of the fat-soluble antioxidant ionol and the water-soluble OP-6 to the incubation medium caused inhibition of LPO, on the one hand, and stabilization of cytochrome P-450 on the other hand. It must be noted that ionol is essentially a more effective inhibitor of LPO in hepatocytes and a correspondingly more effective protector of cytochrome P-450 against degradation than the water-soluble OP-6.

It can thus be concluded from these results that antioxidants are highly effective stabilizers of cytochrome P-450 in hepatocytes.

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PHYLOGENETICALLY AND ONTOGENETICALLY PREDETERMINED MECHANISM OF DISTRIBUTION OF LYSOSOMAL ACID PHOSPHATASE ACTIVITY ALONG THE ALIMENTARY TRACT

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Electron-microscopic [1, 11] and biochemical [2, 5] research has yielded evidence that the ultrastructure of cellular lysosomes of the intestinal mucosa and the activity of their enzymes undergo considerable changes depending on the animals' dietary conditions. However, this evidence has been obtained only in rats. In young rats during the period of milk feeding, for instance, lysosomes in the small intestine were found to be larger and more "active" than in mature rats. On the basis of facts such as these it has been postulated [3, 11] that lysosomes can participate in the digestion only of milk proteins in early postnatal development. Accordingly, the possible role of lysosomes (or of their enzymes) in systemic digestion must be regarded as a temporary, adaptive phenomenon, taking place only at an early age, and confined to mammals.

This paper gives the results of a study of the functional organization of lysosomes of the alimentary tract.

EXPERIMENTAL METHOD

Experiments were carried out on cartilaginous and bony fishes (beluga sturgeon, crucian carp), frogs, water snakes, pigeons, rats, newborn puppies, 20- and 28-day-old rabbit fetuses, and 40-day-old cat fetuses. The animals were decapitated (the fetuses were decapitated after

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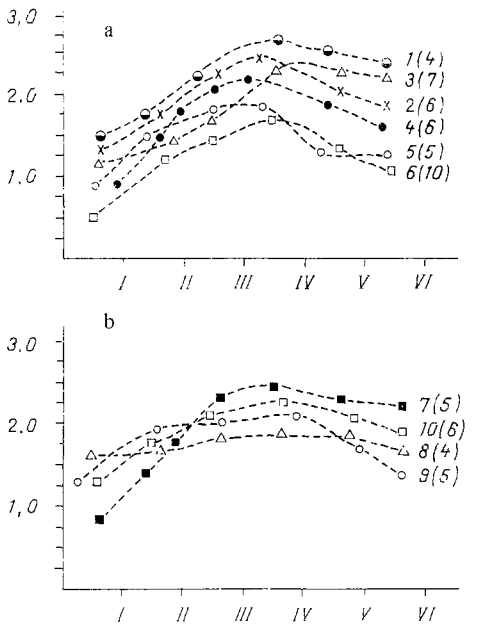

Fig. 1. Changes in free acid phosphatase activity in different parts of alimentary tract of different classes of animals (a) and in certain mammals in the early stages of ontogeny (b). Abscissa, divisions of alimentary tract: I) esophagus, II) stomach, III) duodenum, IV) small intestine, V) large intestine, VI) rectum; ordinate, enzyme activity (in μmoles nitrophenol/g wet weight of tissue). Number of observations given in parentheses. 1) Beluga sturgeon, 2) crucian carp, 3) frog, 4) water snake, 5) pigeon, 6) rat, 7) puppy, 8, 9) 20- and 28-day-old rabbit fetuses, respectively, 10) 40-day-old cat fetuses.

removal from the uterus of the mother animals anesthetized with pentobarbital), the whole of the alimentary tract was exposed by laparotomy and thoracotomy, and equal weighed samples of tissue were taken from different parts of the esophagus, stomach, duodenum, small and large intestine, and rectum taken consecutively in the proximal—distal direction. After homogenization of the tissue in 0.25 M sucrose solution, the lysosomal fraction was isolated by differential centrifugation [8, 10] and was analyzed quantitatively for protein [9] and free activity of the lysosomal marker enzyme acid phosphatase (with sodium *p*-nitrophenylphosphate as the substrate) [6]. Free activity of the lysosomal enzyme gives an estimate of the concentration of lysosomes, permeability of their membranes, accessibility of substrates, and activity of enzymes liberated from the lysosomes [4].

EXPERIMENTAL RESULTS

Earlier research [7] yielded data showing that certain lysosomal enzymes, including acid phosphatase, are located in the tissue of the distal part of the small intestine only (in the ileum) in certain species of animals (mice, rats, rabbits). More recent studies on rats, however, showed that acid phosphatase is found in the tissue not only of the ileum, but also of the jejunum and stomach [2, 5]. In the present experiments activity of this enzyme was studied in those regions, and also in the esophagus, duodenum, large intestine, and rectum. The enzyme was found to be present to some extent in nearly all parts of the alimentary tract of the animals studied (Fig. 1). A characteristic feature of the localization of acid phosphatase in the alimentary tract is its uneven distribution between the various parts. Despite some particular features of the acid phosphatase content in different parts of the alimentary tract (which will be specially discussed), its irregular distribution obeys a strictly definite rule. Starting with the esophagus, activity of the enzyme rises gradually to reach a comparatively high level in the small intestine, after which it again falls smoothly in the

distal parts of the intestine. Experiments on animals in a phylogenetic series thus showed that high lysosomal activity along the alimentary tract is observed as a rule in those parts where processes of digestion and absorption of food mainly take place. This is evidently not by accident, but a phenomenon with definite physiological significance, characteristic of vertebrates at least.

Further investigations, undertaken from the ontogenetic aspect (although, admittedly, on mammals only), showed that the same distribution exists in the antenatal period of development. In fetuses in the early stages of formation, by contrast with mature animals, a high background level of lysosomal activity is found along the entire alimentary tract. In this period differences between its distribution among the various organs are very slight. This is particularly clear from results obtained on 20-day-old rabbit fetuses. However, with the development of the fetus and, in particular, toward the time of birth, an unevenness of the distribution of lysosomal activity is found in organs of the alimentary tract. In 28-day rabbit and 40-day cat fetuses, for instance, the gradient of displacement of high lysosomal activity toward the small intestine was quite similar to that observed in puppies aged 3-4 days (Fig. 1), which had already changed from placental feeding to feeding on their mothers' milk.

It can thus be concluded from these results that the uneven distribution of lysosomal activity along the alimentary tract is a phylogenetically and ontogenetically predetermined feature of their morphological and functional organization which may play a definite role in the exercising of the specific functions of this system.

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