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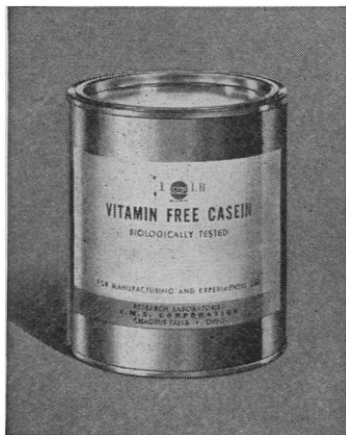
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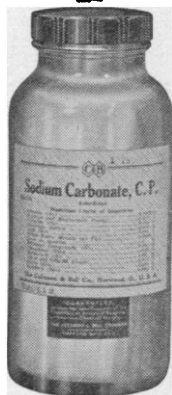
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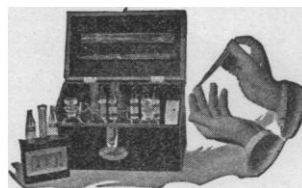
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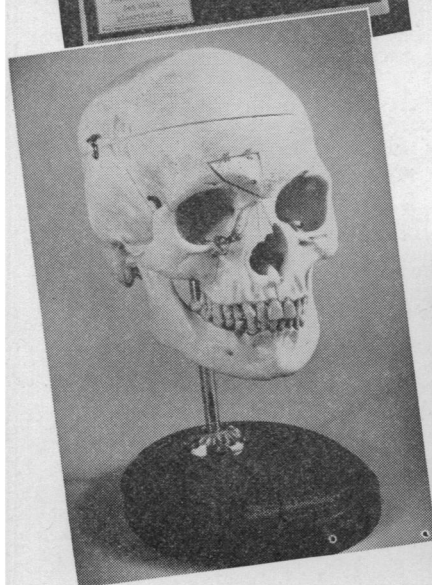
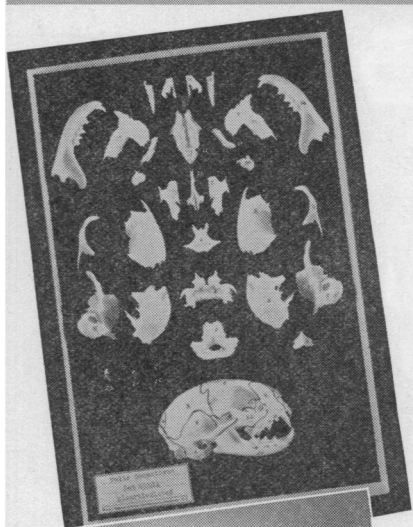
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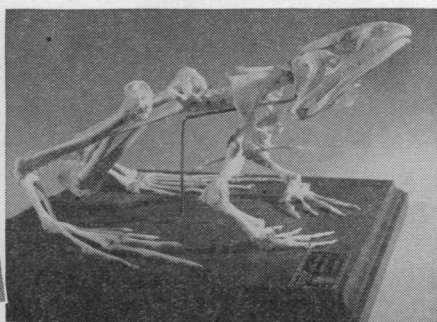
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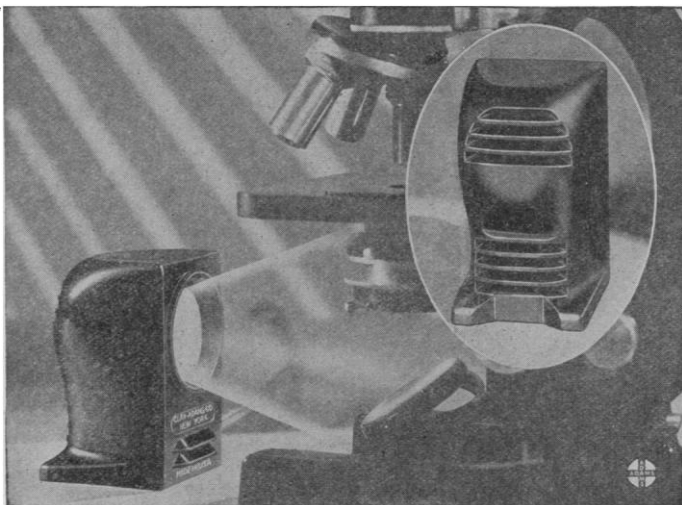
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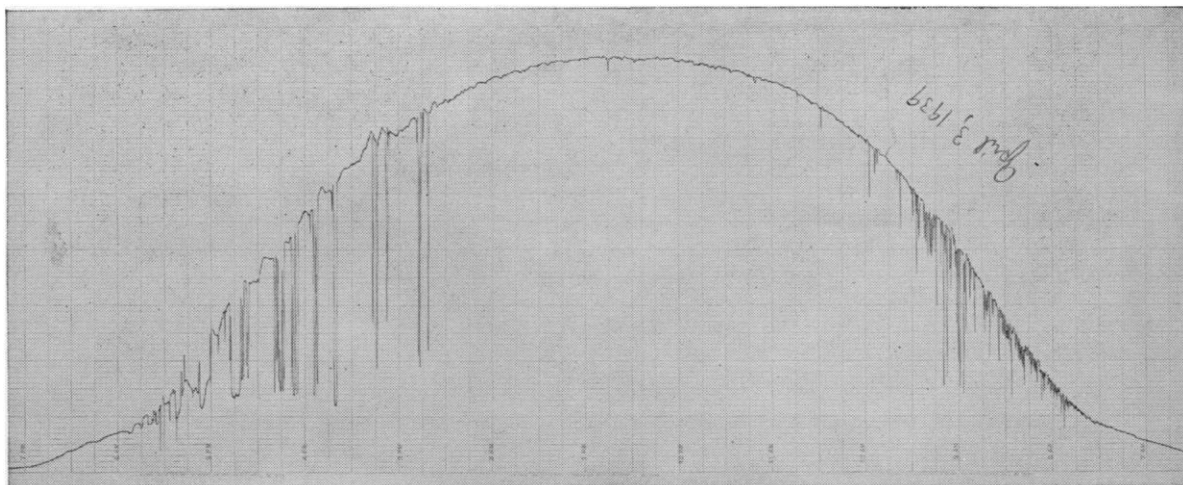


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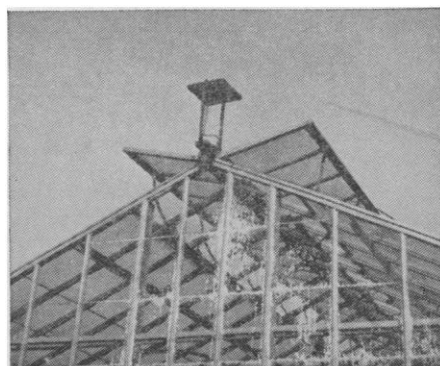
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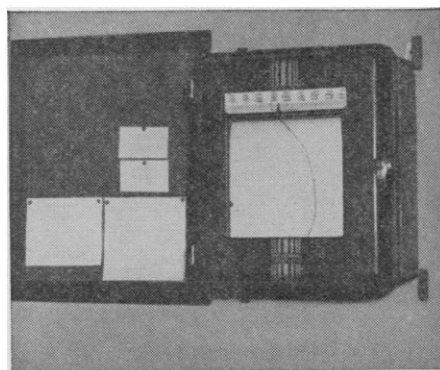
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EQUILIBRIUM THERMODYNAMICS AND BIOLOGICAL CHEMISTRY^{1,2}

By Professor GEORGE SCATCHARD

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SINCE science progresses by building block upon block, it is important to examine the structure from time to time to make sure that there are no badly fitted blocks, none which are being made to carry more than their proper capacity and none which might be made more useful. This is particularly true when thermodynamics, which is a vast and variegated structure erected upon the simple bases of the two laws of

¹ Address of the retiring vice-president and chairman of the Section on Chemistry, American Association for the Advancement of Science, Dallas, Texas, December 29, 1941.

² Contribution from the Research Laboratory of Physical Chemistry, Massachusetts Institute of Technology, No. 498.

thermodynamics, is applied in biology and biological chemistry to systems so much more complicated than those in which its results have been tested by physical chemists. Yet such an examination is discouraged because we are so certain of the foundation on the two laws of thermodynamics as laid out by J. Willard Gibbs.

I see no reason to question the validity of the two laws of thermodynamics, even for vital processes, and the only mistake I know in Gibbs's great paper is a trivial typographical error. However, a close examination shows that the foundation we are using is not exactly the one laid out by Gibbs. A discussion

RAPID TRANSMISSION TECHNIQUES FOR STONE-FRUIT VIRUSES

THE nature of the virus diseases of woody plants, including the stone fruits, is such that without the insect vector transmission can ordinarily be effected experimentally only by grafting. The chief obstructions to progress have been: (1) the apparently long incubation periods that obtain when ordinary transmission techniques are employed, (2) the lack of adequate details on how these viruses move in their respective hosts, (3) the almost complete lack of knowledge on the identity of the insect vectors, and (4) the lack of adequate attention to the possibility of developing new transmission and indexing techniques.

In studies on yellow-red virosis in peach¹ it was found that when a simple pruning technique was employed the incubation period was reduced from approximately a year to one month. The present modified technique involves: (1) the insertion of diseased buds about midway on the stems of rapidly growing peach seedlings² when between 12 and 24 inches tall and (2) cutting off the stem one node above the diseased bud from 0 to 7 days afterwards to stimulate a new spurt of growth.

This rapid transmission technique has since been tested for shortening the transmission periods of a number of other stone-fruit virus diseases which go to the peach, with equally successful results. Distinctive symptoms of such peach virus diseases as rosette, rosette-mosaic and mosaic have been induced on peach seedlings within a month from budding. A new yellows disease of the sour cherry has also been found to index readily on peach seedlings by producing the distinctive symptom of rosette within three weeks from budding. Similar rapid transmissions have been obtained with still other stone-fruit virus diseases.

Other less efficient ways of shortening incubation periods were by defoliation, girdling and fertilization. A promising variation, especially useful with older plants, involved placing the diseased bud on one side of the stem between two rapidly growing young shoots, the remaining shoots having been previously removed.

Dormant stone fruits including cherries, plums and peaches may respond quickly to another technique involving the grafting of diseased scions onto heavily pruned healthy plants just as growth starts. This modification in technique has been successfully em-

ployed in shortening incubation periods of several viruses in cherries and plums. Besides whip, approach, wedge and cleft grafts, chip buds consisting of bark and sapwood have been successfully employed at times when the bark will not slip. The whip grafting technique resulted in the transmission of a disease with the production of ring-spot symptoms on sour cherry (*Prunus cerasus* L.) in the extremely short period of 14 days from grafting.

The principle of the rapid transmission technique is the stimulation in a growing plant by pruning of a new spurt of growth which attracts the virus with the prompt appearance of symptoms. The response seems to best be explained by the idea that a virus moves bodily through a plant in the food translocation stream. Contact periods for effecting passage of viruses from diseased buds into the stem require only the few days necessary for the formation of a callus bridge between scion and stock. Ordinarily they pass into the stem and move downward to the lower stem and roots in the food stream and only return to the upper part of the plant during a period of rapid growth such as occurs after passage through another dormant period. Pruning stimulates the lateral dormant buds to activity and changes temporarily the course of the translocation stream from downward to upward until the new growth can support itself. The immediate inflow of plant foods carrying the virus gives the minimal incubation period. The new spurt of growth from the lateral buds which has been induced by pruning can be likened to the stimulation at will of next season's growth.

The principle of the pruning technique would seem to be almost universally applicable in the study of the virus diseases of woody plants.

E. M. HILDEBRAND

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- Housing for Health*. Papers Presented under the Auspices of the Committee on the Hygiene of Housing of the American Public Health Association. Pp. 221. The Science Press Printing Company. \$1.00.
- THOMAS, CHARLES ALLEN and OTHERS. *Anhydrous Aluminum Chloride in Organic Chemistry*. Number 87 in American Chemical Society Monograph Series. Pp. xiii + 972. Reinhold. \$15.00.

¹ E. M. Hildebrand, *Contrib. Boyce Thompson Inst.*, 11: 485-496, 1941.

² Peach seedlings were found ideal for greenhouse studies. Batches of peach pits (southern, wild), after storage in moist peat at 5° C. (40° F.) for 10 weeks to break dormancy, were germinated in sand, transplanted to soil in 4 or 5 inch pots and ready to use at about 18 weeks from starting the dormant treatment. New batches of pits can be started at will any season of the year.

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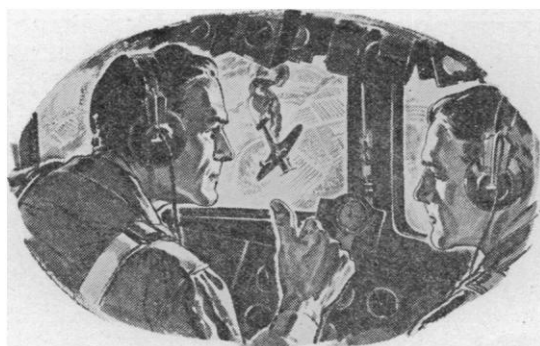
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International circuits, operating on short and long waves, have made the United States the communication center of the world. Today, R.C.A. Communications, Inc., conducts direct radiotelegraph service with 49 countries.

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Production of radio equipment is essential for news and timely information, for military and naval communications, for dissemination of news among foreign countries. The "arsenal of democracy" has a radio voice unsurpassed in range and efficiency. In the RCA Manufacturing Company's plants, workers have pledged themselves to "beat the promise," in production and delivery dates of radio equipment needed for war and civilian defense.

★ ★ ★

American life and property at sea are being safeguarded by ship-and-shore stations.

The Radiomarine Corporation of America has equipped more than 1500 American vessels with radio apparatus and is completely engaged in an all-out war effort.

★ ★ ★

Radio broadcasting is keeping the American people informed accurately and up-to-the-minute. It is a life-line of communication reaching 55,000,000 radio sets in homes and automobiles. It stands as the very symbol of democracy and is one of the essential freedoms for which America fights. The National Broadcasting Company—a service of RCA—and its associated stations, are fully organized for the coordination of war-time broadcasting.

★ ★ ★

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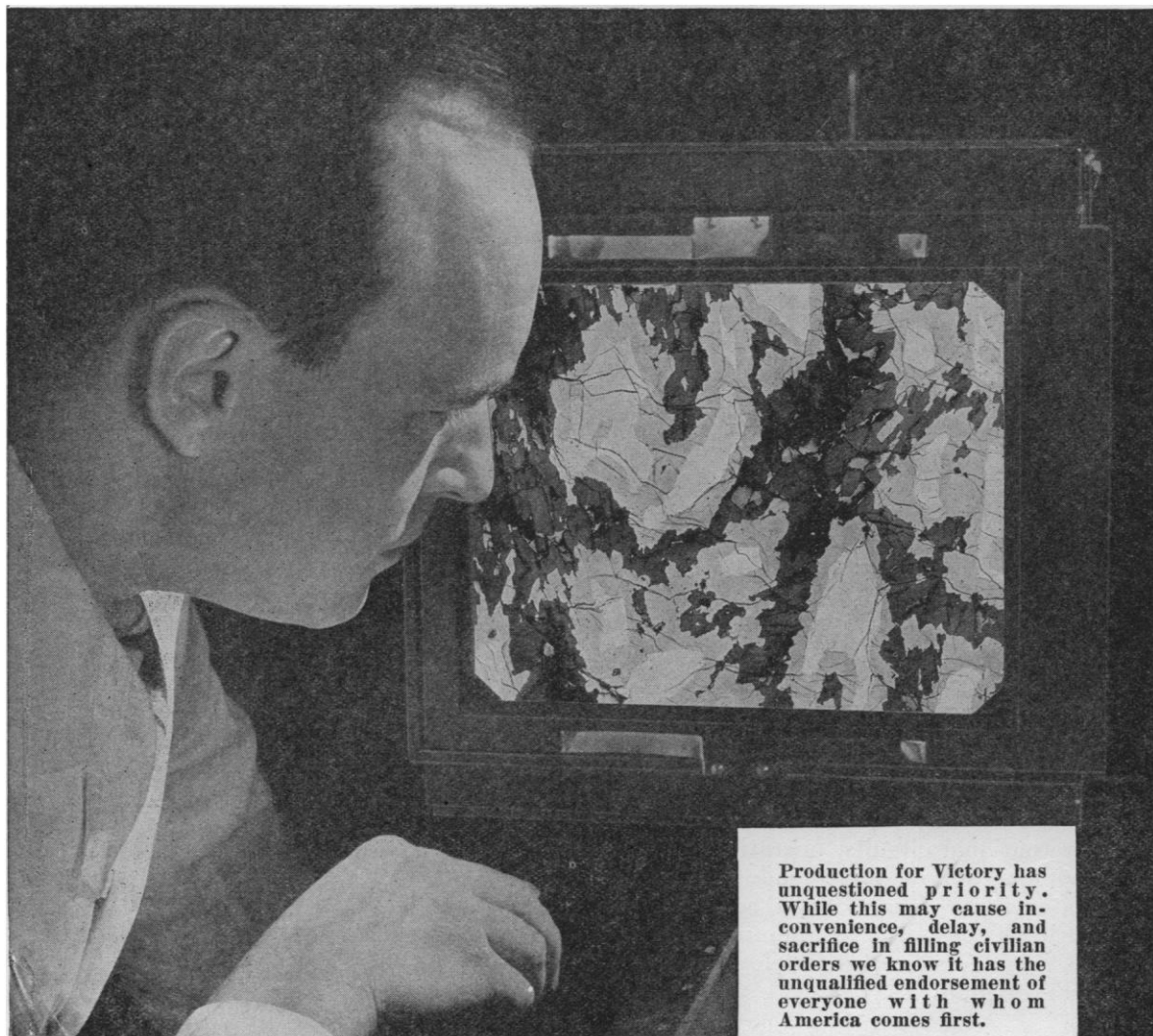
When war came and America took its place on the widespread fighting front, radio was At the Ready . . . with radio men and radio facilities prepared to answer the call to duty "in the most tremendous undertaking of our national history."

David Sarnoff
PRESIDENT



Radio Corporation of America
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