of vitamin-A was found to be the chief factor concerned in the causation of this condition. The 'stones' so produced consisted for the most part of magnesium-ammonium phosphate. Later, in an attempt to alter the composition of these stones by purely dietetic means, calcium was added to the diets deficient in vitamin-A. The stones resulting therefrom were composed either of calcium carbonate or calcium hydroxide. Metabolic studies, made by S. Ranganathan, in rats fed on such diets showed a great excretion of calcium through the urinary tract. With a view to diverting the course of the urinary calcium, phosphate was added to the lime-rich-vitamin-A-deficient diets. Not only was the urinary calcium reduced but there was also a marked lowering in the incidence of stone, in spite of the fact that the diets were still deficient in vitamin-A. Such a result was to be expected as the phosphate was able to remove one of the chief pre-disposing causes of stone-production, *viz.*, excess of calcium in the urine. Recently, Dr. Watchorn produced stones experimentally by means of magnesium-rich diets. The calcium-content of the stones resulting therefrom was almost identical with those produced in the Coonoor Laboratory on calcium-rich diets. But the stone-formation brought about by magnesium-rich diets is stated, by this observer, to be preventable by the addition of lime. This function of calcium, if corroborated, will form an interesting study as it would be an instance of the neutralization by one basic radical (Ca) of the stone-producing potency of another (Mg.).

R. MCCARRISON.

Nutrition Research Laboratories,
June 28, 1932.

Raman Effect in Liquid Carbon Dioxide.

THE Raman Effect in carbon dioxide gas has been studied by Dickinson, Dillon and Rasetti,* and recently by the author,† but there exist no data regarding this substance in the liquid state. A comparison of the Raman frequencies for various molecules in the liquid and gaseous states is of great importance and certain very interesting results have already been obtained. Amongst various other polar molecules the case of hydrogen halides studied in detail by Salant and Sandow‡ is notable as the sharp lines obtained in gases are replaced by broad bands in the liquids, the frequency shifts in the former being sensibly higher than in the latter. Non-polar molecules, however, stand on a different footing, and the case of carbon dioxide affords a beautiful example of the same. The results obtained by the author for the liquid at room temperature are compared below with the known frequencies of the gas :—

CO_2	Liquid	1281	1386	1412
	Gas	1285	1388	1408

The frequencies hardly undergo any change as we pass from the liquid to the gas and it may also be noted that in addition, the lines are equally sharp in both cases.

S. BHAGAVANTAM.

210, Bowbazaar Street,
Calcutta,
June 28, 1932.

Detection of Enzymes by "Spot Tests".

THE detection and characterization of enzymes in biological fluids offer considerable difficulties when they are coloured and are available in micro-quantities.

A drop of the substrate followed by a drop of the fluids is mixed on a strip of fat-free filter paper which is afterwards kept under a bell-jar over water for about 30 minutes. Necessary controls are run side by side. The spot is examined by suitable reagents. In some cases, as for example, oxidases and peroxidases, a visible change is immediately observed. With esterases and urease the change in hydrogen-ion concentration is observed by appropriate indicators. Where a reducing sugar is released on hydrolysis, as in the case of the common carbohydrases and glucosidases, Fehling's test is employed, a jet of steam being directed on to the spot to facilitate the reduction. A brick red

* Phys. Rev., **34**, 583, 1929.
† Ind. Jour. Phys., **6**, 319, 1931.
‡ Phys. Rev., **37**, 373, 1931.

or orange colour indicates the presence of the enzyme.

This method which is rapid and yet simple, has been successfully employed for a determination of the enzyme make-up of plant saps and insect body fluids.

M. SREENIVASAYA.
B. N. SASTRI.

Indian Institute of Science,
Department of Bio-chemistry,
Bangalore,
June 27, 1932.

Hyperfine Structure and Isotopes.

IN a number of cases hyperfine structure of spectral lines has been successfully explained by ascribing a spin moment to the nucleus. An examination of the lines, under suitable conditions with a low density, long column discharge, often reveals in addition to satellites that answer theoretical expectation, others which are comparatively faint. One has to take the utmost care to avoid mistaking spurious lines (ghosts) for actual satellites. Especially is this necessary when the satellites are faint compared with the known strong ones. In photographing the structure of a line an exposure enough for the strong satellites would not be adequate to bring out the fainter ones, and an exposure that is necessary to bring out the faint satellites would result in the strong satellites being over-exposed, the faint satellites then being lost in the dark background. A number of lines, especially those of Cd. I, have been examined in the Central College Physics Laboratory, with a long column discharge as source, a stream of cadmium vapour being sent through a mercury arc with tungsten anode and cooled mercury cathode, three Lummer plates made by Hilger, two of quartz and one of glass, being used as the analysing instruments. A careful examination has revealed the existence of satellites over and above those that can be accounted for on the hypothesis of a nuclear moment of $\frac{1}{2}h/2\pi$. For instance, in the case of the line 5086 ($5\,^3P_2 - 6\,^3S_1$) the following is the structure according to the present writer:

(a) +0.076 (2)
(b) +0.039 ($\frac{1}{2}$) (*new*)
(c) +0.011 (1?) (*not recorded by others*)
0.000 (10)
(d) −0.026 (4)

The satellites (a), (c) and (d) are the theoretically expected ones. The unaccounted satellite (b) in some plates is seen as a close double with a separation of 0.012 Å. This satellite has also been measured directly with a micrometer eye-piece.

The existence of these faint satellites suggests the possible presence of other isotopes, in relatively very small quantities as in the case of hydrogen and oxygen. The nuclear moment in the case of these isotopes may be different from that of the more abundant ones. In view of this possibility it appears to the author that a careful study of hyperfine structure with special reference to faint components is important.

B. VENKATESACHAR.

Physics Department,
Central College,
Bangalore.
July 25, 1932.

The Occipital Condyles and the Urostyle of the Engystomatidæ.

THE development of the Vertebral Column in Anura has been engaging our attention for some years and in the meantime, Dr. Mookerjee has published a paper on this very subject.* We have noticed in our preparations of the larvæ of *Microhyla*, *Cacopus* and *Kaloula* interesting features about the occipital zone and the urostyle, photomicrographs of which are reproduced here. Dr. Mookerjee also draws attention to the same characteristics in the case of *Rana* and *Bufo*. It is not quite certain whether the development of the vertebral body and neural arch in the *Engystomatidæ* is in conformity with what has been described by Dr. Mookerjee in *Rana*, *Bufo*, *Xenopus* and *Bombinator*, and we hope to be able to give a fuller and more detailed account of the

* Phil. Trans. Roy. Soc., Vol. 219, Series B, No. 465, 1931.