these were found, both floating near the surface in quiet water sinks some distance from the main breeding pond (located near Berkeley, California). Unfortunately, analogous data on *T. rivularis* are lacking, but it appears relevant to note certain differences in the typical breeding sites of the two species in question. *T. rivularis* ordinarily breeds in fairly rapid streams where a clean, rocky substrate prevails; *T. torosus*, on the other hand, prefers the quieter waters of ponds and eddy pools, situations which ordinarily afford little solid material as bases for spermatophore attachment. Thus, at least to the extent of the foregoing generalizations, it is possible that a stronger fixation of the stalk in *rivularis* would in some degree facilitate the mating of this species under the conditions of its breeding environs.

* Ritter (*Proc. Calif. Acad. Sci.*, ser. 3, Zool., **1**, 73–114, 1897) found certain masses of sperm from this species. Concerning them he states: "From my present knowledge these would be more properly called drops of semen than spermatophores." Ritter observed three such masses. One he found ". . . contained in and protruding from the cloaca of an amplectic female . . ." Another was found on the substratum of the aquarium in which was a captive male; a third was taken from the cloaca of a male. During the present work with *torosus* many such masses of sperm have been noted protruding from the cloaca of the female, and it is clear that these represent only the head of the spermatophore which the female ordinarily removes from the stalk after emission by the male.

† Dr. Twitty (oral communication) indicates that the spermatophore which he found deposited by *T. rivularis* in the laboratory was also firmly attached to the floor of the aquarium.

[1] Smith, R. E. (in press) (1941).

[2] Twitty, V. C., *Copeia, Ann Arbor*, **1935** (2), 73–78 (1935).

[3] Noble, G. K., *The Biology of the Amphibia*, McGraw-Hill (1931).

[4] Noble, G. K., and Brady, M. K., *Zoologica, New York*, **11** (8), 89–132 (1933).

[5] McCurdy, H. M.; *Amer. Jour. Anat., Philadelphia*, **47**, 367–399 (1931).

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*ON A CLUSTER OF NEBULAE IN HYDRA**

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Clusters of nebulae are the largest known aggregations of matter which possess definite individual characteristics. In preparation of a theoretical study of the large scale distribution of matter in the universe we propose to analyze some simple structural features of a number of clusters of nebulae. Most of the observational data used were obtained with the 18-inch Schmidt telescope on Palomar Mountain. Photographs taken with this instrument, because of their excellent and uniform definition over a field of about seventy square degrees are well suited for a survey of a number of the more near-by clusters of nebulae.

In the present report we shall be concerned with a cluster of nebulae in Hydra. The three nebulae NGC 3285, 3309 and 3312, the apparent magnitudes of which according to the Shapley-Ames catalog are $m = 13.2$, 12.7 and 13.1, respectively, lie near the line of sight of the center of the cluster

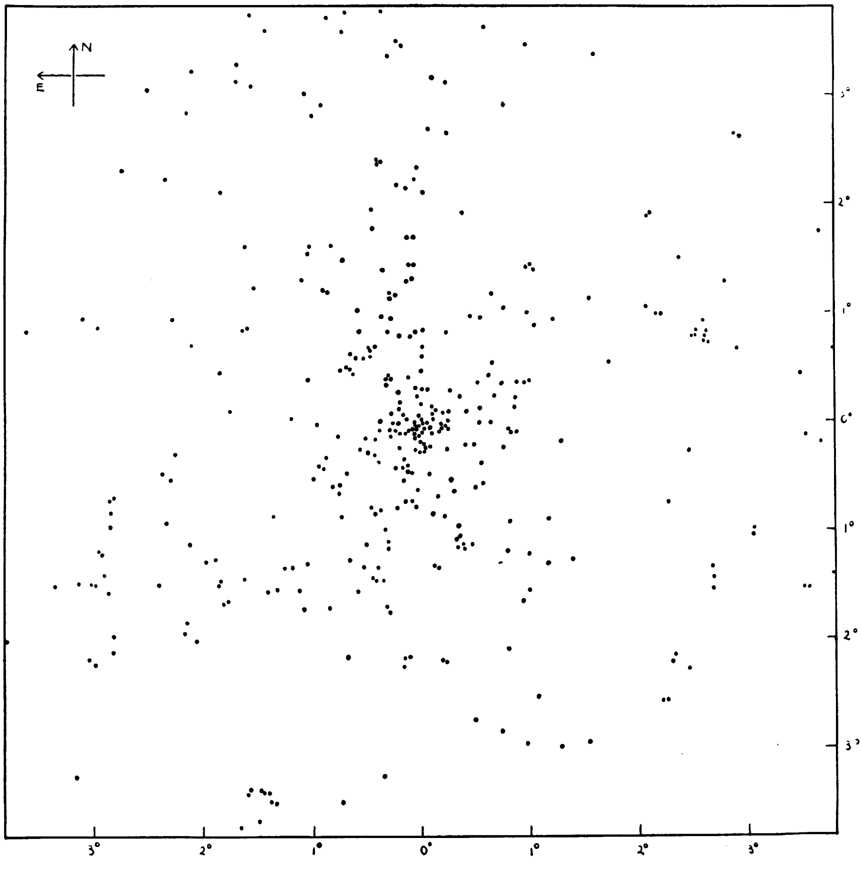

FIGURE 1
The hydra cluster of nebulae.

(at about R.A. $10^h\ 34^m$, Decl. $-27°\ 16'$, epoch 1950). The distribution of the nebulae brighter than about the apparent magnitude $m = 16$ is shown in figure 1.

In order to determine the radial distribution of the nebulae circles whose radii are equal to $n \times 10'$ were drawn around the center of the cluster and in each ring of 10′ width the total number of nebulae was counted in the four quadrants fixed by the north-south and the east-west directions. These counts are given in table 1. The number of nebulae in a ring of outer radius r is n_r.

TABLE 1

COUNTS OF NEBULAE IN RINGS WHOSE WIDTH IS 10 MINUTES OF ARC

NUMBER OF RING	QUADRANTS NE	SE	SW	NW	n_r	N_r
1	2	10	5	4	21	243.6
2	7	10	9	6	32	123.0
3	6	8	3	3	20	46.4
4	2	7	4	3	16	26.7
5	8	6	7	4	25	32.5
6	8	7	4	6	25	26.7
7	2	8	3	4	17	15.1
8	7	2	6	1	16	12.4
9	4	3	4	3	14	9.5
10	2	2	1	1	6	3.7
11	6	4	1	4	15	8.2
12	6	3	3	2	14	7.1
13	2	3	0	1	6	2.8
14	4	7	3	0	14	6.0
15	5	8	2	3	18	7.2
16	0	1	0	2	3	1.2
17	1	0	2	9	12	4.2
18	0	10	1	1	12	3.9
19	3	3	4	4	14	4.4
20	3	5	5	1	14	4.2
21	3	4	4	0	11	3.1
22	4	2	1	2	9	2.4
23	5	10	1	1	17	4.4
24	4	1	2	6	13	3.1
25	1	4	2	3	10	2.3
Total	95	128	77	74	374	

In all of the rings which together cover a circle of $25 \times 10' = 4° 10'$ of arc radius a total of 374 nebulae was counted. From table 1 it follows that the Hydra cluster, similar to the Coma cluster,[1] possesses great spherical symmetry and that it, therefore, seems to be a cluster which has very nearly reached a statistically stationary state. This conclusion is further borne out by the radial distribution of the nebulae. In column 7 the number N_r of nebulae per square degree in dependence of the distance r from the center is tabulated. In figure 2 the values of $\log_{10} N_r$ in dependence of r are plotted. The similarity of the radial distribution with that previously obtained for the Coma cluster[1] and with the distribution of matter to be expected for an Emden isothermal gravitational gas sphere is at once apparent. An intercomparison of different clusters and a discussion of the physical significance of the radial distribution curves will be given in another place after some additional similar clusters have been analyzed.

According to Hubble[2] the absolute magnitude of the fifth brightest nebula in a cluster is about $M_5 = -16.4$. The apparent magnitude of the fifth brightest nebula in the Hydra cluster is about $m_5 = 13.2$. Introducing the usual correction for local obscuration[2] at the galactic latitude $\beta = 27°$ of the cluster the apparent magnitude m_5' of the fifth brightest nebula reduced to the galactic pole becomes

$$m_5' = 13.2 + 0.25\ (1 - \text{cosec}\ \beta) = 12.9 \qquad (1)$$

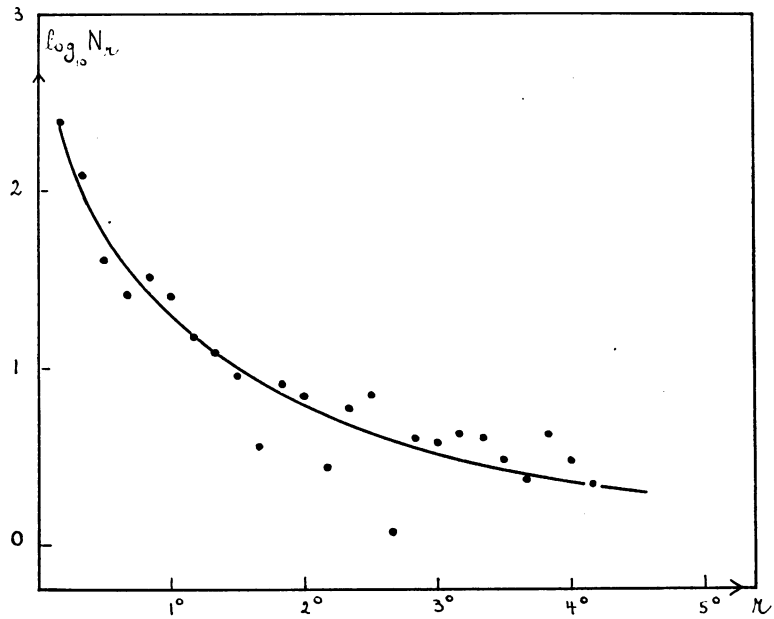

FIGURE 2

Radial distribution of nebulae in the hydra cluster.

and the distance p (in parsecs) of the Hydra cluster

$$\log_{10} p = 1 + (m_5' - M_5)/5 = 6.86 \qquad (2)$$

or

$$p = 7.3 \times 10^6 \text{ parsecs} = 24 \text{ million light years} \qquad (3)$$

The red shifts (apparent velocities v of recession) for nebulae in the Hydra cluster according to Hubble should be expected to be given by the relation

$$\log_{10} v = 0.2\, m_5' + 1.025 = 3.615 \tag{4}$$

or

$$v \cong 4100 km/\text{sec} \tag{5}$$

From the curve in figure 2 it follows that the Hydra cluster has a diameter of at least ten degrees and that the number N_β of nebulae per square degree in the surrounding field is of the order $N_\beta = 1.8$ ($\log_{10} N_\beta = 0.25$). Correcting for local obscuration and for zenith distance[3] the number of nebulae which should be expected if the Hydra cluster were located at the galactic pole and if it could be observed at the zenith distance zero, is

$$\log N = \log N_\beta - 0.15(1 - \operatorname{cosec} \beta) + \Delta Z \tag{6}$$

where according to Hubble[3] for a zenith distance of $Z = 63°$ we have $\Delta Z \cong 0.20$ and therefore

$$\log N = 0.615 \tag{7}$$

Since for nebular counts including all nebulae brighter than the limiting apparent magnitude m_L it is[3]

$$\log N = 0.6 m_L - 9.1$$

our counts of the Hydra cluster roughly include all nebulae whose magnitude corrected for local obscuration is of the order

$$m_L = 16.2 \tag{8}$$

In the previously given analysis[1] of the Coma cluster of nebulae which lies near the northern galactic pole and which consequently at Palomar can be photographed near the zenith, the corresponding limiting magnitude at which nebulae could safely be distinguished from stars on photographs obtained with the 18-inch Schmidt telescope was

$$m_L = 16.6 \tag{9}$$

The Hydra cluster cannot at Palomar be photographed at any zenith distance smaller than 63°, for which an extinction $\Delta m_p = 0.30$ in apparent photographic magnitude must be expected, a fact which satisfactorily accounts for the difference between the values (8) and (9).

The roughly 200 nebulae in the Hydra cluster counted in this investigation cover a range of only three magnitudes and therefore presumably represent less than half the population of this cluster whose further analysis with the help of larger wide angle telescopes such as the 48-inch Schmidt telescope now under construction should prove profitable.

* Fifty-six nebulae covering 0.43 square degrees near the center of the Hydra cluster are included as group 5 in Shapley's list of groups of nebulae (*Proc. Nat. Acad. Sci.*, **19**, 591 (1933).

[1] Zwicky, F., *Astrophys. Jour.*, **86**, 217 (1937).
[2] Hubble, E., *The Realm of Nebulae*, pages 71, 169, etc., Yale University Press (1936).
[3] Hubble, E., *Astrophys. Jour.*, **79**, 139 (1934).

ENZYMES IN ONTOGENESIS. XVI. ACTIVATION OF PROTYROSINASE BY SODIUM ALKYL SULFATES[*, 1]

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A number of compounds—sodium oleate, sodium taurocholate, Aerosol and Duponol—which activate protyrosinase contain both polar and non-polar groups (Bodine and Allen,[2] Bodine and Carlson[5]). Thus the property of amphipathy is common to these activators.† Since this property appears to be fundamental for an explanation of their behavior in solution, it ought to be useful to test the members of a homologous series in which the polar group is kept constant and the non-polar group is varied. This paper, therefore, describes the activation of protyrosinase by sodium alkyl sulfates with from eight to eighteen carbon atoms in the non-polar chain.‡

Diapause grasshopper (*Melanoplus differentialis*) eggs to the mass of 41.7 g. were triturated with mortar and pestle, diluted with 0.9 per cent NaCl, and centrifuged. The lipoidal layer was aspirated off and the supernatant decanted onto 0.2 g. of KH_2PO_4. After two hours at room temperature, this fluid was centrifuged. The resulting supernatant was made to 10 per cent with $(NH_4)_2SO_4$. An hour later the precipitate was centrifuged away and the supernatant made to 25 per cent $(NH_4)_2SO_4$. After a similar interval the precipitate was centrifuged down, mixed with 100 cc. of 0.9 per cent NaCl, and placed at 0°C. within a cellophane dialyzing tube. This tube floated in a liter of 0.9 per cent NaCl solution, which was thrice renewed within a four-day period. Next, the fluid from the tube was centrifuged and the clear, straw-colored supernatant was stored at 0°C. This extract, which was used throughout the course of the following experiments, contained a quantity of protyrosinase but no tyrosinase (Bodine and Allen[4]) and in itself showed no oxygen uptake.

The Warburg apparatus was used to determine the rate of oxygen uptake at 24.9°C. for the enzymic oxidation of tyramine to melanin. A