by Prof. Svedberg is in agreement with the physico-chemical behaviour of insulin, and is of the same order as those of ovalbumin and Bence Jones protein.

According to the extensive determinations of Culhane, Marks, Scott, and Trevan,[2] one international unit of insulin is equivalent to 1/24 mgm. of crystalline insulin. The weight of dextrose which this amount of insulin will remove from the blood is provided by data from the standardisation of insulin by the fall of blood-sugar in the rabbit. Assuming that the blood of a rabbit averages 1/13 of the total weight, the mean of the blood-sugar decrease in 174 rabbits (starved for 24 hr.), following injection of one unit of insulin, amounts to 100 mgm. of dextrose. In order to obtain this figure (for which I am indebted to the Pharmacological Department of these laboratories) the maximum drop of blood-sugar level has been taken. The true figure is probably higher, for although the decreased blood-sugar level inhibits the physiological production of insulin, the resulting liver-glycogenolysis would tend to prevent the minimum level being attained. This glycogenolysis is subnormal in rabbits starved for 24 hours.

The only other figure available in the literature is that due to Bouckaert *et al*,[3] who found that in order to maintain a normal blood-sugar level in rabbits receiving parenterally 1·26 gm. of dextrose per kgm. per hour, the injection of 6·8 units of insulin per kgm. per hour was necessary. This indicates that one unit of insulin is equivalent to 185 mgm. of dextrose. I have taken a mean value of 150 mgm. as the dextrose equivalent of one international unit of insulin. Hence it follows that 1 gm. of insulin will remove 3600 gm. of dextrose, or, using the value of 35,100 for the molecular weight of insulin, one molecule will remove $\frac{3600 \times 35100}{180}$, or approximately seven hundred thousand molecules of dextrose. Thus, there is no possibility that the action of insulin in removing dextrose from the organism is a stoichiometrical one depending on the presence of a number of certain active groups in the insulin molecule.

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[1] Mar. 21, 1931, 438.
[2] *Biochem. J.*, **23**, 397; 1927
[3] *Arch. intern. physiol.*, **31**, 180; 1929.

Singlets of the Two-Electron Spectra B II, C III, N IV, and O V.

IN a recent analysis of C III the absolute term values of singlets and triplets could be independently determined from the *D* series in both systems. The difference $2\ ^1S_0 - 2\ ^3P_1$ was obtained as 52,380 ± 200 cm.$^{-1}$, which conclusively proves that λ2297, ν43524 cannot be the intercombination line, proposed by Bowen and Millikan.[1] Indeed, no such line has been found, in agreement with the improbability of a change of *s* in a spectrum with such small *j* separations.

The strong C III lines λ2297 and 1247 are identified with transitions to the normal $2s\ 2p\ ^1P_1$ from the two deep terms $^1D_2$ and $^1S_0$, arising from the configuration $2p\ 2p$. The terms thus obtained are checked by a large number of combinations with higher singlet levels.

In consequence of these identifications, the corresponding transitions in B II are taken as the lines λ3452 and 1842, previously thought[1] to be $2\ ^1S_0 - 2\ ^3P_1$ and $2\ ^1P_1 - 3\ ^1S_0$. Using the irregular doublet law, the combinations $2S - 2P$, $2P - 2D'$, and $2P - 2S'$ are then found for N IV and O V as shown in the accompanying tables. Three of the tabulated lines, B II $2P - 3D$, B II $2S - 2P$, and C III $2S - 2P$, were given their right assignment by Bowen and Millikan.[1] The terms are calculated from $2P - 3D$ on the assumption that

$$3D = Z^2 \times \frac{109{,}737{\cdot}1}{3^2},$$

which was very closely verified for C III by 5 members of the *D* series. The n^* for D' and S' are referred to the $2p$ state of C IV.

	$2P-3D$.	$2s\ 2p\ ^1P_1$.	$2S-2P$.	$2s\ 2s\ ^1S_0$.
B II	72,519 1378	121,291 1·90	73,396 1362	194,687 1·50
C III	174,131 574	283,868 1·86	102,351 977	386,219 1·60
N IV	298,525 335	493,613 1·89	130,687 765	624,300 1·68
O V	453,819 220	758,644 1·90	158,795 629	917,439 1·73

	$2P-2D'$.	$2p\ 2p\ ^1D_2$.	$2P-2S'$.	$2p\ 2p\ ^1S_0$.
B II	28,966 3452	92,325 1·77	54,264 1842	67,027 1·95
C III	43,524 2297	240,344 1·80	80,168 1247	203,700 1·92
N IV	58,189 1724	435,424 1·85	104,676 955	388,937 1·93
O V	72,924 1371	685,720 1·87	129,112 774	629,532 1·94

In the next table, $3P$ is determined from $2S - 3P$, and then, confirming the term system, strong lines are found in all the spectra at exactly the calculated position for $2D' - 3P$. In C III, $2S' - 3P$ was also found.

	$2S-3P$.	$2s\ 3p\ ^1P_1$.	$2D'-3P$ calc.	$2D'-3P$ obs.
B II	144,105 693	50,582 2·95	41,743	41,740 2395
C III	258,941 386	127,278 2·79	113,056	113,056 884
N IV	404,524 247	219,776 2·83	215,648	215,652 463
O V	580,828 172	336,611 2·86	349,149	349,113 286

These transitions, $2p\ 2p\ ^1D_2 - 2s\ 3p\ ^1P_1$ and $2p\ 2p\ ^1S_0 - 2s\ 3p\ ^1P_1$, are in accord with the Heisenberg selection rule[2] for two-electron jumps, $\Delta l_1 = \pm 1$, $\Delta l_2 = 0$ or ± 2. However, no trace has been found of the corresponding transition in the triplet system, $2p\ 2p\ ^3P - 2s\ 3p\ ^3P$, agreeing with another form, $\Delta l_1 = \pm 1$, $\Delta l_2 = \pm 2$, given as the Heisenberg rule by Grotrian[3] and Pauling and Goudsmit.[4] It seems as if the observed data in C III could be represented by the addition to the selection rule that the transitions $\Delta l_1 = \pm 1$, $\Delta l_2 = 0$ are allowed only if $\Delta L = \pm 1$.

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[1] I. S. Bowen and R. A. Millikan, *Phys. Rev.*, **26**, 310; 1925.
[2] W. Heisenberg, *Zeit. f. Phys.*, **32**, 841; 1925.
[3] W. Grotrian, "Graphische Darstellung der Spektren, etc.", I., p. 204; 1928.
[4] L. Pauling and S. Goudsmit, "The Structure of Line Spectra", p. 93; 1930.