

perhaps temporarily rejected it in the light of newly won sophistication. An obvious example can be seen in the multitude of interpretations the mass transfer coefficient has earned since its filmy start. On the other hand, there is real danger in too easy or too attractive a model. The formalism of the film theory apparently was so elementary as to have deceived students and mature engineers alike into investigating basic mechanisms no farther during a couple of decades of Middle Ages. And a different example: Fascination with distribution functions and the like seems to have been so great as to obscure the distinction between the statistics obeyed by model elements and the working of an individual element, and to inhibit inquiry into the latter during a decade or more of the Modern Age.

POSTSCRIPT

This seems an appropriate juncture, before returning to flow and transfer, to express my opinion that as engineers learn new science, however esoteric, and acquire mathematical skill, however abstract, their tradition and habit of practicality will produce engineering applications. The applications may come directly in invention, design, and operation or less directly—and often more profoundly—in concepts and patterns of thought that pass into what we call “physical intuition” and “engineering judgment.”

Yesterday's dimly viewed science and incomprehensible mathematics are today's engineering research areas and tomorrow's engineering practice—and undergraduate course contents. Of course the undergraduate student must learn what engineering is about, and he should see in his professors a broad selection of engineering experience and outlook. But he should also have the opportunity of acquiring a truly liberal education, and this requires continually up-to-date scientific and technological competence within the engineering faculty. Maintaining this kind of competence takes research and substantial numbers of professors of the sort called engineering scientists—or, pejoratively, pseudoscientists. In my experience it is greatly aided by the presence of true scientists on the engineering faculty. True or false, these are persons whose participation signals the decline and fall of real engineering to a certain type of mind. Yet, how much might earlier competence in the areas of fluid mechanics and applied mathematics I mentioned have benefitted my present subject and chemical engineering in general! Suppose the young metallurgical engineer with a PhD in physical chemistry, Irving Langmuir, had joined the engineers and entrepreneurs at a leading university instead of the chemistry professors at Stevens! Why weren't there other young Langmuirs, more Drews and Higbys, researchers who scouted in the literature of physiology and Soviet applied science, critics to point out that not all films are 2300 degrees hot and stagnant? . . .

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