figures," Dean Walters gives the five largest summer session enrolments as follows:

Columbia University	14,007
University of Chicago	6,338
University of Minnesota	6,641
University of Wisconsin	5,065
University of California	10,228

SPECIAL ARTICLES

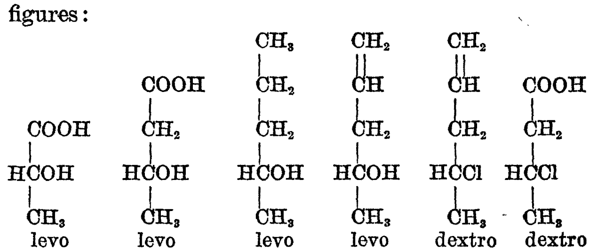
ON THE CONFIGURATIONAL RELATIONSHIP OF 3-CHLOROBUTYRIC AND 3-HYDROXYBUTYRIC ACIDS

IN recent years reports have appeared from several laboratories on the correlation of the configurations of hydroxy and of halogeno acids. The conclusions reached by different authors are quite contradictory. As an illustration two pairs of acids may be mentioned, namely, lactic and chloropropionic acids and malic and bromo- or chlorosuccinic acids. According to Clough and to Levene and Mikeska, dextro-lactic acid is correlated with dextro-chloropropionic acid, whereas Freudenberg correlates it with levo-chloropropionic acid. In the succinic acid series, Clough, Holmberg, Levene and Mikeska correlate dextromalic with dextro-chloro- or bromosuccinic acid, whereas Freudenberg and Kuhn correlate it with levobromosuccinic acid.

All the conclusions were reached by indirect methods and therefore need confirmation by more direct methods.

Levene and Mikeska have advanced sufficient evidence for the assumption that in simple aliphatic secondary alcohols the substitution of the hydroxyl by a halogen atom proceeds without Walden Inversion.

Admitting the correctness of this assumption, it is possible to correlate the configurations of the halogeno acids with carbinols, and these have already been correlated with lactic acid. The process by which this task can be accomplished is seen from the following figures:



levo levo levo levo dextro dextro

Thus, on the basis of this set of reactions, dextro-3-chlorobutyric acid is correlated with levo-3-hydroxybutyric acid and hence with levo-lactic acid.

The same conclusion had been reached previously by Levene and Mikeska on the basis of the behavior of 3-hydroxybutyric and 3-chlorobutyric acids on passing from the ionized to the unionized state. In the pair levo-3-hydroxybutyric and dextro-3-chlorobutyric acids the difference $[M]_{ion} - [M]_{acid}$ has a minus sign.

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THE SPECTRUM OF DOUBLY IONIZED POTASSIUM (K III)

A LARGE number of lines of the spark spectrum of potassium appearing in the electrodeless discharge have been classified by the author as belonging to the K II spectrum. (*Proc.*, Amsterdam, 1926; *Zeitschr. f. Phys.*, 38: 94, 1926; *Archives Neerlandaises,* 11: 70, 1928). The remaining lines lay in the region below λ 3500. It was supposed that these lines belong to the higher ionization stages K III and K IV. A list of these lines has been published by the author. Since we now know the spectra of Chlorine I (De Bruin and Kiess, SCIENCE, 68: 356, 1928) and Argon II (De Bruin, *Zeitschr. f. Phys.*, 48: 62, 1928; 51: 101, 1928) it is not difficult to locate the K III spectrum by aid of the irregular doublet law and to find the energy scheme. A doublet and quartet term system has been found. The key to the analysis is given by the deep $4s^4P_{321}$ with the term differences $\Delta\nu = 1265.9$ and 773.5. The low $4s^2P_{21}$ has the difference $\Delta\nu = 1506.9$. In the following table we give as an example the principal multiplets of the quartet sys-

		$4s^4P_{321} - 4p^4P_{321}$	
5	3513.88	28450.4	$4s^4P_1 - 4p^4P_2$
6	3468.32	28824.2	$4s^4P_2 - 4p^4P_3$
3	3448.01	28993.9	$4s^4P_1 - 4p^4P_1$
6	3420.82	29224.4	$4s^4P_2 - 4p^4P_2$
3	3358.43	29767.3	$4s^4P_2 - 4p^4P_1$
6	3322.40	30090.1	$4s^4P_3 - 4p^4P_3$
6	3278.79	30490.3	$4s^4P_3 - 4p^4P_2$
		$4s^4P_{321} - 4p^4D_{4321}$	
5	3056.84	32704.0	$4s^4P_1 - 4p^4D_2$
6	3052.07	32755.2	$4s^4P_2 - 4p^4D_3$
3	3023.43	33065.4	$4s^4P_1 - 4p^4D_1$
6	2992.42	33408.0	$4s^4P_3 - 4p^4D_4$
5	2986.20	33477.6	$4s^4P_2 - 4p^4D_2$
3	2954.33	33838.8	$4s^4P_2 - 4p^4D_1$
5	2938.45	34021.6	$4s^4P_3 - 4p^4D_3$
1	2877.31	34743.6	$4s^4P_3 - 4p^4D_2$
		$4s^4P_{321} - 4p^4S_2$	
5	2689.90	37165.0	$4s^4P_1 - 4p^4S_2$
5	2635.11	37937.8	$4s^4P_2 - 4p^4S_2$
6	2550.02	39203.0	$4s^4P_3 - 4p^4S_2$

tem. In successive columns appear the intensities, wave-lengths, wave-numbers and term combinations of the spectral lines.

The details of the investigation will appear soon.

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VARIATION IN SIZE OF PLASTIDS IN GENETIC STRAINS OF ZEA MAYS

IN connection with physiological studies of different genetic types of *Zea Mays,* a remarkable variation in the size of the chloroplastids has been observed. While in most strains the mature chloroplastids vary from 6 to 7 μ or from 7 to 8 μ in their longest dimension, one strain has been found which has green chloroplastids only 3 to 4 μ in diameter, and several strains have been studied which have chloroplastids ranging from 10 to 25 μ in their longest dimension. There seems to be no definite relationship between size of plastid and development of the chloroplastid pigments, as has been indicated in earlier studies concerned with the development of the chloroplastids of maize. Strains of albino maize occur which also have giant plastids, so that albinism can not be due to a failure of the plastids to reach a certain size regarded necessary for the development of the chloroplastid pigments. There is a direct correlation between number and size of plastids in individual cells of plants having giant chloroplastids. A mesophyll cell may have as few as two plastids when they are exceedingly large. In cells with few plastids, it may be seen that the plastids are generally paired with respect to size. The giant plastids are often in the process of division, so that it is not difficult to find plastids in all stages of division to form daughter plastids.

So far as studies have been made the variations in the size of plastids in maize appear to be inherited.

The variation in the size of chloroplastids briefly referred to above is interesting in view of the general uniformity in size of plastids which apparently prevails in all of the plant groups above the algae. In 215 species of plants belonging to many families of Bryophytes, Pteridophytes and Spermatophytes, Mobius[1] found 105 to have plastids 5 μ, 70 to have plastids ranging from 3 to 5 μ, 31 to have plastids ranging from 5 to 7 μ and 9 to have plastids from 7 to 10 μ in their longest dimensions. It is assumed that the general uniformity in the size of the chloroplastids in the plants above the algae is associated with the photosynthetic process. The average size of plastid, 5 μ in diameter, as determined from the species studied, is thought to have the surface-volume ratio best suited for the adsorption of the plastid pigments and most favorable for the annexing of the molecules of carbon dioxide to the chlorophyll. This uniformity in size of plastid is regarded to have much the same significance in the assimilation process as the uniformity in the pigment-content of the chloroplastids of different plants as established by Willstaetter and his coworkers from a study of some two hundred species of plants.

In the literature are described a few non-alga plants which do not have numerous small chloroplastids in their cells, among which may be mentioned the genus *Anthoceros* of the Bryophytes, several species of *Selaginella* and *Peperomia metallica* Lind. The cells of *Anthoceros* usually have two (often more in the epidermal cells) chloroplastids. The cells of *Selaginella Martensii* and *S. grandis* have only a single chloroplastid, while the assimilation cells of *S. Kraussiana* have from one to two chloroplastids. According to Schurhoff[2] the palisade cells of *Peperomia metallica* Lind. have four large chloroplastids, while the spongy parenchyma cells have a variable number of smaller chloroplastids. The plastids of the palisade cells reach a maximum size of 24 μ in their longest dimension. Alexandrov[3] has found the chloroplastids of the leaf cells of *Portulaca oleracea* to vary from 5 to 6.5 μ (3.5 μ in the epidermal cells) when they do not contain starch, but as starch is stored the plastids undergo enlargement so as to reach the unusual size of 23 μ in their longest dimension. A similar relation between size of plastid and amount of stored starch, in so far as the giant chloroplastids are concerned, appears not to exist in the genetic strains of maize studied, for the plastids are large even when the plants are protected from the light, and giant plastids occur in albino plants which are unable to synthesize carbohydrates.

The strains of maize which differ widely in size of plastids should serve as useful tools in the study of the plastid as a permanent cell organ and in the determination of the relation between plastid size and photosynthetic efficiency.

The study here briefly referred to was made in the Pflanzenphysiologisches Institut der Universität Berlin, as a fellow of the John Simon Guggenheim Memorial Foundation.

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1 1920, Mobius, M., "Ueber die Grösse der Chloroplasten," *Ber. d. Deutsch. Bot. Ges.,* 38: Heft 6.

2 1908, Schurhoff, P., "Ozellen und Lichtkondensoren bei einigen Peperomien," *Beihefte z. Bot. Centralbl.,* Bd. 23, Abt. I.

3 Alexandrov, W. G., *Ber. d. Deutsch. Bot. Ges.,* 43: 325–332, 1925.