

additivity rule and the total heat of hydration of a hydrate. The results obtained by the authors do not substantiate such a relation. They, however, feel that there may be a relation between the deviation from additivity per molecule of water of crystallisation and the heat of hydration per mole.

The detailed discussion and results will soon be published elsewhere.

TABLE I

| Substance                                                                                              | $\chi_m$ | $\chi_{H_2O}$ |
|--------------------------------------------------------------------------------------------------------|----------|---------------|
| MgSO <sub>4</sub> ·7H <sub>2</sub> O ..                                                                | 135.50   | 11.96         |
| MgSO <sub>4</sub> ·5H <sub>2</sub> O ..                                                                | 108.70   | 11.39         |
| MgSO <sub>4</sub> ·H <sub>2</sub> O ..                                                                 | 60.78    | 9.02          |
| MgSO <sub>4</sub> ..                                                                                   | 51.76    | ..            |
| CaSO <sub>4</sub> ·2H <sub>2</sub> O ..                                                                | 73.02    | 12.27         |
| CaSO <sub>4</sub> ·½H <sub>2</sub> O ..                                                                | 52.97    | 9.00          |
| CaSO <sub>4</sub> ..                                                                                   | 48.47    | ..            |
| ZnSO <sub>4</sub> ·7H <sub>2</sub> O ..                                                                | 137.97   | 11.87         |
| ZnSO <sub>4</sub> ·H <sub>2</sub> O ..                                                                 | 63.34    | 8.46          |
| ZnSO <sub>4</sub> ..                                                                                   | 54.88    | ..            |
| CdCl <sub>2</sub> ·2H <sub>2</sub> O ..                                                                | 98.68    | 15.43         |
| CdCl <sub>2</sub> ..                                                                                   | 67.82    | ..            |
| SrCl <sub>2</sub> ·6H <sub>2</sub> O ..                                                                | 145.31   | 13.54         |
| SrCl <sub>2</sub> ..                                                                                   | 64.05    | ..            |
| Ba(ClO <sub>3</sub> ) <sub>2</sub> ·H <sub>2</sub> O ..                                                | 112.80   | 9.35          |
| Ba(ClO <sub>3</sub> ) <sub>2</sub> ..                                                                  | 103.45   | ..            |
| Zn <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> ·4H <sub>2</sub> O ..                                  | 165.00   | 10.37         |
| Zn <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> ..                                                     | 123.50   | ..            |
| Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O ..                                   | 225.70   | 14.52         |
| Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·2H <sub>2</sub> O ..                                    | 115.33   | 17.41         |
| Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·H <sub>2</sub> O ..                                     | 98.69    | 18.19         |
| Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ..                                                       | 80.50    | ..            |
| BaBr <sub>2</sub> ·2H <sub>2</sub> O ..                                                                | 128.28   | 10.64         |
| BaBr <sub>2</sub> ·H <sub>2</sub> O ..                                                                 | 116.60   | 9.61          |
| BaBr <sub>2</sub> ..                                                                                   | 106.99   | ..            |
| BaCl <sub>2</sub> ·2H <sub>2</sub> O ..                                                                | 100.16   | 12.79         |
| BaCl <sub>2</sub> ..                                                                                   | 74.57    | ..            |
| 3CdSO <sub>4</sub> ·8H <sub>2</sub> O ..                                                               | 292.40   | 14.65         |
| 3CdSO <sub>4</sub> ..                                                                                  | 175.16   | ..            |
| CdBr <sub>2</sub> ·4H <sub>2</sub> O ..                                                                | 148.73   | 15.20         |
| CdBr <sub>2</sub> ..                                                                                   | 87.92    | ..            |
| SrBr <sub>2</sub> ·6H <sub>2</sub> O ..                                                                | 164.26   | 10.64         |
| SrBr <sub>2</sub> ..                                                                                   | 100.40   | ..            |
| Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> ·5H <sub>2</sub> O ..                                    | 121.62   | 11.83         |
| Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> ..                                                       | 62.48    | ..            |
| K <sub>2</sub> SO <sub>4</sub> ·Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·24H <sub>2</sub> O .. | 502.55   | 12.97         |
| K <sub>2</sub> SO <sub>4</sub> ·Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ..                     | 191.05   | ..            |
| Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·18H <sub>2</sub> O ..                                 | 323.20   | 12.78         |
| Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ..                                                     | 93.05    | ..            |

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NOTE ON NYCTOTHERUS COCHLEARIS  
NOV. SP., FROM RANA CURTIPES

JERDON

THE ciliate described here was found in the rectum of the frog, *Rana curtipes* Jerdon, collected in the forest near Castlerock (Goa frontier). Associated with it, other ciliates, such as *Nyctotherus macropharyngeus*, *Balantidium helveticum* and *Opalina ranarum* were also found. Among these associated ciliates, the individuals of the new species, scanty in number, were conspicuous owing to their large body size and were visible to the naked eye, as small white vesicles. The body form and structure of the ciliate were noted in the living condition. Total preparations made by fixing with Bouin's fluid and staining with Ehrlich's haematoxylin, were used for microscopic study.

NYCTOTHERUS COCHLEARIS NOV. SP.

The body in general outline, is somewhat three-sided. The dorsal surface is deeply convex as found in other species, but the ventral exhibits a protrusion in the middle, by which the third side is formed. The anterior and posterior poles however, are narrow and rounded. The peristomeal region being straight, looks truncated. Thus the body form resembles more or less a spoon with the handle broken off at the truncated part of the ciliate. If the ventral protrusion of the body is taken as an umbo, the form may very well be compared to a shell of a bivalve. Hence the name *cochlearis*. The long and ellipsoidal nucleus, is one of the chief characteristic features of this new species, and is situated immediately over the cytopharynx, having a ratio of length to breadth 6 length. This long nucleus occupies the whole from the antero-dorsal to the antero-ventral surface of the body. The chromatin of the nucleus constitutes a number of compactly arranged and deeply stained round bodies. The micronucleus was not noted. The wide oesophagus leads into a narrow and curved cytopharynx, which ends in the middle of the posterior half of the body. The cilia, lining the oesophagus and the cytopharynx, are long and fine. Those on the body are short. A number of small and large vacuoles representing perhaps the food-vacuoles, were seen distributed all over the cytoplasm. The contractile vacuole is single, and lies at the posterior end.

Measurements in microns:—Body (length × with) range 407-437 × 315-335; Nucleus: (length × width) 235 × 40; Nuclear

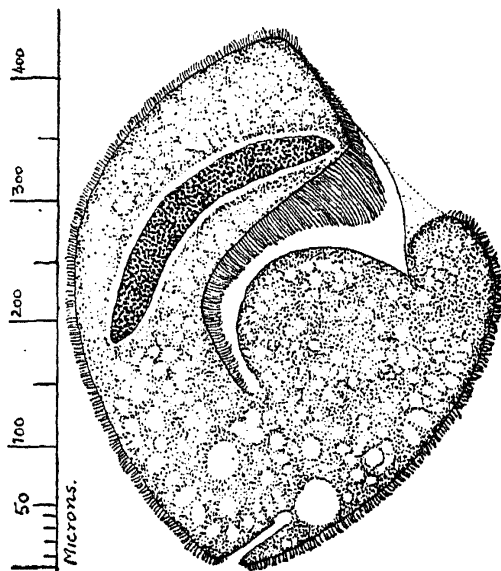


FIG. 1.

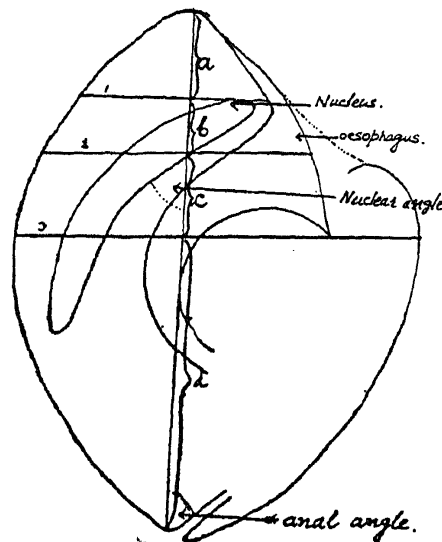


FIG. 2.

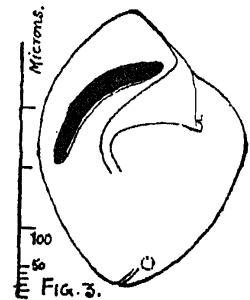


FIG. 3.

*Nyctotherus cochlearis* nov. sp.,  
from *Rana curtipipes*.

*N. cochlearis*, showing the proportions of the  
various lengths as represented by *a*, *b*, *c* and *d*.

*N. cochlearis* nov. sp., as seen  
under the low power of microscope.

[*a*—the shortest distance between the nucleus and the anterior extremity; *b*—the distance between the first line and the second passing through the middle of the oesophagus; *c*—the distance between the second line and the third passing through the terminal end of the oesophagus; *d*—the distance between the third line and the posterior extremity of the body.]

angle—48°; Anal angle—63°; Oesophagus 115;  
*a*=80; *b*=60; *c*=55; *d*=235.

In the recorded species of *Nyctotherus*, it can clearly be noticed that certain species have a definite tendency to attain exceptionally great lengths. Taking this character into consideration the species of *Nyctotherus* may be classified into three main groups, (1) giant, (2) intermediate and (3) small. Species like *N. magnus*, *N. vorax* and *N. gigantium*, etc., which range between 300-660 microns, may be included in the first group. Species as *N. ruber*, *N. macropharyngeus*, *N. cordiformis hylæ*, *N. faberi*, *N. magnus malabarica*, etc., which lie between the giant and the small forms and range from 150-300 microns, come under the second group. The small species such as *N. termitis*, *N. paludicolæ*, *N. vulgaris*, *N. ochoterenai*, *N. duboisii*, etc., ranging between 90-150 microns, may be placed in the last group.

Obviously, the species under discussion, having large measurements, belongs to the first group, and may be compared with its allied species *N. magnus*, *N. vorax* and *N. gigantium*. Bez-

zenberger's *N. magnus* from *R. hexadactyla* (Asia), having a maximum of 660×460 microns, stands as the largest among the giant forms. It has a cytopharynx which is recurved at its end, whereas in the present species, this kind of curvature is absent. The nucleus in our species, is definitely ellipsoidal, but in *N. magnus*, it is flat and irregular. In the other species, namely *N. vorax*, described by Carini, from a Brazilian Girinos, it is ovoidal. *N. cochlearis* differs also from *N. magnus* and *N. vorax*, in the body form, which is kidney-shaped in the former and globular in the latter.

It thus differs from all the giant forms including even *N. gigantium*, which has a bean-shaped nucleus and an ovoidal body. Compared with the species of the other two groups, intermediate and small, our species differs from them, not only in the body measurements but also in the shape and size of the nucleus. For these reasons *N. cochlearis* should be considered a new species.

In conclusion the writer thanks Prof. P. W. Gideon, for providing all facilities during the

## COMPARATIVE TABLE

|                           | <i>N. magnus</i> Bezz | <i>N. vorax</i> Carini | <i>N. cochlearis</i> nov. sp. |
|---------------------------|-----------------------|------------------------|-------------------------------|
| Body size ..              | 660 × 460 mcr.        | 300-450 × 200-250 mcr. | 400-430 × 315-335 mcr.        |
| Body shape ..             | Kidney-shaped         | Globular               | spoon-shaped                  |
| Nucleus size and shape .. | Flat and irregular    | 100 × 75 mcr., ovoidal | 235 × 40 ellipsoidal          |
| Cytopharynx ..            | recurved at end       | Funnel-like            | Funnel-like                   |
| Nuclear angle ..          | ..                    | 65°                    | 48°                           |
| Anal angle ..             | ..                    | ..                     | 63°                           |

course of this work, and Prof. Armando Manes, for suggesting the Latin name.

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1. Bezenberger, E., 1904. 2. Bhatia, B. L., 1936.  
3. Carini, A., 1921, 1929, 1939, 1940.

**CATALYSIS OF THE REACTION  
BETWEEN VANADATE AND AROMATIC  
AMINES CATALYSED BY THE  
OXALATE ION**

It has been previously reported that oxalate catalyses the reaction between dichromate and hydriodic acid<sup>1</sup> and dichromate and hydrobromic acid<sup>2</sup> and dichromate and aromatic amines.<sup>3</sup> Viswanatham and Gopalarao<sup>4</sup> have found that the oxalate ion has a profound accelerating action on the reaction between the vanadic

simultaneously and the time required for the appearance of blue violet colour was noted. In the absence of oxalate it took three minutes for the colour to appear, whereas when one ml. of N/10 oxalic acid was added (under otherwise identical conditions) the colour was immediately produced. The results with other amines experimented with are recorded in the following table.

All substances, (except benzidine), under test are dissolved in concentrated sulphuric acid and a known volume of the solution is treated with a known volume of decinormal vanadate solution and a requisite amount of water is added to bring up the volume of the reaction mixture to a total of 20 ml.

The author is grateful to Prof. G. Gopalarao for his valuable guidance in the work.

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TABLE I

| No. | Substance               | Quantity and concn. of test soln.       | Quantity of 0.1 N vanadate | Overall concn. of oxalate | Observation                                                                                                                             |                                                                                                                           |
|-----|-------------------------|-----------------------------------------|----------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                         |                            |                           | without oxalate                                                                                                                         | with oxalate                                                                                                              |
| 1   | Aniline                 | 2 ml. of 1% soln.                       | 2 ml.                      | $1 \times 10^{-2}$ N      | Light green colour in ten minutes.                                                                                                      | Slight green precipitate in 3 minutes.                                                                                    |
| 2   | Dimethyl-aniline        | 0.1 ml. of 2.5% soln.                   | 1 ml.                      | $1 \times 10^{-2}$ N      | Light orange colour in 30 minutes.                                                                                                      | Orange colour in 2½ minutes.                                                                                              |
| 3   | Paratoluidine           | 2 ml. of 0.1% soln.                     | 1 ml.                      | $1 \times 10^{-2}$ N      | No change even in ten minutes.                                                                                                          | Reddish brown colour in 5 minutes.                                                                                        |
| 4   | $\alpha$ naphthyl-amine | 1 ml. of 0.1% soln.                     | 1 ml.                      | $1 \times 10^{-2}$ N      | Light pink colour after 8 minutes.                                                                                                      | Pink colour in ½ minute turning reddish brown in 2 minutes.                                                               |
| 5   | Diphenyl-amine          | 0.1 ml. of 0.05% soln.                  | 0.5 ml.                    | $0.5 \times 10^{-2}$ N    | Blue-violet colour in 3 minutes.                                                                                                        | Blue violet colour immediately.                                                                                           |
| 6   | Diphenyl-benzidine      | 0.1 ml. of 0.05% soln.                  | 0.25 ml.                   | $0.5 \times 10^{-2}$ N    | Light blue violet colour in 1 minute turning more intense in 2 minutes.                                                                 | Intense blue-violet colour immediately.                                                                                   |
| 7   | Benzidine               | 5 ml. of 0.05% soln. in 10% acetic acid | 0.1 ml.                    | $0.5 \times 10^{-2}$ N    | Blue-violet colour immediately. A fine blue violet precipitate forms in 8 minutes which does not settle down even after thirty minutes. | A bulky violet precipitate in 1½ minutes which settles down almost immediately leaving the supernatant liquid colourless. |

acid and the hydriodic acid. This catalytic influence of the oxalate ion has been utilised by them for the iodimetric estimation of vanadate.<sup>5</sup>

It is now found that oxalate markedly accelerates the reactions of a number of aromatic amines with vanadate also. The phenomenon has been studied by noting the time required for the appearance of the characteristic colour on reaction with vanadate in the presence and absence of oxalate. For example, 0.5 ml. of a decinormal solution of sodium vanadate is taken in a clean beaker and water is added to make the volume 20 ml. and 0.1 ml. of a 0.05% solution of diphenylamine in concentrated sulphuric acid was added and the mixture stirred quickly. A stop-watch was started

1. C. R. Viswanatham and G. Gopalarao, *Curr. Sci.*, 1942, 11, 102. 2. —, *Ibid.*, 1943, 12, 186. 3. —, *Ibid.*, 1944, 13, 47. 4. —, *Ibid.*, 1943, 12, 229. 5. C. R. Viswanatham, J. V. S. Ramanjaneyulu and G. Gopalarao, *Proc. Nat. Inst. Sci. India*, 1943, 11, 333.

**EARTHWORMS AND INSECTS IN  
RELATION TO SOIL FERTILITY**

BESIDES producing general effects, viz., weathering of soil carried above the surface, the earthworms, and insects like termites and ants are known to bring about changes in the organic matter, mineral matter and structure of the