

THE CORRELATION OF CERTAIN CHEMICAL FINDINGS WITH HISTOLOGICAL STRUCTURE¹

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It may be stated that in general those substances found in tissues are the products of the cellular activity of the tissues themselves. Undoubtedly many tissue constituents have been brought there as such by the blood; but under average conditions of uniform diet the determinable integral constituents are the products of the metabolic processes of the cells and cell nuclei upon the substances brought to them by various means. The glycogen of the liver and muscles, the phosphatids of the brain and the purines of all tissues are specific enough examples to demonstrate the possibility of tissue constituents being in general the product of the specific tissue activity.

During the work on uric acid in tissues it was noted that certain tissues invariably contained more uric acid than others. This difference was so marked and so constant in occurrence whatever the kind of animal under investigation, that in order to explain these differences, recourse was had to the histological structure of the tissues in question as well as to their function.

It seems plausible therefore to divide tissues into two general classes, basing the classification upon the histological structure and the uric acid content and strengthening the comparison by a consideration of the function.

In the one group it is possible to place all those tissues whose nuclear mass is relatively great in proportion to protoplasmic mass such as liver, spleen, kidney and general glandular tissue. In the other group may be placed those tissues in whose cells the nuclear material is relatively small in proportion to protoplasm, such as muscle tissue.

In the former group we find without exception that uric acid is present in quite considerable quantity. In the latter group the uric acid content is uniformly low in amount.

Histological evidence points to the fact that glandular tissue activity is inherently bound up with nuclear activity. The changes in gland activity are accompanied by well marked changes in nuclear structure. The specific function therefore of these tissues is closely associated

¹ The work herein reported was carried on while the author was working in the Department of Bio-Chemistry of Harvard Medical School and represents a part of the work required for the Degree of Doctor of Philosophy.

if not entirely bound up with nuclear metabolism. With muscle tissue however we are unable to trace any direct histological connection between tissue activity and marked changes in nuclear structure. The main function of muscle tissue depends upon its protoplasmic metabolism. Increase in muscle activity has yet to be proven to yield an increase in uric acid excretion that can be traced to increased nuclear activity. Whereas both Mareš and Smetanka have conclusively proven that increase in glandular activity causes increase in nuclear activity and metabolism, with increase in uric acid excretion.

It is not assumed that the nuclei of muscle cells have no part in the production of uric acid; but it is considered that the nuclear activity of muscle cells is differentiated from that of gland cell nuclei in that in the former the protoplasmic activity is predominant while in the latter nuclear metabolism is the main factor in the functioning of the tissues.

From the results of the herein reported analyses the foregoing conclusions seem justified. The proposition is advanced that the comparative analysis of the tissues of an animal as regards their uric acid content gives some index of the relative nuclear activity of the tissues examined.

A survey of the appended tables demonstrates the points under discussion. The figures represent milligrams of uric acid in one hundred grams of tissue.

Distribution of uric acid in cat tissues

	BLOOD	MUSCLE	LIVER	KIDNEY	SPLEEN	LUNGS
	mg.	mg.	mg.	mg.	mg.	mg.
1	0.34	0.47	13.51	6.61	7.76	3.67
2	0.47	0.37	6.60	4.60	4.09	3.15
3	0.41	0.29	4.76		3.37	0.46
7	0.10	0.26	3.72		0.61	
8	0.12	0.15	4.10		1.98	
9	0.20	Trace	4.73		0.30	
10	0.29	0.79	2.83		4.76	
11	0.15	0.28	2.27		1.30	
13	0.83	1.20	2.54			

Rabbit

	MUSCLE	LIVER	KIDNEY	SPLEEN	LUNGS	TESTES
	mg.	mg.	mg.	mg.	mg.	mg.
1	0.72	4.96	1.02	26.60	2.89	1.43
2	0.60	5.69	0.80	10.13	1.38	

Hen

	BLOOD	MUSCLE		KIDNEY	SPLEEN	LIVER
		W	R			
	<i>mg.</i>	<i>mg.</i>	<i>mg.</i>	<i>mg.</i>	<i>mg.</i>	<i>mg.</i>
1	4.51	1.14	1.83	21.06	10.5	27.05
2	3.68	0.68	0.74	40.59	11.19	26.59

Man

	MUSCLE	LIVER	SPLEEN
	<i>mg.</i>	<i>mg.</i>	<i>mg.</i>
3	1.29	3.40	5.47
4	0.62	2.41	1.55
5	0.92	2.04	2.39
6	0.59	2.48	5.55

Dove

MUSCLE	KIDNEY	LIVER
<i>mg.</i>	<i>mg.</i>	<i>mg.</i>
3.30	52.33	15.74

Turtle

MUSCLE	LIVER
<i>mg.</i>	<i>mg.</i>
0.42 White	1.03

Cat

THYROID
<i>mg.</i>
5.71

Inasmuch as the hen and dove excrete their nitrogen as uric acid thus differentiating them from the Mammalia it would not be accurate for the purpose of the argument to include the blood and kidney analyses as examples. With these exceptions the differences as previously discussed are plainly apparent.

CONCLUSIONS

From a comparison of the relative uric acid content of body tissues with their histological structure both at rest and after activity it is possible to correlate the function of the tissues with their nuclear

activity and thus draw a line of demarcation between a predominately protoplasmic activity and a predominant nuclear activity.

LITERATURE CITED

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