6° Il est à signaler que l'ester-sulfate de cortisone est plus polaire que l'ester-sulfate de cortisol dans tous les systèmes essayés. Il en est de même pour le sulfate de 11 déhydrocorticostérone qui est plus polaire que le sulfate de corticostérone, donc la polarité de ces sulfates est inversée par rapport à celle du stéroïde libre.

J. R. PASQUALINI, R. ZELNIK et M. F. JAYLE

Laboratoire de chimie biologique, Faculté de Médecine, Paris (France), le 1er avril 1960.

Summary

The 21-sulfates of the six following corticosteroids: desoxycorticosterone (DOC), corticosterone (B), 11-dehydrocorticosterone (A), cortisol (F), cortisone (E), and 17α hydroxy-11-desoxycorticosterone (S), were prepared. Their separation by four different paper chromatographic systems was investigated. A method for detection of the spots is described.

On the Thermogenic System of Hibernants[1]

It is generally assumed that heat production in the hibernant during arousal comes from respiration and from muscular activity[2]. It has been shown that the ATP stores of the hibernator become depleted during arousal[3]. This is interpreted as a kind of ATPase action of the tissues either of the myosin type or of another.

Studies in this laboratory have been directed in part to assess the role, if any, of ATPase and acylphosphatase in thermogenesis in the awakening hibernator. The purpose of this report is to publish results leading to a theory of thermogenesis in the hibernant.

The tissue preparations from mature hamsters were solubilized in 9·0 volumes of 0·5% triton X-100-0·5 *mM* EDTA and the supernate used after centrifugation 30 min at 25000 × *g*. Acylphosphatase was measured by the method of GRISOLIA *et al.*[4] and ATPase by the method of LOWRY *et al.*[5]. The tissue preparations of normal and hibernating hamsters studied were, from the brain: brain stem, cerebellum, cerebral cortex, hippocampal region, and thalamic-hypothalamic region; and from the carcass: heart, liver, and gracilis muscle. Each set of data represents the values obtained from 12 to 14 animals.

For the purposes of this discussion it is sufficient to summarize the data in Tables I and II. More detailed reports will appear. It is seen that acylphosphatase is much less sensitive to lowering temperature than is the ATPase. In spite of an apparantly greater relative increase of ATPase in the hibernator than of acylphosphatase, the latter enzyme is much more active at the hibernating temperature used in these studies (0–2°C).

On the basis of data published on the respiration and heat production of hibernators[7], and on an assumed − 12 Kcal mole^{-1} as the ΔH of hydrolysis of acylphosphates and − 8 Kcal mole^{-1} as ΔH for ATP[8], Table III was constructed.

It is seen from this that ATPase is not sufficient even to maintain the homeothermic state of the hibernator at an environmental temperature near 0°C. Much less is it capable of initiating the temperature rise which occurs early in arousal. Acylphosphatase, on the other hand, is more than adequate for this service. The fact that it may be much more active than necessary near 0°C is not an impediment to this concept of its function. It is not difficult to conceive cases where the enzyme would operate *in vivo* at lower than maximum activity, as is the normal case with most enzymes. The enzyme measured in these studies represents the total amount of active enzyme. It seems to be distributed between the cellular particles and the nonsedimentable portion in nonsolubilized preparations.

The most probable substrate for acylphosphatase *in vivo* is 1,3-diphosphoglyceric acid which may arise from the cleavage and oxidation of fructose-1,6-diphosphate, from ATP and 3-phosphoglycerate, and from phosphocreatine and 3-phosphoglycerate[9], all of which pathways seem to operate in the hibernating hamster.

The relatively higher activity of acylphosphatase in the brain, according to the concept enunciated here, would be consistent with the fact that the head parts of the hibernator warm sooner and faster than the hind parts[2]. It is suggested that acylphosphatase plays its role in two stages: first it releases energy stored as phosphocreatine and ATP which process would be sufficient to warm the animal to the point where glycolysis and respiration become important in thermogenesis, and then it would act as an energy discharging system after glycolysis resumed[10].

L. C. MOKRASCH

Neurochemistry Laboratory, University of Kansas Medical Center, Kansas City, April 5, 1960.

Table I. Acylphosphatase

Tissue	0°C Normal Activity[a]	Activity ratio 38°C/0°C		Activity ratio Hibernator /Normal	
		Hibernator	Normal	38°C	0°C
5 Brain Zones	4·16	5·4	5·9	1·03	1·13
3 Carcass Zones	2·51	9·2	9·2	1·04	1·02

[a] Average, μM min^{-1} g^{-1} tissue. Temperatures are those at which the assay was performed

Table II. Adenosinetriphosphatase

Tissue	0°C Normal Activity[a]	Activity ratio 38°C/0°C		Activity ratio Hibernator /Normal	
		Normal	Hibernator	38°C	0°C
5 Brain Zones	0·048	110	90	0·94	1·17
3 Carcass Zones	0·050	150	89	1·30	1·76

[a] Average, μM min^{-1} g^{-1} tissue. Temperatures are those at which the assay was performed.

Table III. Summary of Normal and Potential Thermogenesis in the Hamster

Hibernating (5°C): 0·09 to 0·14 Kcal h^{-1} kg^{-1}
Calculated for 1st h of arousal: 5 to 7 Kcal h^{-1} kg^{-1}
ATPase (0°C): 0·02 to 0·04 Kcal h^{-1} kg^{-1}
Acylphosphatase (0°C): 3 to 4 Kcal h^{-1} kg^{-1}
Acylphosphatase (10°C): 5 to 6·5 Kcal h^{-1} kg^{-1}

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