LETTERS

More on the Definition Of Biochemical Engineering

DEAR SIR:

As pointed out by W. L. Faith in his letter published July 22, the field of biochemical engineering has not yet "gelled" enough to submit to good definition. Nevertheless, it can hardly be so amorphous a thing as to deserve the description ". . . areas involving the processing of materials by application or manipulation of chemical reactions involving life processes" (Editorial, AG AND FOOD, May 13).

At present it appears that the field should be divided into two distinct areas. One of these is simply fermentation engineering—the application of chemical engineering principles to the unit process of fermentation. The other area of biochemical engineering (or preferably bio-engineering) is more difficult to describe. It embraces a knowledge of such techniques as molecular distillation, chromatography, dialysis, ion exchange, lyophilization, etc. More often than not these involve physical transformation rather than the "...application or manipulation of chemical reactions."

This "biochemical area" involves more than specialized unit operations, however. It involves a frank recognition that morphology, structure, or colloidal properties play a dominant role in processing. Let me cite an example. So long as one studies soybean extraction by observing clay plates, even wedge-shaped clay plates, he is behaving like a straight-run chemical engineer. Only when he turns his attention to the heterogeneity of the flake itself does he become a bioengineer [cf. H. P. Fan *et al.*, *Ind. Eng. Chem.*, **40,** 195–9 (1948)]. Bio-engineering is indeed a branch of chemical engineering but one which requires some additional disciplines.

It is instructive to examine the roots of biochemical engineering. Just as chemical engineering depends for sustenance on the basic sciences of physics, mathematics, and physical chemistry so biochemical engineering depends upon biophysics, mathematical biophysics, and physical biochemistry.

To push the analogy further it seems that because of these already established roots, bio-engineering should make a firmer graft onto chemical engineering than, let us say, a petroleum branch or a plastics branch. A bio-engineer should be able to interpret current research in the basic sciences, and he should be able to apply such research to the solution of his own problems. When necessary, he may even have to go back and develop certain areas of these basic sciences in order to fashion them for his own use.

Finally, if forced to give a one-sentence definition of the field of biochemical engineering, I should say that it involves: (1) the concentration, recovery, and perhaps modification of the complex substances from plant and animal tissues and (2) the mass culture of such tissues.

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Tallow Short?

DEAR SIR:

In the July 8, 1953, issue beginning on page 552, you have published an article by Raymond H. Ewell entitled "The Outlook for Inedible Fats and Oils."

On page 555, Table III, Dr. Ewell shows 1951 production of inedible tallow and grease as 2,276,000,000 pounds. In checking his source in M17-1-01 on page 8, I find the following production figures:

	Lb.
Tallow, inedible	1,301,031,000
Tallow, inedible, refined	276,078,000
Grease, other than wool	620,961,000
TOTAL	2,198,070,000

These figures fall short 77,930,000 pounds. Would you please clarify?

C. W. LUDWIG
Vice President
Cooperative Mills, Inc.

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DEAR SIR:

With reference to Mr. Ludwig's letter, the figure for 1951 production of inedible tallow and grease given by Mr. Ludwig—2,198,070,000 pounds, is the figure actually given in facts for Industry M17-1-01. The figure given in Table III—2,276,000,000 pounds, is calculated as follows:

Factory consumption	1,684,000,000
Exports	533,000,000
Increase in stocks	62,000,000
TOTAL	2,279,000,000
Minus imports	3,000,000
TOTAL	2,276,000,000

It is generally believed by fats and oils statisticians that production calculated in this way gives a more reliable figure than that cited in Facts for Industry M17-1-01. This is the method used by the Bureau of Agricultural Economics to compute tallow and grease in statistics in "The Fats and Oils Situation."

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