Pansegmental Primordial Glycogen Body in the Spinal Cord of Postmetamorphic *Pleurodeles waltl*ii (Urodela)*

A. J. Zamora

Laboratoire d'Histologie Normale et Pathologique du Système Nerveux, INSERM U. 106. C.M.C. Foch, 42 rue Desbassayns de Richemont, F 92150 Suresnes (France)

**Summary.** Light microscopical histochemistry and transmission electron microscopy have been used to identify large amounts of glycogen stored in the cytoplasm of specialized astroglial cells in the spinal cord of ribbed newts. These cells are found throughout the whole length of the cord. They are located in the dorsolateral and lateral aspects of the periependymal stratum, and according to their cytological characteristics they have been considered as glycogenic astroglia. Massive glycogen inclusions occupy a subsurface position, mainly in those cell processes that do not project outside the central field, which form a tight packed territory surrounding the ependyma. Topological, histological, histochemical and cytological similarities are revealed between glycogenic astroglia and specialized astroglial cells found in the primordial lumbar avian glycogen body, as well as in the brachial glycogen body of the chick spinal cord. The similarities strongly suggest the homology between these structures. The pansegmental distribution found in the newt could be a clue for understanding the physiological role of such a structure.

**Key words:** Urodeles – Spinal Cord – Glycogen Body – Astroglia.

The presence of a single, fragile, localized, but macroscopically distinguishable body which occupies the dorsal aspect of the lumbar spinal cord of birds was reported for the first time by Emmert in 1811. Meyer (1884) and Gage (1917) were the first to note the accumulation of large quantities of glycogen in this structure. In confirmation, Terni (1924) coined the term “glycogenic body” after demonstrating histochemically the intracellular storage of the carbohydrate, an observation later corroborated by Watterson (1947). This author undertook comprehensive studies of the anatomical relationships, morphogenesis, growth rates, vasculogenesis and some regulatory mechanisms of such body in the chick (Watterson, 1949). Although

---

* Supported by grant INSERM C.R.L. 76.4.047.6 to Prof. J.C. Lacroix, Université Pierre et Marie Curie, Paris

1 Cited by Watterson, 1949

0340-2061/78/0154/0083/$02.40
the purpose of this paper is strictly morphological, one should emphasize that the functional role of this structure is still unclear, even when it has been postulated to be relevant for the metabolic maintenance of spinal cord integrity (Smith and Geiger, 1961; Hazelwood, Hazelwood and Olsson, 1963).

An ultrastructural analysis of the developing avian glycogen body was undertaken by Matulionis (1973) and the fine structure of the glycogen body of the young chicken has been described by Lyser (1973); these studies have recognized it as a specialized periependymal astroglial territory of the lumbar spinal cord, confirming what pioneer workers have postulated (von Kölliker, 1902; Imhof, 1905). More recently, using light microscopical histochemical methods, Sansone and Lebeda (1975) demonstrated the existence of a group of cells particularly rich in glycogen which surround the central canal of the cervical segments of the spinal cord of the domestic chicken; they consider these cells as being less developed but homologous of the lumbar glycogen body, and accordingly they have proposed the term brachial glycogen body to designate this structure.

Up to the present, the glycogen body has been considered as belonging exclusively to birds but this statement lacks comprehensive observations: comparative anatomical studies have not been devoted to the search of specialized astroglial territories in the spinal cord of different vertebrate classes.

Histochemical and ultrastructural features presented in the present report indicate that throughout the length of the periependymal stratum of the spinal cord of the ribbed newt, groups of astroglial cells storing huge quantities of glycogen can be recognized; this structure is interpreted as an astroglial differentiation homologous to the avian glycogen body.

Material and Methods

Previous to fixation, postmetamorphic Pleurodeles waltlii Michahelles (Boulenger, 1910; Noble, 1931; Thorn, 1968) were kept in fresh tap water at room temperature and were fed beef liver twice a week. To avoid annual metabolic variations, all animals were perfused at the same period, which was arbitrarily chosen as the month of May. After being anesthetized by immersion in a 0.01% aqueous solution of tricaine methane-sulfonate (Sandoz MS 222), the animals were perfused according to the same procedure detailed in a previous paper (Zamora, 1978), and which basically consists of an intravascular perfusion with a buffered mixture of paraformaldehyde, glutaraldehyde and acrolein, followed by postfixation in unbuffered osmium-ferrocyanide (Karnovsky, 1971), since use of the later significantly enhances the preservation of glycogen in the nervous tissue. Blocks of tissue were embedded in Araldite. A modification of the embedding schedule was found to be required: for semithin sections utilized in the

Fig. 1. Semithin transversal section stained with toluidine blue showing the central field of the brachial spinal cord. In the periependymal stratum, extensive cytoplasmic areas (stars) contain denser regions (arrows) corresponding to deposits of glycogen. D, dorsal septum of von Kölliker, projecting up towards the dorsal longitudinal sulcus. The asterisk indicates the central canal. × 500

Figs. 2 and 3. Higher magnification showing two deposits of glycogen, indicated by arrows in Fig. 1. Round fenestrations are interpreted as resulting from withdrawal of associated lipid droplet. D, dorsal septum of von Kölliker × 1000