both man and horses and common in France and occasionally in America, is identically the same species and should be called by the name first used by Hektoen in this country.

A butter having only a few yeasts and molds, when other conditions are favorable is a safer hazard for shipments and storage is the claim of F. W. Bouska and J. C. Brown of Chicago in their paper on "Yeasts and oidia in pasteurized butter." Creameries which have the best commercial reputation for their butter also have the lowest yeast and mold counts. These two men give methods for sampling and counting butter which they have recently devised.

The late Dr. Edw. Birge presented his study on the activities of certain bacteria in sewage. He believed that some bacterial forms can be found which will play an important rôle in the treatment of sewage, and that the time will come when septic tanks will be seeded as alfalfa fields and cream vats are seeded now.

A method for the detection of pasteurized milks is described in detail by Dr. W. D. Frost, of the University of Wisconsin. The addition of a special dye stains the blood cells, always present in pasteurized milks. In raw milks the cells will not be stained.

A strong plea for the thorough investigation of all waters whose potability is questioned, and for thoroughly trained investigators experienced in laboratory and field work, is put forth by H. A. Whittaker, of the University of Minnesota, in a paper on the "Investigation of drinking water supplies."

A. L. Amott, a commercial milk expert in Chicago, has given much time, energy and thought to "The milk supply of Chicago," and discusses the source of supply, amount, production, transportation, city distribution, prices, farmers' organizations, and milk inspection. He calls attention to the improvement of the milk supply and the lowered baby death rate in recent years in Chicago.

B. W. Hammer, of the Iowa Agricultural College, in a paper on "The bacteriology of ice cream," summarizes the knowledge of such points as number and kinds of bacteria, sources of materials, effect on the bacteria during freezing, hardening and holding, softening and rehardening. He also treats of the manufacture of ice cream with a low bacterial count, and the relation of ice cream to the public health, and bacterial standards.

SPECIAL ARTICLES

THE QUANTITATIVE BASIS OF THE POLAR CHARACTER OF REGENERATION IN BRYOPHYLLUM

When the defoliated stem of a plant of *Bryophyllum calycinum* is cut into as many pieces as it possesses nodes, each piece will produce shoots from the two dormant buds of its node and roots at its basal end. When a long piece of stem possessing 6 or more nodes is cut out from such a plant only the most apical node will produce shoots from its two buds while the other nodes will show no or only inconsiderable growth. The question is, Why do all the nodes except the most apical fail to produce shoots when they are part of a long piece of stem, while they would each produce shoots when isolated? This is the problem of polarity in regeneration in its simplest form.

Earlier biologists, especially Sachs, have suggested that this polarity is due to the fact that the ascending sap carries the substances needed for shoot regeneration and that if a piece of stem is cut out from a plant the sap must collect at the apex and thus give rise to the shoots at the most apical node. This explanation is only satisfactory if the assumption is added that in the case of the stem of *Bryophyllum* practically none of these substances reach the dormant buds in the nodes below the most apical one. The problem is how to furnish a scientific proof for this suggestion. This can be done by treating this problem from the viewpoint of chemical mass action.

The formation of new shoots in an isolated node of a defoliated stem of *Bryophyllum* can only be the result of synthetical processes the velocity of which depends for a given temperature and degree of moisture upon the relative mass of the material reaching the dormant buds of the node in the unit of time. The material required for growth will be taken from the sap reaching the node. The disappearance of this material from the sap will cause similar material to leave the cells of the stem and to diffuse into the sap. If this purely chemical reasoning is sound it would follow that the larger the mass of the stem the greater the mass of chemical substances available for the growth of shoots per unit of time. On this basis we should expect that the mass of shoots formed on the node of an isolated piece of stem would be in proportion with the mass of the piece of stem. That this is correct can be shown by cutting a defoliated stem of *Bryophyllum* into as many pieces as it possesses nodes. In this case, each node will produce shoots but their mass will be unequal in the different pieces, and will be greatest where the mass of stem is greatest.

If it is true that in a long defoliated piece of stem only the two shoots of the apical node grow out because practically all the material available in the stem flows to the apex; and that the shoots in the nodes below do not grow out because practically none of the material reaches them, then we should expect that the mass of the two shoots formed at the apex of a long piece of stem should approximately equal the mass of all the shoots which would have been formed if the stem had been cut into as many pieces as it contained nodes. A large number of experiments have been made which have shown that this is correct. The following example may suffice: Four large stems of *Bryophyllum* were defoliated and a piece containing 9 nodes was cut from each defoliated stem. From each piece of stem the three uppermost nodes were cut off and cut into three pieces containing one node each. These 12 one-node pieces produced 23 shoots. The 4 stems, with 6 nodes each, produced all together 8 shoots. After 20 days the dry weight of the shoots and of stems was determined. It was found that the 12 small pieces of 1 node each had produced 23.2 mg. dry weight of shoots per gram of dry weight of stems, while the 4 large pieces with 6 nodes each had produced 26.3 mg. dry weight of shoots per gram of dry weight of stems.

This shows that the mass of the two shoots produced at the apex of a long piece of stem equals approximately the mass of shoots which would have been produced in the same stem in the same time under the same conditions if the shoots could have grown out in all the nodes. This leaves no doubt that the polar character of the regeneration of shoots is due to the fact that all the material available for growth reaches the apical and none of the other nodes of a long piece of stem. The average growth of shoots in small pieces is slightly less than in large pieces in the experiment mentioned (23.2 mg. instead of 26.3 mg.), probably because the extreme ends of each piece die or cease to participate in the supply of material for growth. As a consequence the mass of a stem which supplies material for growth is less when the stem is cut into smaller pieces than when it is left intact.

It had been shown in previous papers that the mass of shoots and roots produced by a leaf of *Bryophyllum* is also in proportion to the mass of the leaf.[1]

A fuller description of the results will be given in the *Journal of General Physiology*.

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THE SCATTERING OF ELECTRONS BY NICKEL

A study of the electron emission from a nickel target under electron bombardment has revealed certain features of this emission which appear to be of considerable interest on account of their probable bearing on the structure of the nickel atom.

Besides the emission of slow-moving secondary electrons characteristic of all metals the emission from nickel contains an appreciable fraction of electrons of higher speed which appear to be scattered directly from the incident beam of primaries by the atoms of the target. The fastest of these scattered electrons have speeds almost if not quite equal to the speed of the primaries. It would appear that the sharp deflections experienced by these scattered electrons must result from their penetrating into the atom structure and being

[1] Loeb, J., *J. Gen. Physiol.*, 1918–19, I., 81; 1919–20, II., 297, 651.