1. NERVOUS SYSTEMS OF THE SNAIL

Nervous System and Neural Maps in Gastropod Helix lucorum L.¹

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INTRODUCTION

The structure of the nervous system of snails was described in several classic articles at the beginning of this century [19, 38, 39, 49]. These papers describe the structure of the ganglia, give the nerves names, and show their targets. Snails have been intensively used in neurophysiological studies aimed at describing principles of the functioning of neural networks, determining the involvement of identified neurons, providing a detailed description of nervous system structure, and mapping identifiable neurons. The goal of the present paper is to provide a concise, comprehensive review which can be understood by a newcomer to the field.

The various species of Helicoidea used in experimental investigations are all similar in many respects. Given the similarities in behavior and organization of locomotion, the utilization of a particular snail depends mostly on its availability. Helix pomatia is most commonly used, a common edible garden snail found throughout central Europe and in the East up to the Moscow region. H. lucorum taurica is found in the Crimea, whereas another subspecies, H. lucorum marten-sia, is found in the Caucasus. In southern and western Europe, Helix aspersa (synonym Cryptomphallus aspersa) is typical. Although these snails are smaller in size, they are fully developed within 6 months and are easier for laboratory rearing. Recently, a new species of large snails was introduced into experimental practice from Northern Africa: H. aspersa maximus, which is also more suitable for maintaining in the laboratory. In the physiological (but not zoological) literature, all these snails are referred to as "terrestrial" snails (in Russian, grape snails). Cell maps in these species are very similar, and it seems useful to describe all of them in a similar manner. However, the neural maps reported in the literature have not used uniform numbering schemes (i.e., a given neuron may be numbered differently from map to map). This suggests another goal of our work: not only to describe homological cells in different species, but also to compare different descriptions within one species.

Structure of the Nervous System

Systematically, the snails in question are described as follows: Phylum Mollusca, Class Gastropoda, Subclass Pulmonata, Superfamily Stylommatophora, Family Helicidae. As in other molluscs, numerous neurons are located in the periphery: in the skin, foot, and other organs [49]. These peripheral parts of the nervous system are almost unexplored; most
work has been focused on the central ganglia which are fused in a circumesophageal ring. The ring contains 5 pairs of ganglia and a visceral ganglion. A view of these ganglia is presented in Fig. 1. A short description of the nerves described in this figure follows.

**Buccal Ganglia.** Nervus glandulae salivaris has salivary glands as its target, whereas anterior and posterior parts of the buccal mass are innervated by nn. pharyngealis primus, secundus. The pharynx and stomach are innervated by nn. gastricus anterior, posterior.

**Cerebral Ganglia.** N. olfactorius innervates olfactory ganglia in ommatophores (tentacles with eyes on their ends). N. opticus contains two branches, and innervates the eye and ommatophore retractor muscle. The skin and muscles (except retractor) of the ommatophore are innervated by two nerves: nn. peritentacularis internus, externus. The gravitational organ (statocyst) located in pedal ganglia is innervated by n. acusticus. The skin of the head is innervated by n. cutaneus cephalicus, the penis by n. penis, and the cerebral artery by n. arteriae cerebralis. The lips, oral cavity, and