LXXXI. URICASE AND ITS ACTION.

VI. DISTRIBUTION IN VARIOUS ANIMALS.

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LITTLE systematic work on the distribution of uricase in the individual organs and tissues of various animals has been done. Batelli and Stern [1909] examined certain organs of a number of domestic animals; in all cases the liver was found to contain uricase, and in certain cases the kidneys; uricase was not found in the lung, spleen, pancreas, brain or muscle of certain of these animals (horse, dog, cat, rabbit, ox, sheep). Galeotti [1911] reported that the liver of selachians contained uricase, and Przyłęcki [1926; 1927] studied its distribution amongst the invertebrates, without, however, determining in which organs it was present.

EXPERIMENTAL.

The animals examined were dissected immediately after death, the organs taken being freed as far as possible from non-specific tissues (fat, connective tissue, blood, etc.). In most cases 2 g. of fresh organ were weighed out and shaken for 60 min. with 20 cc. of 0.025–0.05 % uric acid (as lithium salt, at p_H 8) in the presence of 1 cc. of toluene; in the case of small animals, the smaller organs of several individuals were pooled to make up the required weight. The sample of tissue was ground in a mortar with a few cc. of the uric acid solution, the remainder of which was used to wash the contents of the mortar into the reaction flask. Uric acid was determined colorimetrically by the method of Folin and Denis in the above systems, and in systems containing 20 cc. of uric acid solution and 1.5 cc. of water (this being roughly equivalent to the water content of the added tissues).

The results (Table I), calculated as mg. of uric acid oxidised per g. of fresh tissue, indicate that the sole organs possessed of uricolytic activity in widely distributed species of animals are the liver and/or kidneys. In most cases only the liver contains uricase (horse, sheep, cat, rabbit, guinea-pig, mouse, hedgehog, bat, carp, crayfish, fresh-water mussel); in the ox uricolysis is performed chiefly by the kidney; in the frog the activity of the kidney is approximately equal to that of the liver; whilst in dogs, swine and rats kidney tissue has comparatively little activity. In the case of dogs, the activity found for liver and kidney tissues varies considerably with the breed and, possibly, with the individual, as in one case 10.8 mg. were oxidised per g. of kidney and in another 2.3 mg., whilst, as was stated in Part v, dog-kidneys may be quite free of uricolytic action. It is, further, well-known that certain breeds (Dalmatians) excrete both allantoin and uric acid [Benedict, 1916], and in these dogs it may be assumed that uricase is deficient in either the liver or kidneys, or both of these organs.

Table I.

Mg. of uric acid decomposed by shaking 20 cc. of 0.025-0.05 %
uric acid for 60 min. with 1 g. of tissue

Animal	Temp.	Liver	Skeletal			Lungs	Brain	Intes- tine	Stomach	Spleen	Ovary	Testicle	Uricoly- tic index	Remarks
			Kidney	muscle	Heart									
Ungulata:														
Horse	18°	2.0	0	0	0	0	0	—	—	0	—	0	88	Pancreas inactive
Ox	15°	2.6	8.8	0	—	0	0	—	—	0	—	—	93	
Pig	18°	3.5	1.3	0	—	0	0	—	—	0	—	—	98	
Sheep	18°	2.8	0*	0*	—	0*	—	—	—	0*	—	—	80	
Carnivora:														
Dog (Alsatian)	16°	12.2	10.8	0	0	0.1	0	0	0	0.1	—	0	98	Pancreas inactive
Dog (Fox-terrier)	16°	—	2.3	0	—	—	0	0	0	0.1	—	0	97	
Cat	18°	4.5	0	0	—	—	0	0	0	0.1	—	0	97	
Rodentia:														
Rabbit	16°	3.9	0	0	0	0	0	—	0	—	0	—	95	Foetuses, without liver, and placen- ta inactive
Rabbit (foetus, 7 mm.)	16°	3.9	—	—	—	—	—	—	—	—	—	—	95	
Guinea-pig	16°	2.4	0	0	0	0	0	0	0	0	—	0	94	Suprarenal glands and pancreas in- active
Rat (albino)	16°	3.4	0.6	0	0	0	0	0	0	0	—	0	96	
Mouse (albino)	18°	2.3	0	0	0	0	0	0	0	0	—	0	—	
Insectivora:														
Hedgehog	16°	3.8	0	0	0	0	0	0	0	0	—	0	—	Thyroid and sup- rarenal glands in- active
Bat (<i>Eptesicus serotinus</i> Schreib.)	20°	0.8	0	0	0	0	0	0	0	0	—	0	—	
Various:														
Frog (<i>R. escul.</i>)	18°	2.7	2.1	0	0	0	0	0	—	0	0	0	—	Skin and bones in- active
Carp	18°	1.1	0	0	—	—	—	0	—	—	0	—	—	Skin, bones and gills inactive
Crayfish	18°	2.2	0	0	—	—	—	0	—	—	0	—	—	Gills inactive
Fresh-water mus- sel (<i>Anodonta mutabilis</i>)	18°	0.4	—	—	—	—	—	—	—	—	—	—	—	Remainder after removal of liver inactive

* According to Batelli and Stern.

The rabbit examined was a pregnant doe, containing a number of foetuses, 7 mm. in length. It is of interest that the foetal livers had the same uricolytic activity as the maternal liver, and that the remaining tissues were, as in the adult animal, inactive.

Certain of the results found for poikilotherms are in disagreement with those obtained by Przyłęcki [1926; 1927], who was unable to demonstrate uricase in carp-liver and in crayfish, whilst *Anodonta* apparently contained considerable quantities of uricase. The uricolytic action of carp-liver is extremely feeble, and in systems which, as in Przyłęcki's experiments, were not shaken, it would probably not be possible to demonstrate uricase; the same applies to crayfish, in which only the liver is active, whilst Przyłęcki examined the action of a mixture of the tissues of the whole animal. As to fresh-water mussels, Przyłęcki based his statement chiefly on the results of metabolism experiments on the living animals—under these conditions accompanying bacteria were in all probability the cause of the disappearance of injected uric acid.

If the mammalian tissues examined be placed in order of decreasing uricolytic activity, the following series is obtained: ox-kidney > dog-liver > dog-kidney > cat-liver > rabbit-liver > hedgehog-liver > pig-liver > rat-liver > sheep-liver > ox-liver > guinea-pig-liver > mouse-liver > horse-liver > bat-liver. This series differs in several respects from that given by Batelli and Stern, amongst others, in that they placed horse-liver above all other organs except ox-kidney, and found horse-kidney also to possess considerable activity. It is our opinion that these discrepancies should be ascribed not necessarily to faulty experimental technique, but rather to the same causes as those suggested previously for dog-kidneys, namely, to differences in the various breeds of the same species, which are exceptionally prominent in the case of domestic animals. Further, individual differences may exist even amongst different individuals of the same breed, due to pathological conditions in the organs in question, which would, in the case of horses, be the more probable in that normal, healthy animals are not as a rule available in slaughter-house material.

No connection appears to exist between the distribution of uricase and the phylogenetic relationships of the animals examined.

SUMMARY.

1. Uricase is present in the liver of every animal examined.
2. It is also present in the kidneys of oxen, pigs, dogs, rats and frogs.
3. It is absent from the kidneys of the horse, sheep, cat, rabbit, guinea-pig, mouse, hedgehog, bat, carp and crayfish, and from all organs other than the liver and kidneys of all animals examined.

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