results and have established a new high-temperature limit for active protoplasm in higher plants, also a new endurance record. The principal facts are as follows:

1. Joints of *Opuntia* were observed to maintain a fair rate of enlargement when at a temperature of 56.5° C., the air surrounding them being at 58° C. (137° F.).

2. Growth of young joints of *Opuntia* the temperature of which rose to 62° C. (144° F.) in an air temperature of 63° C. (146° F.) stopped and some shrinkage ensued, but growth or enlargement was resumed when their temperature fell to 50° C.

3. The young joints which were subjected to these temperatures were about 15 to 20 mm. in width and 25 mm. in length, and after being held at or near the record temperatures for an hour or more, which was repeated in one case, carried forward normal development, reaching maturity at a normal average of 100 mm. in width and 130 mm. in length.

4. It is to be noted that data from observations in which temperatures were taken from the air or from water in which the roots or aerial parts of plants were immersed, have but little value in any estimation of the working temperature of active protoplasm by reason of the abnormal hydration and transpiration conditions introduced. These conditions as well as the proportions and state of the main colloidal components must determine the temperature effects.

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A CALCULATOR FOR CONVERTING GAS CHAIN VOLTAGE INTO EQUIVALENT C_{H+} OR p_H VALUES

IN the determination of hydrogen-ion concentrations by electrometric methods employing the hydrogen electrode, the step of finding the C_{H+} or p_H value from the measured voltage, with the aid of the working formula, though not difficult, is time-consuming. The extensive tables of Schmidt and Hoagland[1] simplify the process considerably. They give, in parallel columns, the voltages measured between a hydrogen electrode and a tenth-normal, and between the hydrogen electrode and a normal calomel electrode, respectively. With these are given the corresponding p_H, C_{H+} and C_{OH-} values, respectively. If the calomel electrode — because of difference in concentration of its potassium chloride solution, for example — has a different value, against the normal hydrogen electrode, from those assumed in these tables, a simple computation is necessary.

By definition, $p_H = -\log C_{H+}$, and the working equation, derived from Nernst's equation, shows these quantities to be linearly proportional to the measured voltage. If in all cases we had to deal with a single unvarying reference potential, the simplest procedure would be to draw the straight line, expressing the relationship, on a chart of rectangular coordinates, and to use this as the conversion chart. This plan, however, is not practicable in its application to all cases, because of the preferences of different workers for different types of reference electrodes.[2] Some prefer the tenth-normal, others the normal, still others the saturated type. In any given type, there are likely to be minor differences between different electrodes. To be able to apply the graphic chart to all cases requires that the straight line be capable of being shifted, parallel to itself at any one temperature, to correspond to the fundamental potential of the reference electrode being used.

Since it is a straight line relationship with which we are dealing, and since the variations mentioned do not change the slope of line, an instrument of the slide-rule pattern is not only feasible, but highly practicable. For convenience, the circular type was chosen. The C_{H+} and p_H scales are engraved on a disk 125 mm. in diameter. From the relation between these two quantities, their main divisions coincide; *e.g.*, for $p_H = 8$, $C_{H+} = 10^{-8}$.

[1] Univ. of Cal. Pub. in Physiol., 5, 23, 1919.

[2] A graphic conversion chart of the kind mentioned is reproduced in "Electrometric Methods and Apparatus for Determining Hydrogen-ion Concentrations," L. & N. Co., 1920, p. 25.

Of these main divisions there are 14, covering the entire range from normal acid to normal alkaline reaction. The 125 mm. disk is mounted by means of a central pivot on a second disk, having its scale of voltage around the circumference of the first. The range of the latter extends from 0.24 to 1.17 volts. Concentric with the disks is a movable arm of transparent celluloid, with a radial hair-line scribed upon it, to facilitate making readings. The points on the voltage scale corresponding to the potentials of tenth-normal, normal and saturated KCl calomel cells are marked, as a matter of convenience. The temperature for which the slide-rule gives correct readings is 25° C.

To use the instrument, the zero mark of the circular scale is set on the voltage corresponding to the reference electrode being used. The hair-line is set to indicate the measured voltage, and the corresponding p_H and C_{H+} readings appear under the hair-line on the inner disk. Settings are possible to an accuracy of ± 0.5 millivolt.

The slide-rule can be used equally well when the reference electrode, instead of being the usual calomel half-cell, is a hydrogen electrode of known potential relative to the standard solution in which it is immersed. Whatever the nature of the fixed electrode, the change in potential difference at the terminals of the gas chain is 59.1 millivolts for each decimal change in the concentration. The graduation of the inner disk is based upon this assumption, which makes it applicable to any case.

Because of the fact that so few data are available on the variations of gas chain electromotive forces with temperature, it seems advisable, pending an accumulation of reliable information on this point, to make measurements at a temperature of 25° whenever this is possible.

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MATHEMATICS IN SPANISH-SPEAKING COUNTRIES

The Spanish-speaking countries publish only one journal devoted to advanced mathematics, which is now called *Revista Matemática Hispano-Americana* and is published at Madrid, Spain, under editorship of J. Rey Pastor. In view of the fact that the professors of mathematics in so many countries can obtain no other advanced mathematical journal in their own language one might suppose that this periodical would not suffer for want of suitable manuscripts or sufficient financial support.

Such a supposition is, however, not in accord with the facts, judging from a call issued recently by its editor. In this call it is stated that there is now an almost complete lack of Spanish mathematical production and that it has been necessary therefore to publish an excessive number of articles by the same authors. It is also stated that nearly all Spanish professional mathematicians occupy the position of spectators and critics, and thus place the burden of doing the work connected with the periodical on the shoulders of one or two men.

In view of the fact that in the English-speaking countries of America the mathematical journals are now overcrowded by suitable manuscripts offered for publication it is interesting to note that just the opposite is true in the Spanish-speaking countries of this continent. As was noted in Science, N. S., volume 34, page 372, the Spanish-speaking people organized a mathematical society in 1911. This society has been fairly successful in awakening among them an interest in the newer fields of mathematics, but, judging from the call noted above, which was directed to the members of this society, it seems that this interest is still far from being general and effective.

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THE EARLIEST BEES, WASPS AND ANTS

It seems desirable to correct some statements appearing in text-books of geology, which lead students to imagine that we are acquainted with bees, wasps and ants from Mesozoic strata. Thus, Professor J. W. Miller,