

lated from cardiac blood at this time. Serum from Chinese hamsters infected 20 days previously was capable of forming, *in vitro*, circumoral precipitates on adult female worms isolated from the intestine of the golden hamster.

In a parallel study (6), it was found that animals which had been infected for 14 to 26 days exhibited severe generalized myositis. Although the latter condition doubtless constitutes a stress situation for the host, it does not appear to be reflected in changes in adrenal lipid within the time limit of this study. Hematoxylin- and eosin-stained sections of the adrenals exhibited no evidence of pathological changes during the course of the experiment and beyond (to 112 days of infection). Adrenal weights (6) bore no obvious relationship to the status of the infection. It is possible that stress brought about by the migratory phase of the infection would be mediated or reflected in other endocrine changes or that measures of adrenal response other than sudanophilic substance would resolve this apparent duality of physiological response. Data on the Chinese hamster response should constitute a useful adjunct for comparative study in connection with the studies of the singular adrenal responses of the golden hamster in stress situations.

ALBERT L. RITTERSON
SIDNEY I. MAUER

Departments of Bacteriology and
Anatomy, University of Rochester
School of Medicine and Dentistry,
Rochester, New York

References and Notes

1. B. C. Wexler, *Endocrinology* 49, 36 (1951).
2. C. Fortier *et al.*, *ibid.* 46, 21 (1950); M. Alpert, *ibid.* 46, 166 (1950).
3. J. H. Leatham and L. A. Stauber, *ibid.* 50, 311 (1952).
4. This investigation was supported, in part, by a research grant (E-1042) from the National Microbiological Institute of the National Institutes of Health, U.S. Public Health Service.
5. T. L. Chiffelle and F. A. Putt, *Stain Technol.* 26, 51 (1951).
6. A. L. Ritterson, *J. Parasitol.*, in press.

24 June 1957

Ultracentrifugal Determination of Molecular Weight of Myosin by the Archibald Procedure

Attempts to determine the molecular weight of myosin from ultracentrifugal sedimentation and diffusion data have not, so far, been successful. This failure is due not only to the fact that there has been no agreement about the values for the sedimentation and diffusion constants but is aggravated by the finding of Parrish and Mommaerts (1) that the sedimentation constant, after the usual corrections, still depends not only on the protein concentration but also on the

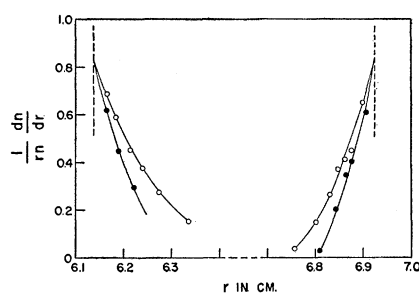


Fig. 1. Archibald plots for the ultracentrifugal sedimentation of myosin. Protein concentration, 0.5 percent; temperature, 5°C; rotor speed, 4196 rev/min; duration, 24 and 42 hours. The parameter $\frac{1}{rn} \times \frac{dn}{dr}$ is plotted against the distance in the cell, r ; the curves, extrapolated toward the meniscus and the bottom of the cell (vertical dotted lines), indicate the values for δ .

temperature and rotor speed. These kinetic anomalies, which we have confirmed in the present work, are entirely unexplained and seem to invalidate any efforts to determine the molecular weight in the traditional fashion.

It seemed advisable, therefore, to attempt a determination with methods which have an equilibrium rather than a kinetic basis. Since equilibrium centrifugation would be impracticable because of the long duration, we have followed the direction indicated by Archibald (2), in which the approach toward sedimentation-diffusion equilibrium is investigated. We have made the required measurements in a Spinco ultracentrifuge equipped with an optical system for the observation of Rayleigh interference fringes. These measurements, as explained by Archibald, are intended to estimate a parameter

$$\frac{1}{rn} \times \frac{dn}{dr} = \delta$$

in which n is the protein concentration and r is the distance from the center of rotation, from which the molecular weight is obtained by the relation

$$\delta = M(1 - V\rho)\omega^2/RT$$

In 13 separate experiments (for example, Fig. 1) on four different crystallized myosin preparations with moderate variations of concentration, rotor speed, duration, and temperature, the molecular weight was consistently found to be 382,000 with individual variations within $\pm 20,000$. In all instances, the same molecular weight was obtained from extrapolation toward the top and toward the bottom of the cell. In one more elaborate experiment, in which, at 4196 rev/min and at 5°C, exposures were taken every 12 hours for 3 days, the molecular weight was found to be $385,000 \pm 4000$ for the top of the cell and $375,000 \pm 4000$ for the bottom.

These values are in definite disagreement with all results published so far, but they seem to rest on a much better experimental and theoretical foundation (3). It may be pointed out that a figure of 380,000 to 400,000 corresponds to the presumable weight of the myosin moiety of the 504,000 g of actomyosin which, according to Nanninga and Mommaerts (4), reacts stoichiometrically with 1 mole of adenosine triphosphate. Hence, the myosin molecule has one active center for this interaction (5).

W. F. H. M. MOMMAERTS

BRIGITTE BLANKENHORN ALDRICH
Department of Medicine, University of
California, Los Angeles, and
Cardiovascular Research Laboratory,
Los Angeles, California

References and Notes

1. R. G. Parrish and W. F. H. M. Mommaerts, *J. Biol. Chem.* 209, 901 (1954).
2. W. J. Archibald, *J. Phys. and Colloid Chem.* 51, 1204 (1947).
3. A full description of the details and implications of these values is in preparation.
4. L. B. Nanninga and W. F. H. M. Mommaerts, *Proc. Natl. Acad. Sci. U.S.A.* 43, 540 (1957).
5. This investigation was supported by a grant from the Life Insurance Medical Research Fund.

3 September 1957

Effect of Kinetin and Gibberellic Acid on Excised Anthers of *Allium cepa*

The process of meiosis and the subsequent formation of haploid male gametes is one of the most important events in the life history of an angiosperm. Recently some attempts have been made to cultivate anthers on nutrient media and to follow the course of meiosis and pollen development in order to understand their physiology and biochemistry. Anther culture technique not only seeks to throw light on the mechanism of meiosis but can be of great help in solving problems of cytology and of growth and differentiation.

So far, the best development of pollen *in vitro* has been obtained with anthers of *Trillium erectum* with the help of 25 to 50 percent coconut milk (1, 2). Linkens (2) believes that the beneficial effect of coconut milk is due to its nucleic acid content. Anthers excised earlier than pachytene or even diplotene-diakinesis generally failed to undergo meiosis in culture media. It is believed that certain substances are transported to the anthers from the flower or from some other region of the plant at this stage and that these substances are responsible for the development of the anthers.

Recent studies have shown that two new growth-promoting substances, kinetin (3) and gibberellic acid (4, 5), have a very marked effect on the growth of