The reticulum of the cortical part of a follicle is of two kinds; consisting (1) of a reticulum, composed of coarse threads and of delicate cells, with long branching processes—these cells and threads are attached to the blood-vessels. In the meshes of this reticulum two different kinds of small bodies are seen nearly equal in size; the one (*a*) are very highly refractive and angular, and have short threads attached to their angles, the other (*b*) circular and much less refractive—*a* and *b* are acted upon differently by staining solutions. The highly refractive bodies form the nodal points (2) of a delicate reticulum which encloses the circular less highly refractive cells.

Traces of this fine reticulum can be seen in the medullary portion.

The granular cells mentioned in a preceding note ("Proc. Roy. Soc.," vol. 27, p. 369) take their origin in the connective tissue cells which constitute the network of the medullary portion. These granular cells not only help to form the concentric corpuscles, but are actively concerned in the formation of fibrous tissue; their fibrillated processes are sometimes found to be attached to newly formed connective tissue.

The granular cells are identical with some forms of giant cells—they are not the plasma cells of Waldeyer, although plasma cells are present in the thymus, as has been described by Ehrlich.

January 27, 1881.

THE PRESIDENT in the Chair.

The Presents received were laid on the table and thanks ordered for them.

The following Papers were read:—

I. "The Refraction Equivalents of Carbon, Hydrogen, Oxygen, and Nitrogen in Organic Compounds." By J. H. GLADSTONE, Ph.D., F.R.S. Received January 4, 1881.

Since the communication which I had the honour to read before this Society in 1869, "On the Refraction Equivalents of the Elements," very little has been done on the subject. My own contributions have been almost confined to two communications in the "Journal of the Chemical Society," in 1870; the one a lecture on the subject in general, the other a paper on the "Refraction Equiva-

lents of the Aromatic Hydrocarbons and their Derivatives;" together with a discourse at the Royal Institution in March, 1877, on "The Influence of Chemical Constitution on the Refraction of Light." In the meantime, observations on many substances have gradually accumulated in my note-book.

Of late, however, the importance of the subject in regard to theories of chemical structure has been recognised by Dr. Thorpe and other chemists in this country, and attention has been recalled to it in Germany by the papers of Brühl, who, following closely in the footsteps of Landolt, has endeavoured to explain the results in the language of modern organic chemistry.

At this juncture it may be of service to put on record my present views in regard to the refraction equivalents of the four principal constituents of organic bodies—carbon, hydrogen, oxygen, and nitrogen. The figures in this paper are always reckoned for the line A of the solar spectrum, the refraction equivalent being the specific refraction for A multiplied into the atomic weight, or $P\frac{\mu_A - 1}{d}$. In the present stage of the inquiry, though the results are deduced from many observations, I have not thought it desirable to go beyond the first place of decimals.

Carbon.—Carbon in its compounds has at least three equivalents of refraction, 5·0, 6·0 or 6·1, and about 8·8.

Whether its refraction should be one or other of these appears to depend on the way in which the atoms are combined.

When a single carbon atom has each of its four units of atomicity satisfied by some other element, it has a value not exceeding 5·0. There are some indications that the value may be slightly less than this.

When a carbon atom has one of its units of atomicity satisfied by another carbon atom and the remainder by some other element, it has the value of 5·0, the same as in diamond. This is also the case if two of its units of atomicity are satisfied by carbon atoms. The majority of organic compounds of course fall into this category.

When a carbon atom has three of its units of atomicity satisfied by other carbon atoms, its value is 6·0. The most striking instance is that of benzol, C_6H_6 (refraction equivalent 43·7), in which it is difficult to conceive that each carbon atom is not in the condition just described, and which, reckoning 1·3 for each hydrogen, gives a little less than 6·0 for each carbon. Styrol, C_8H_8 (57·8), gives a similar value.

There are other organic compounds in which only some of the atoms of carbon have the higher value. It has been especially the work of Brühl to point this out, and to show that where they occur (as in amylene or the allyl compounds) the carbon atom is in a condition similar to those in the phenyl nucleus, that condition in fact

which is generally represented in our graphic formulæ by two carbon atoms linked by double bonds.

The value assigned by Brühl in such cases is, however, 6·1. This somewhat higher figure is deduced from the aggregate value of the six carbon atoms in the nucleus of the aromatic series, which (except in benzol and its simpler substitution products) would appear to be nearer 37 than 36. If equally distributed over the six atoms this would give a value of at least 6·1 for each. The fact, however, is susceptible of another interpretation. It does not follow that in these more complicated bodies all the carbon atoms are exerting the same influence on the rays of light. The replacement of hydrogen by some monad radicle is an important change; and if that radicle be CH_3 it is evident that according to present views the carbon atom must have all four of its units of atomicity satisfied with carbon, and by analogy we should expect it to have its refraction increased. What that increased value may be, or which indeed of the two hypotheses is most in accordance with the facts, it seems to me that we have not yet sufficiently accurate data for determining.

When a carbon atom has all four of its units of atomicity satisfied by other carbon atoms, each of which has the higher value of 6·0 or 6·1, its equivalent of refraction is greatly raised. There are compounds in which the atoms of carbon actually outnumber the atoms of hydrogen or its substitute, such as naphthalene, $C_{10}H_8$ (ref. eq. 75·1), naphthol, $C_{10}H_8O$ (79·5), phenanthrene, $C_{14}H_{10}$ (108·3), and pyrene, $C_{16}H_{10}$ (126·1). That the refraction is greatly raised is evident from the fact that, if we were to reckon all the carbon atoms at 6·1, the refraction equivalent of the body would not be fully accounted for. It is evident that in pyrene only ten of the atoms of carbon can be in the same condition as they are in benzol or styrol, the other six must have all their units of atomicity satisfied by carbon alone. Now, if we allow 6·0 as the value of each of the ten carbons, and 1·3 for each of the ten hydrogens, we get 73·0, which taken from 126·1 leaves 53·1 for the remaining six atoms of carbon, or 8·8 for each. By a similar calculation the four extra atoms in phenanthrene are found to have the value of 8·8 each. Taking oxygen at 2·9, naphthol gives 9·1 for each. But the experimental data do not indicate a higher value than 8·4 for each of the extra carbon atoms in naphthalene. Provisionally I venture to assign 8·8 as the refraction equivalent of this highest carbon.

There are several other bodies, such as anthracene, anethol, furfurol, and hydride of cinnamyl, which from their abnormally high refraction appear to contain carbon in this last condition.

Hydrogen.—The general evidence with regard to hydrogen in organic compounds tends to show that it has only one refraction equivalent, that originally assigned to it by Landolt, 1·3.

Oxygen.—Brühl has been the first to point out that oxygen in organic

compounds has two values, and he comes to the conclusion that it has the value 3·35 where the oxygen is attached to a carbon atom by a double linking, but 2·76 in hydroxyl and where the oxygen is united to two other atoms.* This is deduced from experimental data: but there are other results which present difficulties. Thus the refraction of no substance is more certainly known than those of water, wood spirit, and alcohol. But the oxygen in H_2O (5·9) appears to have the higher number 3·3, notwithstanding its union to two atoms of hydrogen, while in CH_4O (13·1), C_2H_6O (20·8), as well as higher alcohols, and the diatomic ethene alcohol, $C_2H_4O_2$ (23·7), and the triatomic glycerol, $C_3H_8O_3$ (33·9), the oxygen is not 2·76, but 2·9 or 3·0, the numbers originally assigned to this element.

Nitrogen.—Nitrogen has two values, 4·1 and 5·1, or thereabouts.

The lower value, 4·1, is that originally deduced from cyanogen and metallic cyanides, and it seems to be generally confirmed by the observations on organic cyanides and nitriles. The higher value, 5·1, is deduced from all my observations on organic bases and amides, such as diethylamine (39·4), triethylamine (54·6), formamide (17·4), &c.

The determination of the value of nitrogen in nitro-substitution products presents some peculiar difficulties. The observations are not accordant. Even were the value of NO_2 obtained with certainty, it would not be easy to say how much should be attributed to the oxygen, especially when it is remembered that combination with oxygen alters very materially the refraction of the analogous elements, phosphorus and arsenic.

I hope shortly to submit to the public the data for these calculations, and in fact the whole of my recent observations on the refraction of organic compounds, together with a fuller discussion of the conclusions that may be drawn from them.

II. "On certain Definite Integrals." No. 8. By W. H. L. Russell, F.R.S. Received January 6, 1881.

I commence this paper with some general reflections on the theory of definite integrals. A definite integral may be written thus—

$$\int_\alpha^\beta dx f(a,\, b,\, c \ldots x) = \phi(a,\, b,\, c \ldots).$$

If we expand in terms of (a) and equate the coefficients of a^n we shall have

$$\int_\alpha^\beta dx f_1(n,\, b,\, c \ldots x) = \phi,\ (n,\, b,\, c \ldots).$$

* These have been calculated for line A.