lock altered and improved. . . . The Canal is 34 feet wide at the bottom, and 94 feet at the surface of the water, with 15 feet of water throughout. . . ."

This fresh-water canal, which receives its water from the River Exe, teems at certain seasons of the year with an abundance of microscopic life. Besides fish of various species, *Paludina vivipara* and *Dreissena polymorpha*, two most interesting molluscs, are always present ; while *Cristatella mucedo* can be found in the higher parts of the canal ; *Plumatella repens* and *Cordylophora lacustris*, near the Topsham lock gate.

It is interesting to record that, up to the present, I have been unable to make one addition to the lists of fresh-water Crustacea recorded by Canon Norman and Thomas Scott in " The Crustacea of Devon and Cornwall ".

Owing to ill-health, I was unable to commence my fresh-water collecting until July 8 last, when no medusæ were to be found. My next collecting trip was made two weeks later, when I found the medusæ plentiful. Surface temperature 65° F. From that date until Oct. 14, medusæ were present in varying numbers. On Sept. 5 the surface temperature was 72° F. and the canal was found swarming with medusæ ; they were so abundant that one could see them with the naked eye. From that day until the fall of the year, the medusæ gradually decreased in numbers. On Oct. 1 not more than twenty medusæ were caught, surface temperature being 60° F., and on Oct. 14 they vanished for the year, surface temperature being 57° F. Although I have collected at various points along the whole canal, I have not found any medusæ above the double lock.

According to my observations there appear to have been at least four distinct broods of medusæ in the canal during the past summer on or about the following dates : July 20, Aug. 24, Sept. 5 and 19.

All the specimens taken were males, and a special search was made for its hydroid, known as *Microhydra*, without success, but it must be somewhere in the canal.

Both the hydroid and its medusa have been found in streams and ponds in the United States, but this is, so far as I know, the first time the medusa has been taken under natural conditions in Europe, where it has been found under artificial conditions ; usually in warm water tanks belonging to botanical gardens.

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Magnetic Moments of Atomic Nuclei.

THE hyperfine structures of atomic spectra are considered as due to the interaction of the nuclear spin with the electronic orbital and spin moments. A theoretical calculation of this interaction enables one to obtain information on the magnitude of the magnetic moments of the nuclei from the separation of the hyperfine structures. This can be done for the case of the alkali atoms. Hargreaves (*Proc. Roy. Soc.*, **124**, 568 ; 1929) has calculated the separation due to a nuclear moment $h/4\pi$ for the case of atoms with only one electron. In his calculations, however, the interaction between the electronic and nuclear spins, which is of the same order of magnitude as the other terms, has been neglected. I have therefore carried out the calculations with the following improvements. For the s-terms, which is the most important case, since they give the largest contribution to the separation, I have used Dirac's theory of the electron, since the simpler Pauli's theory gives a wrong result. For the p-terms I have used Pauli's method, taking into account the interaction of the nuclear and electronic spins. For the p-terms it is not necessary to evaluate numerically the eigenfunctions, since the constants

involved in the formulæ can be derived from empirical data on the separation of the electronic spin doublets. For the s-terms this is of course impossible, and I have calculated the eigenfunctions by the statistical method.

If the mechanical and the magnetic moments of the nucleus are respectively $kh/2\pi$ and μ_0, one finds that the s-terms split into two components with a separation

$$(1) \quad \cdot \quad \cdot \quad \Delta = \frac{2k+1}{k} \frac{8\pi}{3} \mu\mu_0 \psi^2(0),$$

where μ is Bohr's magneton and $\psi(0)$ is the value of the normalised eigenfunction at the origin. The separation of the p-terms is much smaller. Each line of the principal series of the alkalis splits, therefore, into two components with the separation Δ, each of them having a finer structure, which is not resolved, and gives rise to small differences in the observed separation for the different lines. The ratio of the intensities of the two components is $(k+1)/k$, the weaker component being shifted towards the violet. The ratio of the intensities is also 3, 2, 5/3 . . . 1 for $k = 1/2, 1, 3/2$ . . . . ∞.

For cæsium one finds, in wave numbers,

$$\Delta = 146 \frac{\mu_0}{\mu} \frac{2k+1}{k},$$

and for sodium

$$\Delta = 13\cdot4 \frac{\mu_0}{\mu} \frac{2k+1}{k}.$$

The observed values are, for cæsium (D. A. Jackson, *Proc. Roy. Soc.*, **121**, 432 ; 1928) $\Delta = 0\cdot3$, and for sodium (H. Schüler, *Naturwiss.*, **16**, 512 ; 1928) $\Delta = 0\cdot06$ wave numbers. From this, on the assumption of the values $1/2, 1, 3/2, \ldots, \infty$ for k, we obtain the following values for the ratio μ/μ_0 of the Bohr magneton to the magnetic moment of the nucleus :

$k =$	1/2	1	3/2	∞
Cæsium	1950	1460	1300	980
Sodium	890	670	600	450

From the observed ratio of the intensities in sodium one should expect a probable value for k of 1 or 1/2.

The uncertainty of the given values arises from the lack of precision of the empirical data and from the application of the statistical method to the evaluation of the eigenfunctions. This latter source of error might be evaluated to within 20 or 30 per cent.
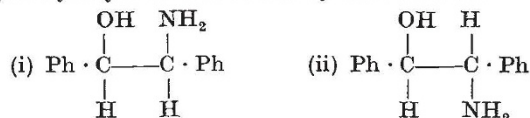
Further details will be published later.

E. FERMI.

Physical Institute of the University,
Rome, Dec. 4.

Optically Active Diphenylethylene Oxide.

WE have recently been able to obtain optically pure *d*- and *l*-*iso*hydrobenzoin, $Ph \cdot CH(OH) \cdot CH(OH) \cdot Ph$, by the action of nitrous acid on *d*- and *l*-*iso*diphenyl-hydroxyethylamine (*Jour. Chem. Soc.*, 1929, 2305). This result might be considered to point to configuration (ii), rather than (i), for *iso*diphenylhydroxy-ethylamine, except for the circumstance that *l*-*iso*-hydrobenzoin is furnished in this way by *d*-diphenyl-hydroxyethylamine as well as by the *l*-*iso*base :

(i)
$$\begin{array}{cc} OH & NH_2 \\ | & | \\ Ph \cdot C\text{---}\!\!\text{---}C \cdot Ph \\ | & | \\ H & H \end{array}$$

(ii)
$$\begin{array}{cc} OH & H \\ | & | \\ Ph \cdot C\text{---}\!\!\text{---}C \cdot Ph \\ | & | \\ H & NH_2 \end{array}$$

In order to settle the ambiguity, we have now prepared specimens of 2 : 3-diphenylethylene oxide from each of these bases, through the quaternary ammonium hydroxides, $Ph \cdot CH(OH) \cdot CH(NMe_3OH) \cdot Ph$. The