mals were perfused with 10% formalin in isotonic sodium sulphate. The brain and spinal cord were removed and the portion of the spinal cord containing the lesion was embedded in paraffin wax. The extent of the lesion was verified in cresyl violet stained serial sections. After appropriate fixation frozen sections (80 μm thick) were cut from the midbrains in a plane transverse to the cranio-caudal axis. These sections were stained for AchE activity using the thiocholine technique of LEWIS[6]. Ethopropazine HCl was used to inhibit butyrylcholinesterase activity.

Using a projection microscope a comparison was made of the distribution of heavily and moderately stained cells in both red nuclei in each animal in which the rubrospinal tract had been severed. On the ipsilateral or control side these cells were seen to be restricted to the magnocellular caudal half of the nucleus.

Following low thoracic lesions a loss of cellular AchE activity was observed after 21 days survival and reached its maximal extent by 55 days. This loss of enzyme activity was restricted to cells in the ventral part of the caudal half of the contralateral red nucleus (compare Figure 1 and Figure 2). Following cervical lesions a loss of cellular AchE activity was observed after 4 days survival and was fully developed by 14 days. The loss of enzyme activity affected more cells in the caudal half of the contralateral nucleus, not only in the ventral part but also in more dorsal regions (compare Figure 3 and Figure 4).

It is thus possible to deduce that dorsal levels of the caudal half of the red nucleus project to between levels C4 and T8 of the spinal cord and that the more ventral part of the caudal half of the nucleus projects to between levels T9 and T13 of the spinal cord. POMPEIANO and BRODAL[8] have shown that the rubrospinal projection is somatotopically organized in the cat. The present study suggests that this may also be the case in the rat. This suggestion is at present under confirmation using retrograde degenerative techniques. SHUTE and LEWIS[10] have expressed the opinion that in the case of neurones whose axons lie entirely within the central nervous system no change could be reliably detected in the AchE content of the cell bodies following axotomy. At least in the red nucleus of the rat the present study shows this is not the case. The use of the thiocholine technique as a neuroanatomical tool adds an interesting dimension to cholinesterase histochemistry[13].

Résumé. La technique de l'acétylthiocholine démontrant l'activité de l'acétylcholinesterase fût employée pour indiquer la perte régionale d'enzyme des cellules nerveuse du noyau rouge du rat à la suite d'une lésion du faisceau rubrospinal. Les lesions aux niveaux thoraciques inférieurs du cordon médullaire donnent lieu à une perte d'enzyme des cellules dans la partie ventrale de la moitié caudale du noyau rouge. Cependant, les lésions du faisceau aux niveaux cervicaux du cordon médullaire donne lieu à une perte d'enzyme de la partie ventrale ainsi que de la partie dorsale de la moitié caudale du noyau. On suggère que cela indique une organization somatotopique de la projection rubro-spinale chez le rat.

D. G. GWYN

Department of Anatomy,
University of Western Ontario, London (Canada),
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Chromosomal Heteromorphism and Female Heterogamety in the Marbled Newt *Triturus marmoratus* (Latreille, 1800)[1]

Investigations on *Triturus marmoratus* lampbrush chromosomes have revealed that in all oocytes of the females studied in the present work bivalent I is characterized by a peculiar morphological asymmetry, which depends on the fact that the 2 partner chromosomes are not identical either in length or in the morphology of the lateral structures: actually some loops inserted at homologous sites show different sizes and matrix texture on the 2 partners: therefore they may be considered to be heteromorphic loops. Among these, the most constant heteromorphic loop is that made with dense matrix (indicated as b in Figure 1) which is inserted on the longer partner chromosome. In addition some globules appear in a heterozigous condition. Within the heteromorphic region chiasmata have not been observed in the several oocytes studied so far; 1, or at times 2 chiasmata are present on the left subterminal region which presumably corresponds to the short arm of the chromosome; occasionally, a single chiasma may also be encountered next to the right terminal region (Figure 2). Thus, the mean chiasma frequency for this bivalent is the lowest in the complement of the species, although the other 11 elements are shorter (Table).

The peculiar morphology of bivalent I from *T. marmoratus* is comparable to that already described in bivalent I from *T. cristatus*[2]. Since the 2 species may undoubtedly be considered closely related on the basis of both their phenotypic[3] and cytotaxonomic[4] characters, bivalent I of *T. marmoratus* can share the significance already ascribed to *T. cristatus* lampbrush bivalent I, i.e. it would consist of the 2 heterochromosomes Z and W[5].

Owing to these cytological observations, which seem in keeping also with the results yielded by recent studies on the lampbrush chromosomes of *Pleurodeles waltlii* and *P. poireti*[6,7], *T. marmoratus* would therefore be endowed with a genetic constitution ZZ (♂): ZW (♀). This interpretation obviously needs experimental support. Nonetheless, the ZZ (♂): ZW (♀) mechanism of sex determination has been already assessed within urodele amphibians – either by cytological studies or by experimental sex-reversal and further analysis of the sex ratio of the offspring of individuals with a sex-reversed phenotype (cf.[8]) – in the suborders[9] Cryptobranchoidea, Sala-

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Mean lengths of the lampbrush chromosomes relative to the length of chromosome XII taken as 100 units long and mean chiasma frequency per bivalent

	Chromosomes											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Relative lengths	349.6	289.8	248.5	242.4	189.2	207.4	206.7	153.1	149.4	144.3	147.0	100
Chiasma frequency	1.3	3.3	2.6	3.0	2.7	2.0	2.9	2.0	2.1	2.4	2.4	2.0

These values have been calculated on 11 oocytes from 7 female specimens.

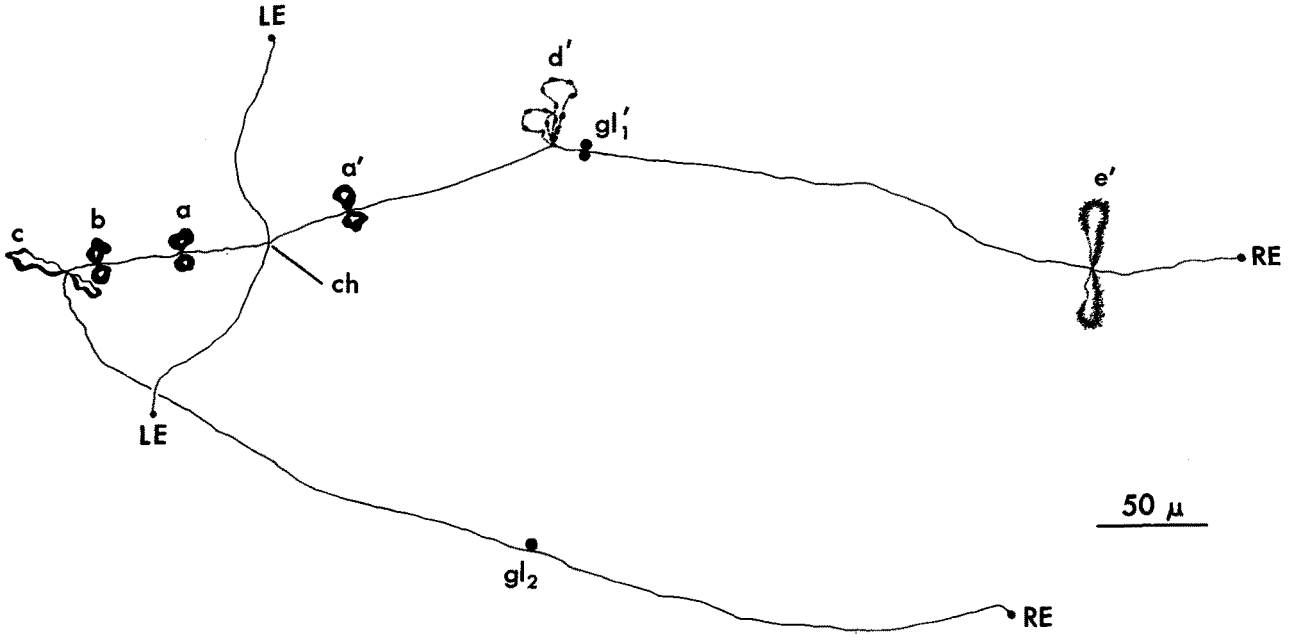

Fig. 1. Camera lucida drawing of bivalent I from oocyte P, ♀-A 1, diameter: 2.12 mm. The two partner chromosomes show different morphology owing to the presence of some heteromorphic loops such as b, c and d', e'; the globules gl_1' and gl_2 are present in a heterozigous condition. The partner chromosome on which b is inserted is constantly longer than the other one (in this oocyte the values of the lengths relative to that of chromosome XII taken as 100 units long are 365 and 298 units respectively). ch, chiasma; RE, right end; LE, left end.

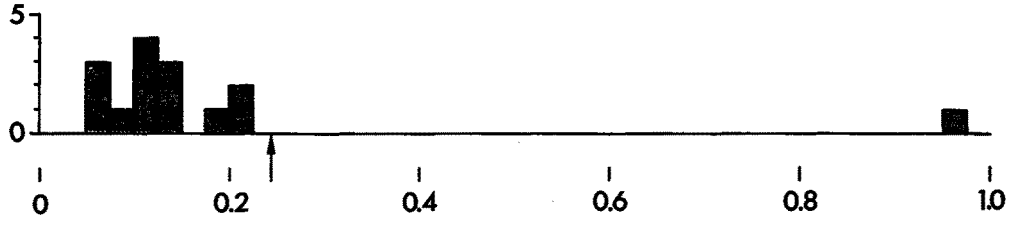

Fig. 2. Histogram representing the distribution of chiasmata on bivalent I (whose length has been made equal to 1 unit) from the 12 oocytes which have been used for the compilation of the maps to be published later. As kinetochore has not been found, the probable centromere region on lampbrush chromosome I is indicated by arrow according to the centromere index (0.249) of the corresponding mitotic chromosome. x axis, fractions of length; y axis, number of chiasmata.

mandroidea and Ambystomatoidea (fam. Ambystomatidae); while in the suborder Ambystomatoidea (fam. Plethodontidae) *XY* chromosomal sex determination mechanisms have been ascertained in males of the Latin American plethodontid salamander genera *Oedipina* and *Thorius* and of the Costa Rican *Chiropterotriton abscondens*[10].

Riassunto. Il bivalente lampbrush I di *Triturus marmoratus* è costituito da 2 cromosomi partner di diversa lunghezza a presenta loops eteromorfi lungo una regione sempre sprovvista di chiasmi. Si può quindi ritenere che tale bivalente sia costituito dagli eterocromosomi Z e W.

G. MANCINO and IRMA NARDI

Istituto di Zoologia e Anatomia comparata dell'Università, Via A. Volta 4, I-56100 Pisa (Italy), 3 December 1970.

[10] J. KEZER, personal communication.