or be transported through the cytoplasm to the medium, perhaps via vesicles. There is a close relationship between pinocytosis, the formation of lysosomes and the accumulation of acid hydrolases, in that an increase in pinocytosis is followed by an increase in the other two functions[19,20].

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*Zusammenfassung.* Es wird gezeigt, dass die normale proteolytische Tätigkeit von stimulierten peritonealen Makrophagen der Maus durch das Benzo-pyron-Cumarin in vitro beträchtlich erhöht wird.

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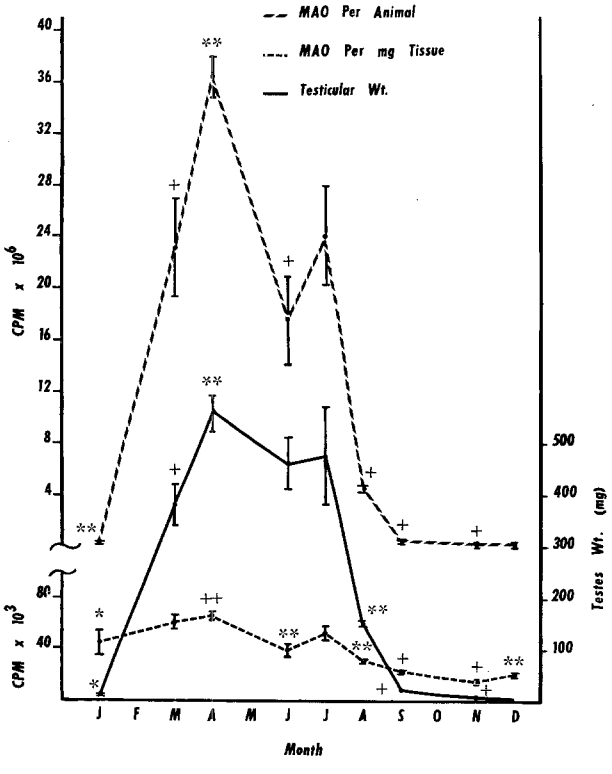
## Seasonal Variations in Testicular Monoamine Oxidase in the House Sparrow (*Passer domesticus*) and Uinta Ground Squirrels (*Spermophilus armatus*)[1]

Monoamine oxidase, a deaminating enzyme (MAO, Monoamine: $O_2$ oxidoreductase (deaminating) EC.1.4.3.4.), and endogenous 5-hydroxy-tryptamine (serotonin, 5-HT), a substrate of testicular MAO, are both normally present in rat testes[2-5]. Testicular MAO activity is low in young rats, increased during sexual development and maturity, and is low again with advanced age[5]. Changes in testicular MAO activity, with respect to aging, were correlated with changes in androgen synthesis and testicular development[5]. No attempt has been made to follow testicular MAO activity in animals that are seasonal breeders with large variations in testicular weight. The purpose of these investigations was to follow testicular MAO activity in house sparrows and ground squirrels to determine the relationship that MAO activity has with testicular development.




Testicular MAO activity and testicular weights of house sparrows trapped in northern Utah from January 1971 through December 1972. Each point represents the mean while the vertical lines are the standard error of mean values (* = $p < 0.05$, ** = $p < 0.01$, + = $p < 0.001$ when compared with the previous value while ++ = $p < 0.05$ when compared with January).

*Materials and methods.* Male house sparrows (*Passer domesticus*) were collected with a mist net in Cache Valley near Utah State University. 7 sparrows were collected in January, 6 in March, 6 in April, 6 in June, 6 in July, 5 in August, 7 in September, 5 in November, and 6 in December. All sparrows were collected the same day for a given group between 13.00 and 16.30 h. The birds were kept overnight in a wire cage with feed (mixed grains) and water given ad libitum.

Six adult male Uinta ground squirrels (*Spermophilus armatus*) were trapped in early April, soon after emergence (April 19, 1972), at a location in the Logan Canyon area approximately 35 km northeast of Logan, Utah. 5 other squirrels were trapped on May, 25 1972. All animals were weighed immediately after capture and sacrificed by decapitation. Immediately after sacrifice the testes were immediately removed from all animals, weighed, decapsulated and assayed for MAO activity as previously described[3]. A *t*-test was used to test for significance between sample means.

*Results.* Testicular weights of the house sparrows (Figure) increased from December to April and decreased from July to November. Testicular MAO activity (Figure), calculated on a per animal basis, increased from December to April, but generally decreased from April to December. On a per mg of tissue basis, testicular MAO activity increased from November to April ($p << 0.001$), but decreased from April to November with the exception of July. Increases in MAO activity from November to January preceeded increases in testicular weight.

Ground squirrels captured in May (Table), had significantly higher body weights, but lower testicular weights

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Squirrel testicular MAO activity from animals trapped on April 19, 1972 (Group I) and animals trapped on May 25, 1972 (Group II)

| Treatment | No. of animals | Body weight | | Testicular weight | | Per mg tissue | |
|---|---|---|---|---|---|---|---|
| | | (g) | *P* value | (mg) | *P* value | CPM $\times 10^3$ | *P* value |
| Group I | 5 | 258.2 $\pm$ 13.4 | | 968 $\pm$ 73 | | 26.14 $\pm$ 1.51 | |
| Group II | 5 | 303.9 $\pm$ 5.7 | $< 0.01$ | 368 $\pm$ 25 | $< 0.001$ | 7.85 $\pm$ 0.36 | $< 0.001$ |

Values expressed are mean $\pm$ standard error of mean.

and testicular MAO activity (expressed on per mg of tissue basis), than those captured in April.

*Discussion.* Of significance is the observation that in house sparrows MAO activity on either a per mg of tissue or total activity basis was highest at the peak of reproductive activity and testicular development (weights), but declined sharply as the breeding season ended and testicular weight declined. It is significant that an increase in MAO activity per mg tissue from December to January preceeded an increase in testicular weight from January to March. This early increase in MAO activity may have been a necessary factor for the subsequent increase in testicular weight and testicular development and is probably a reflection of gonadrotrophin release since FSH stimulates testicular MAO activity and testicular development in the rat[6].

The Uinta ground squirrels also showed seasonal variations with a large decrease in testicular MAO activity from April to June. The rapid decline in enzyme activity in the squirrels can best be explained by a diminished release of FSH from the pituitary. This observation is corroborated by the finding that pineal activity increases in this species during this time interval[7,8]. The low MAO activity observed as the squirrels pass into a non-reproductive period may serve to increase endogenous biogenic amine levels in the testis. This could serve to help insure a rapid decrease in testicular function as the animals enter into a period of reproductive quiescence. Other investigators[9] have shown dramatic alterations in primate testicular weights in as little as 9 days after orbital space flight. These workers suggested that 5-HT might be involved in this rapid decline in testicular weight. 5-HT may be one of the endogenous factors responsible for the cessation of seasonal breeding in house sparrows. This hypothesis is supported by a recent study showing that pargyline, an MAO inhibitor, has a detrimental effect on testicular development and spermatogenesis[10]. Our data show that testicular MAO activity undergoes seasonal variations, and that in conjunction with other factors 5-HT may induce the rapid testicular regression that is exhibited by seasonal breeders as they go out of breeding.

Of importance is the observation that testicular weight and MAO activity reached a peak by April 1, decreased somewhat by June, then rose slightly in July before reaching a low by September (Figure). In a previous study[11], testicular development was initiated in mid January and was completely regressed by late August similar to this study, but maximum gonadal size was delayed until May and June, with a slight delay in development occurring during April and May. These data indicate that the sparrow can adjust testicular development within a rather broad period to match the particular climatic conditions desired for reproduction. In this respect, the first study coincided with a late spring, while an early spring was manifest during the present study.

*Résumé.* Des moinaux familiers (*Passer domesticus*) et des écureuils (*Spermophilus armatus*) des montagnes Uinta ont été capturés à différentes époques de l'année et l'activité de la MAO a été mesurée dans leurs testicules. Chez les deux espèces l'activité de la MAO était la plus grande lorsque le poids des testicules était le plus élevé et la plus basse avant et après la saison du rut. Chez le moineau, l'augmentation de l'activité de MAO a précédé le développement des testicules.

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## Further Studies on the Metabolism of Tryptophan in *Trypanosoma brucei gambiense*: Cofactors, Inhibitors, and End-Products

*Trypanosoma brucei gambiense* has been previously demonstrated to convert $^{14}$C-tryptophan in vitro to two metabolites, indole lactic acid and tryptophol (indole ethanol)[1]. It was suggested that tryptophol produced by parasites located in the central nervous system could be responsible for the behavioral syndrome characteristic of African sleeping sickness. It is the purpose of this report to demonstrate that the metabolism of tryptophan to

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