appears to be quite different from that of Cl_2O. A full report will be given elsewhere.

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May 5, 1934.

The Distances of the Closest Approach of Atoms of Rubidium, Caesium and Barium.

IT is known that rubidium and caesium react with water at the ordinary temperature and so also barium.* Therefore according to the author's rule† for the reactivity of metals with water which states that only those metals would react with water at the ordinary temperature which have the distances of the closest approach of their atoms above 3·00 Å, it seems that all these three metals would have values, which are not available, for the distances of the closest approach of their atoms above 3·00 Å.

This view, it may be noted, is confirmed by the calculation of the distances of the closest approach of atoms of these elements with the help of the author's formula‡ which has proved helpful in rendering some explanation of the formation of amalgams with mercury§ and has given atomic approach values agreeing closely with the experimental ones in nearly a dozen (eleven) elements.

The formula may be represented by

$$D = \frac{P}{V_i \times d^{K/V}}$$

where D is the distance of the closest approach of atoms of the elements in question, P its parachor; *d*, its atomic diameter; V_i, its ionisation potential and K, a constant having the value 1·58. The calculated atomic approach values which this formula has given is indicated below:

Element	Parachor	Atomic Diameter	Ionisation Potential	Valency	K/V	Closest approach of atoms	
						$D_{calc.}$	D_{found}
Rubidium	130‖	3·38¶	4·16††	1	1·58	4·56	—
Caesium	150‖	3·36¶	3·88††	1	1·58	5·7	—
Barium	160‖	4·20**	5·19††	2	0·79	6·57	—

It will be evident from the above table that in the case of all the three elements the calculated values for the distances of the closest approach of their atoms are above 3·00 Å which confirms their ability to react with water at the ordinary temperature. Further, it may be pointed out, since the formula has given values which agree well with experimental ones in a good number of cases and since the values obtained in the present cases are in conformity with the behaviour of these elements with respect to water, the calculated values may seem to represent the experimental ones for which no distinctive data appears to be available.

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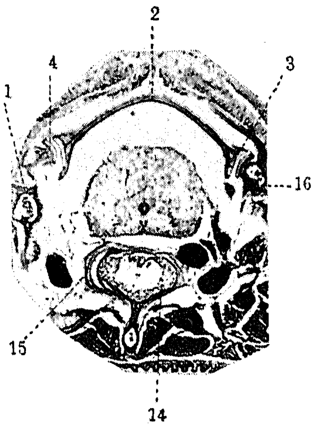
* Mathiessen, *Journ. Chem. Soc.*, **8**, 294, 1856; Davy, *Phil. Trans.*, **98**, 1, 333, 1808.
† Sen, *Nature*, **129**, 585, 1932.
‡ Sen, *Zeit. Anorg. Chem.*, **212**, 410, 1933.
§ Sen, *Chemical News*, **145**, 93, 1932.
‖ Sugden's *Parachor & Valency*, p. 181.
¶ Lorenz, *Zeit. Phys. Chem.*, **73**, 253, 1910.
** Bragg, *Phil. Mag.*, **6**, 40, 169, 1920.
†† Taylor, *A Treatise on Physical Chemistry*. (New Ed.), II, 1203.

On the Development of the dorsal-arcualia, zygosphene and zygantrum in the Vertebral Column of Snakes.

PREVIOUS investigators [1 and 3] on the development of the vertebral column of snakes,

[1] Brünauer, V. E., *Arb. Zool. Inst. Wien.*, **XVIII**, pp. 1-24, 1908-10.
[2] Mookerjee, H. K., *Phil. Trans. Roy. Soc.*, B. **218**, pp. 415-446, 1930.
[3] Schauinsland, H., *Handbuch der vergl. u. experim. Entwicklungslehre der Wirbeltiere. von Oskar Hertwig*, **3**, pp. 339-572, 1906.
(In this paper the list of all the previous papers could be found.)

have stated that the dorsal-arcualia are formed from the basidorsals of either side which eventually meet at the mid-dorsal line to complete the arch. Basidorsals start as membraneous structure, then become cartilaginous and ultimately become



×79 **Fig. I.**

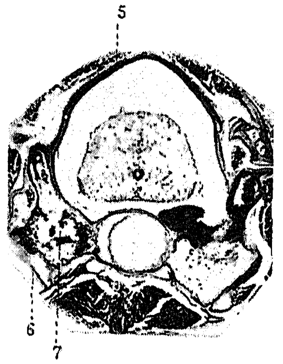
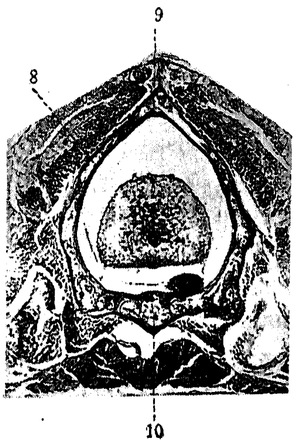


Fig. II. ×79



×75 **Fig. III.**

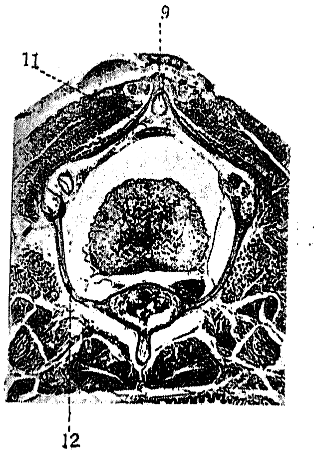


Fig. IV. ×75

Figs. I—IV. Serial transverse sections through different regions of a trunk vertebra of *Tropidonotus stolatus* at 12 cm.

1. Prezygapophysis ; 2. Part of the anterior connective tissue arch ; 3. Zygosphene ; 4. Zygantrum ; 5. Anterior connective tissue arch ; 6. Rib ; 7. Rib-bearing process ; 8. Basidorsal (with marrow cavity) ; 9. Supradorsal ; 10. Centrum ; 11. Trace of connective tissue arch ; 12. Posterior connective tissue arch; 13. Neural spine ; 14. Condyle of the vertebra ; 15. Socket of the vertebra ; 16. Postzygapophysis.

osseous ; but we have found a different story altogether. One of us[2] has shown that in the vertebral column of *Urodela*, corresponding to each vertebra basidorsals are situated at the middle region of the centrum and at the anterior and the posterior portions of it there are two connective tissue arches which without undergoing through the stage of chondrification become osseous. These anterior and posterior connective tissue arches are thinner in cross-section than the basidorsals.

Likewise in the vertebral column of snakes we get the anterior and posterior connective tissue arches which are also thinner than the basidorsals in cross-section, and the two limbs of each arch stand at right-angles to the centrum and are not round like the basidorsals, so that the latter bulge out more on the sides over the spinal cord than the connective tissue arches (Figs. II and IV). In *Urodela* there are two fibrous layers at the intervertebral regions which are connected with the prezygapophyses and the joints of the centrum at the bottom, to allow flexibility of the vertebral column.

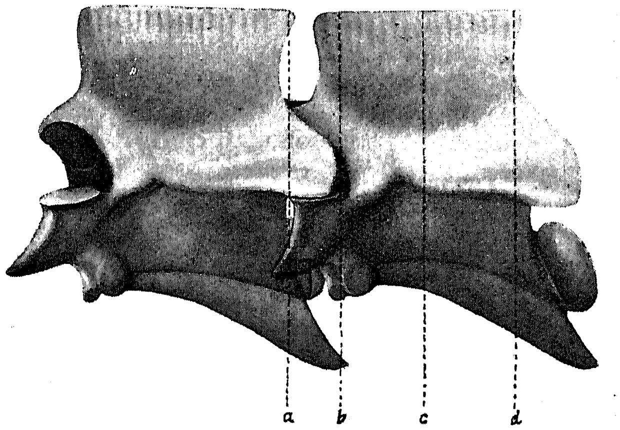
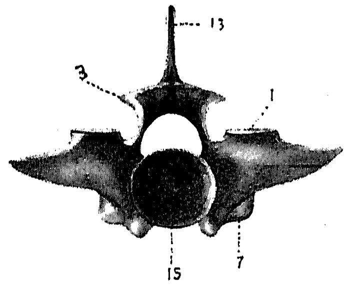


Fig. V. ×30

Side view of the two consecutive adult trunk vertebræ of *Tropidonotus stolatus*.

a, *b*, *c*, *d* are the planes through which Figs. I to IV have passed.



×20 **Fig. VI.**

Anterior view of an adult trunk vertebra of *Tropidonotus stolatus*.

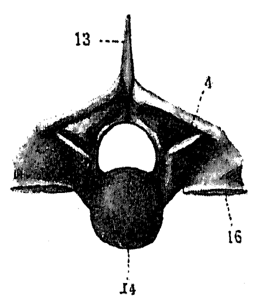


Fig. VII. ×20

Posterior view of an adult trunk vertebra of *Tropidonotus stolatus*.

In the vertebral column of snake the anterior connective tissue arch joins with the posterior connective tissue arch of the previous vertebra, forming two points of articulation and, therefore, in a transverse section passing through the intervertebral portion two additional dorsolateral articulations are found which are called zygosphene and zygantrum respectively, so that flexibility of the vertebral column of snake is also possible (Fig. I). The anterior and the posterior connective tissue arches together with the cartilaginous basidorsals become osseous like *Urodela*, and here also the connective tissue arches do not pass through the stage of chondrification. Another important point to be noted here is that the basidorsals of either side do not meet at the mid-dorsal line, but there is, as in *Urodela*, a third piece which should be called supradorsal (Fig. III). On the dorsolateral sides of each supradorsal in the region of the posterior end, there are two cartilaginous elements forming postzygapophyses at the intervertebral region like *Urodela*. So that a transverse section passing through the intervertebral portion shows supradorsal at the top, postzygapophyses with cut ends of prezygapophyses of the next vertebra at the dorsolateral corners and dorsal to them a portion of the anterior connective tissue arch with zygosphenes and also zygantra of the previous vertebra. For the sake of comparison we have given the side view of two consecutive adult trunk vertebræ and have marked there the planes through which the transverse sections would have passed (Fig. V). Figs. I to IV more or less correspond with the markings on the adult vertebræ. Figs. VI and VII are the anterior and posterior views of the adult trunk vertebra.

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Salt Tolerance of Plants as Induced by Pre-treatment of Seeds.

THE Homeopathic system of therapeutics rests on two main principles: (1) that 'like be cured by likes', and (2) that the remedies be administered usually in minute doses. The latter fact has a close parallel in the agricultural practice of fertilisers, where the dosages of the active ingredients added are extremely small as compared to those already present even in the poorer soils. This gave rise to the speculation, if the first principle of Homeopathy that 'like be cured by likes' could in anywise be utilised to serve some necessities of plant life.

As an initial experiment, it was proposed to try the possible application of this principle to the successful production of plants on salt lands. There was a considerable mortality of seedlings in saline soils. May be the plants otherwise healthy, developed certain fatal symptoms due to the presence of certain salt or salts in the soil. Were it so, it was held possible to save them by administering identical salts in minute doses. By the same law, if a plant already affected by the given symptoms be now sown in a saline soil, it is as probable that the salt in the soil will now prove a remedy; in other words, the salt tolerance capacity of the plant will greatly increase.

To test the correctness of these assumptions a series of laboratory experiments were conducted with wheat, *Dolichos lablab*, *Sorghum* and barley. In the first series, only the treatment of seeds was undertaken, while the treatment of seedlings and plants was left over for the second. As the saline soils in Sind contain chiefly the chloride and the sulphate of sodium, experiments were restricted in the present instance to the use of chloride of sodium only.

The method in the main was to first induce the supposed symptoms in healthy seeds, by treating them with NaCl solutions of different homeopathic concentrations (ranging from $0 \cdot 35$ to $\frac{0 \cdot 35}{10^{18}}$ %). The seeds so treated were sown in sand cultures at 25 per cent. moisture and containing the same salt NaCl in such percentages as are commonly found to be present in the salt lands in Sind. A study of the percentage germination in the different cases was made with the following results:—

Table showing average percentage germination of wheat seeds, treated with salt solutions of different concentrations and sown in sand cultures with and without salt.

In the sand culture	Seeds untreated	Seeds pre-treated with water only	Seeds pre-treated with salt solutions of various minute concentrations
No salt	100	100	100
NaCl 0·4%	65	80	100
,, 0·5%	40	57	70–90
,, 0·6%	15	20	20–75

In a pure sand culture (without any salt in it) the germination is cent. per cent