and the inoculated plants failed to show the disease—thus confirming the results of Johnson, Allard and others that active growths are essential for revealing the signs of natural or experimental mosaic.

Nine supposedly normal tobacco plants[1] were inoculated by rubbing two or three of the leaves of each with freshly cut mosaic potato tubers from three separate sources. After eight to fifteen days all but two of these nine tobacco plants exhibited the signs of typical mosaic disease, which can still be observed at present—over six months after inoculation. At the same time twenty-two tobacco plants similarly treated with non-mosaic materials, which were not derived from potato plants, remained normal.

The mosaic potato tubers were allowed to sprout and when the leaves showed the picture of the typical disease, some were removed and were rubbed into two to three leaves of each of eight supposedly normal tomato plants. After eleven days, all these latter exhibited typical mosaic.

In addition eighteen tobacco seedlings, in series of three, were inoculated in the same manner with six tubers from separate potato plants which showed very slight, if any, manifestations of mosaic. It is important to note that after as long a period as twenty-seven to thirty-seven days, from one to three of each series, or a total of thirteen, exhibited the typical picture of this affection. With the exception of the long incubation period the disease in these plants showed no difference from that derived from markedly involved potatoes. This production of mosaic in tobacco from supposedly normal potatoes has recently been reported by Johnson.

The active agent, whether originally derived from potatoes, tomatoes or tobacco, reacted similarly in centrifugalization tests. In dilutions in distilled water of 1:1,000 which had a specific gravity of 1.004, or of 1:5,000 with a specific gravity of 1.001, the supernatant fluid, after two hours' centrifugalization at 3,000 r. p. m., could induce mosaic disease in normal tobacco plants as quickly, actively and constantly as the sediment.

We may conclude that the disease in potato plants can be transferred to tomatoes and tobacco from either the leaf or tuber. The signs in tomatoes and tobacco are identical, whether the inoculum is derived from plants which showed very marked mosaic or from those which exhibited signs so slight as to be dubious—a fact which should be borne in mind in the selection of mosaic-free plants, since potato plants are always propagated from tubers. Furthermore, the appearance of the experimental disease is identical with the natural affection in tomatoes and tobacco.

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[1] We have found that the species *Nicotiana affinis* ("jasmine tobacco"), a horticultural variety of *Nicotiana alata* ("winged tobacco"), which was employed in these experiments together with the Connecticut broadleaf variety of tobacco, is as susceptible to the disease as the latter, but once the affection is established the signs are much more prominent—thus making it an ideal plant for these transfer experiments.

NOTES ON THE TOPOGRAPHY OF THE GOLGI APPARATUS IN GLAND CELLS

DURING the last year and a half I have been engaged in an intensive study of the Golgi apparatus in secretory cells, following up the recent researches of Nassonov and my subsequent suggestions as to the homology of the acrosome with recognized secretory granules. Over twenty kinds of gland cells have thus far been examined, most of which can be roughly grouped, on the basis of the appearance of their secretory granules, in one or another of the three usual types—mucous, serous or lipoidal (so-called modified sebaceous glands).

Cells which may be roughly classified as of the mucous type have been studied in the salivary gland of Limax, in the red portion of the Harderian gland of the rabbit, in the intestinal epithelium of the salamander, in the submaxillary and tear glands of the cat, and in the Harderian gland of the duck. In the invertebrate, Limax, the Golgi apparatus is always represented by a large number of discrete Golgi bodies, which are scattered throughout the cell but always peripheral to the increasing accumulations of secretory granules. In late stages they accordingly occupy a position on the periphery of a large mass of secretory products, which practically fills the whole cell. In all the vertebrate gland cells, on the other hand, the Golgi apparatus begins as a simple network, which gradually enlarges as secretion progresses, but always retains the condition of a much reticulated network. This network tends to occupy a position peripheral to the mass of secretory granules, which, on completion, are gradually pushed away from the Golgi area by their successors, and thus accumulate in peripheral spaces of the cell often quite distant from the Golgi apparatus.

Cells, to be roughly classified as of the serous type, have been studied in the salivary gland of Limax, in the pancreas of the salamander, and in the parotid, submaxillary and pancreas of the cat. Again in the invertebrate, Limax, the apparatus consists of scattered Golgi bodies, which are present in very large numbers and, as the secretory cycle progresses, become scattered throughout the cell not only peripherally but especially among the secretory granules. In the vertebrates, there is the usual network, at first of simple type, later showing a progressive increase in complexity. But the most interesting feature in this type of cell is that the network gradually extends itself among the accumulating secretory granules, so that (with an exception of no importance here) it is brought into contact with many or all of the developing granules. The behavior of the Golgi apparatus thus enables one to distinguish a serous from a mucous cell by the mere difference in the relation set up between the granules and the Golgi network. It would appear that mucous granules are rapidly synthesized and separated from the Golgi area upon completion; while serous granules undergo a more gradual development (as shown indeed long ago by Altmann in the parotid, for example), the entire granular complement coming simultaneously to maturity at the end of a secretory cycle.

Cells producing lipoidal secretions have been studied in the oil glands of the chicken and duck, in the inguinal and Harderian (white portions) glands of the rabbit and in the Meibomian glands of the cat. The details differ somewhat in these different glands, but all agree in the fact that the Golgi apparatus, beginning as a more or less temporary polarized mass or network, is eventually disrupted and scattered as separate Golgi fragments or bodies throughout the cell. In some cases this is accompanied by a complete loss of cellular polarity, the nucleus moving into an indifferent central position. At the end of the secretory cycle, the entire cell is in all cases lost together with the secretory products. In the secretion thus produced, the Golgi pieces can in some cases (oil gland of duck and one part of the white portion of the rabbit's Harderian gland) actually be seen, still retaining, though outside of cellular boundaries, their identity and often their original intracellular shape—a striking demonstration of the real, material existence, often denied, of the Golgi apparatus.

In addition, the vas deferens and epididymis of the cat and rabbit and the liver of the cat have been examined, revealing networks of characteristic development and the usual polarity, but of types not readily classified in the groups indicated above.

These studies bring out in a surprising way the interdependence of the topography of the Golgi apparatus in a gland cell and the type of secretion being produced. In no case is this better demonstrated than in the submaxillary of the cat, where the demilune cells have been shown to possess a Golgi network obviously different from that in the mucous cells. This demonstrates beyond a doubt that these cells belong to different categories, and are in no way related to each other histologically—as many have supposed. Further, the topography of the Golgi apparatus in the demilunes indicates that they are cells of the serous type—a view reached on different grounds by other workers.

A detailed report of this work is now being prepared for publication.

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ABSTRACTS OF PAPERS PRESENTED AT THE WASHINGTON MEETING, APRIL 25 AND 26

Deviation from the regular as an art principle: DR. C. E. SEASHORE and MILTON METFESSEL, State University of Iowa. This paper contains an exhibit of various renditions of the song "Annie Laurie" as transcribed by a photographic method. Records of this type permit us to express quantitatively and in fine detail the expression of artistic emotion in singing in terms of variations in pitch, time and intensity. Volume, timbre and other complex factors may also be determined by an extension of the same principle of measurement. One complete score of "Annie Laurie" as sung by Wells is exhibited with illustrative sections from twelve other singers in support of general principles discovered.

The rôle of mental measurement in the discovery and motivation of the gifted student: DR. CARL E. SEASHORE, University of Iowa. The paper discusses the scope and significance of measurements of first, magnitude; second, fixity; and third, intricacy in organization of varieties of individual differences; and illustrates this by new methods of procedure in the progressive selection and elimination of students at the college level. New aspects of three procedures are discussed, namely: first, diagnostic examinations in determining fitness for college work near the end of the high school course; second, placement examinations measuring, (a) training and (b) aptitude for each of the subjects open to freshmen; and third, a scientific approach to the building of the achievement examinations.

Biology and the principles of physics: PROFESSOR WOLFGANG KOHLER, University of Berlin. Wherever we find order in the processes of nature, we are inclined to assume that special arrangements bring about this order, compelling the forces of nature to work along certain lines with exclusion of others. Greek astronomy is an instance of this tendency. But in our times again, biology and psychology are used to explain the striking order in organic processes by the assumption of an extraordinary amount of special arrangements or machine-structures that are said to produce the observed order of functions. We have learned to regard our sun-system as a whole maintaining itself and its order by free intercourse of natural forces. But we generally forget