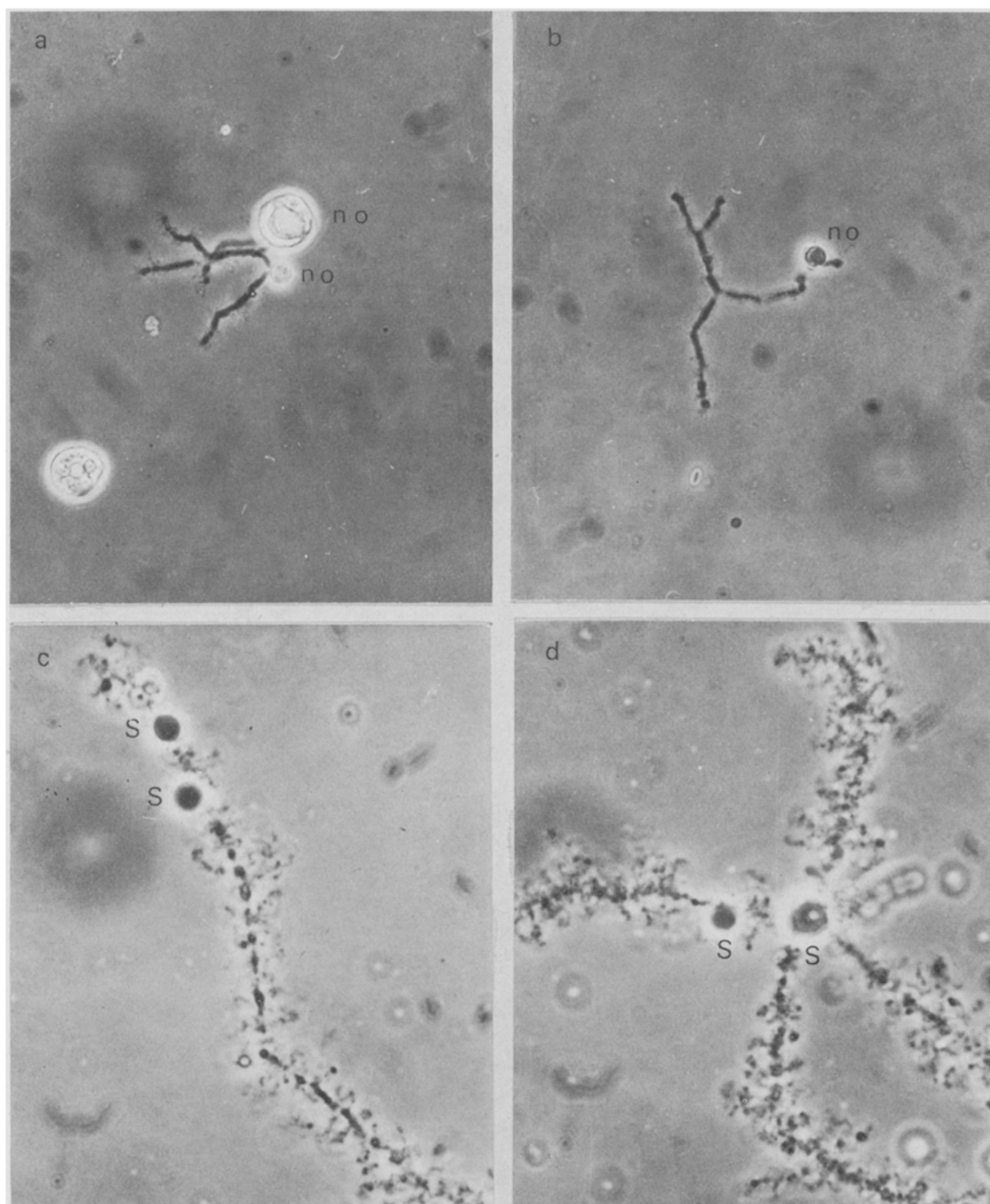


Fig. 2a) and b). Bivalents VIII and X from a large-size oocyte in preovulatory condition. The chromosomes appear shortened and the loops are generally condensed, while the nucleoli are still inserted on the nucleolus-organizing regions. Further explanation in text. $\times 545$.

c) and d). Part of lampbrush chromosomes II (c) and IX (d) showing the couple of subterminal spheres. In (d), the most distal sphere is heterozygous, the second ones are fused. $\times 1350$.

between the main landmarks of the lampbrush chromosomes and the linear differentiation between euchromatic and heterochromatic areas that has recently been constantly found along the mitotic chromosomes³.

Riassunto. L'identificazione dei centromeri, delle regioni nucleolo-organizzatrici e di quelle sfera-organiz-

zatrici ha permesso il completamento della morfologia dei «lampbrush chromosomes» di *Triturus alpestris apuanus*.

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Via Volta 4, Pisa (Italy), 27 September 1971.*

³ I. NARDI, M. RAGGHIANI and G. MANCINO, *Experientia*, in press.