

population should show the character of length 4. The column of volumes, however, shows that there is only one out of the 64 with a volume 4<sup>3</sup>. All others with factors for length four have larger volumes, because their factors for breadth and thickness are greater than four. Here again the law of the golden mean is followed as all combinations bearing unequal size factors are forced to build cubes by the modifying factor shape. Evidently all matings resulting in equal volumes will make equal cubes and therefore show equal characters of length, breadth and thickness, though not necessarily possessing equal size factors nor even the factor for the size which they exhibit. If we group the results by volume and length of side, we have:

Volume	Instances	Side of Cube
64	1	$\sqrt[3]{64} = 4.$
96	6	$\sqrt[3]{96} = 4.57 -.$
144	15	$\sqrt[3]{144} = 5.25 +.$
216	20	$\sqrt[3]{216} = 6.$
324	15	$\sqrt[3]{324} = 6.87 +.$
486	6	$\sqrt[3]{486} = 7.86 -.$
729	1	$\sqrt[3]{729} = 9.$

That means that the chance for a parental size (whether line or surface or volume) to reappear is only 1:64 instead of 1:4. Moreover it is clear that each of the 8 possible combinations given on page 7, when mating with its like, will breed true to all three size characters, and continue to breed true thereafter if selfed. That means that these matings will form constant races, viz.:

Mating	Resultant	Volume	Size
1 × 1	4 × 4 × 4	64	4
2 × 2	4 × 4 × 9	144	5.25
3 × 3	4 × 9 × 4	144	5.25
4 × 4	9 × 4 × 4	144	5.25
5 × 5	9 × 9 × 4	324	6.87
6 × 6	9 × 4 × 9	324	6.87
7 × 7	4 × 9 × 9	324	6.87
8 × 8	9 × 9 × 9	729	9

Besides the parent-like strains then, we shall seemingly have two other races, one of volume 144, size 5.25, the other of volume 324, size 6.87, which will continue to breed true if

selfed. Each of these strains consists of three gametically different, though visibly indistinguishable lines, which when crossed will give an F<sub>1</sub> equal to both parents, but segregating to some extent in the F<sub>2</sub>. The finding in the F<sub>2</sub> or later generations of lines which breed true to size characters is thus not proof of the presence of multiple size factors in the original parents, etc.

In the bulletin in preparation I intend to discuss the bearing of the law of the golden mean upon the interpretation of inheritance of shape and number, mutants, latent factors, inhibitory factors, coupling and repulsion, factors other than those of size, shape, and number, and other points as they may come up, but for the sake of science I invite investigation into these relationships on the basis I here offer, even before I am able to publish the bulletin, which may not appear for several months.

B. H. A. GROTH

#### "THE LOWEST TEMPERATURE OBTAINABLE WITH ICE AND SALT"

FAHRENHEIT placed the 0° mark on his arbitrary thermometer scale at "the lowest temperature obtainable with ice and salt" or 32° below the freezing point of water, believing that water did not have a constant freezing point because of the undercooling which precedes solidification.<sup>1</sup>

While discussing freezing mixtures with a friend recently I stated that a temperature of -19° C. could be *easily* obtained and maintained for some hours with an ice and salt mixture. My friend questioned the accuracy of the thermometer inasmuch as -19° C. is below 0° F. (0° F. = -17.78° C.). I have, therefore made a careful test to ascertain whether an ice and salt mixture may not show a lower temperature than 0° F.

About a gallon of finely chopped, hard, ice was mixed with a quart or more of coarse salt in a water-tight wooden box, the wooden box being used because of the insulation which it

<sup>1</sup> See Encyclopedia Britannica, 11 ed., "Heat," article 2.

afforded. The temperature was then observed with five thermometers:

Thermometers 1 and 2 were "nitrogen filled" thermometers graduated in Centigrade degrees ranging from  $-29^{\circ}$  to  $+360^{\circ}$  in  $1^{\circ}$  intervals. These are the ordinary high-grade laboratory thermometers.

Thermometer 3 was a small "Anchutzh normal" thermometer reading from  $-25^{\circ}$  to  $+50^{\circ}$  in  $1/5^{\circ}$  intervals. This is one of the most accurate types of chemical thermometers obtainable.

Thermometer 4 was a large thermometer of the same type as No. 3, but reading from  $-19^{\circ}$  to  $+360^{\circ}$  in  $1/5^{\circ}$  intervals.

Thermometer 5 was an ordinary Six's maximum and minimum thermometer graduated in degrees Fahrenheit, each graduation representing  $2^{\circ}$ .

Thermometer 6 was a standard Weather Bureau type minimum thermometer reading from  $-35^{\circ}$  to  $+115^{\circ}$  F. in  $1^{\circ}$  ranges. This is probably one of the most accurate types of Fahrenheit thermometers obtainable.

Thermometer No. 6 was spirit filled. No. 5 contained a combination of spirit and mercury and all of the others were mercury filled.

Thermometers 1, 2 and 3 gave the same temperature for the ice and salt mixture, *i. e.*,  $-21^{\circ}$  C. which is the equivalent of  $5.8^{\circ}$  below zero Fahrenheit. Thermometer 4 was graduated only to  $-19^{\circ}$  C. and the mercury was some distance below the bottom of the scale. By interpolation a reading of  $-20^{\circ}$  to  $-21^{\circ}$  C. was made. Thermometer 5 gave a minimum of  $-4^{\circ}$  F. while the Weather Bureau thermometer (No. 6) gave a reading of  $-5^{\circ}$  F.

Previous to this experiment I had filled a wooden box holding perhaps 30 pounds of ice with a freezing mixture in the evening and placed it in an empty ice box to conserve ice. In the morning I noted a temperature of  $-19^{\circ}$  C. ( $-2.2^{\circ}$  F.).

From these experiments I am convinced that  $0^{\circ}$  F. is not "the lowest temperature obtainable with ice and salt." Just what the "lowest temperature" is I am unable to state, having failed to secure a greater lowering than  $-21^{\circ}$  C. Theoretically the lowest tem-

perature should be the cryohydric point ( $-22^{\circ}$  to  $-23^{\circ}$  C.) where the cryohydrate, ice and salt containing 23.6 per cent. of NaCl, separates.

ROSS AIKEN GORTNER

#### THE AMERICAN PETROLEUM SOCIETY

THE American Petroleum Society was organized September 10 at the U. S. Bureau of Mines, Pittsburgh, Pa. This organization is the result of an effort of the bureau for the past seven years to bring together the men interested in the petroleum industry.

Invitations were sent out in July to the secretaries of twenty-four of the great national societies of the United States, inviting them to be present and to cooperate in this organization. Eighteen of these societies responded at a meeting on August 1 at the Bureau of Mines. A similar invitation was sent out in August to eight additional societies, making a total of thirty-two societies that were invited to attend the September conference. A large number of these were represented at the meeting on September 10, when the final organization was completed.

This society will concern itself with the study of all phases of natural gases and petroleum, including the origin, statistics, conservation, drilling methods, production, transportation, storage, refining and specifications for refined products.

When it is considered that each year, within the United States alone, there are produced crude petroleum and natural gases having a value in excess of \$200,000,000, and that no society has ever been organized in America for their comprehensive study it is reasonable to suppose that the future of this society is assured. There is to-day a tremendous waste of natural gases which, by proper methods of drilling, could be prevented. Also, there is waste of crude oil due to improper methods of production and handling. The necessity for a critical study of petroleum and gases by the members of such a society is evident.

At the meeting on September 10 at the Bureau of Mines the constitution and by-laws were adopted, and officers were elected as follows: