expected to accept a constant diet of abstract definitions and meticulous propositions without knowing how he—or anybody—is to be regarded as fitter for the experience. The author's claim that applications are consigned to a series of annexes, in order not to overburden the text unduly, bespeaks a pedagogical style which does not elicit my sympathy. Applications, in my view, should form an integral part of any text and can only, when appropriately chosen, serve to lighten the reader's task (if not, perhaps, the writer's). Moreover, the applications are themselves only marginally more concrete than the basic material of the text; and the manifold topics introduced in the annexes are discussed in so perfunctory a manner that the reader will be even more bewildered by this plethora of unmotivated "applications" than he was by the main body of the text. For example, differential modules and the associated notions of homology and homotopy occupy half a page, and the topic of simplicial complexes receives one page of discussion.

Certain idiosyncrasies of style contribute to the difficulty which may be experienced by a reader brought up on a less austere mathematical diet. Principal among these is a system of notation which, while being entirely logical and consistent, is somewhat private and unwieldy; and a massive priority to the concept of "relation" over that of "function". This last is to be explained by the author's own research interests; but it is a depressing experience to read that a function from E to E' is a binary relation which is left-bijective.

A final criticism concerns the extraordinary omission of the excellent book, *Universal Algebra*, by Paul Cohn, from the bibliography. A more commendatory remark is also in order, however; an experienced algebraist, trained in the classical tradition and wishing to familiarize himself with certain parts of abstract mathematics (category theory excluded) might well benefit from consulting this text.

PETER HILTON

EXPENSIVE ENGINEERING

Concorde

The Story, the Facts and the Figures. By T. E. Blackall. Pp. xiv + 108 + 47 plates. (Foulis: Henley-on-Thames, May 1969.) 56s.

THERE will be many stories about Concorde, for this tremendous venture has been surrounded by controversy since its inception. It has been described as too early and too late, a social necessity and an unjustified nuisance, an international money spinner and a political white elephant. Only now as we approach the moment of truth has a respectful hush descended. Meanwhile, men who have dedicated a third of their professional lives to the project get on with their job, well aware of the risks and of the rewards.

Mr Blackall with his feet firmly on the ground has restricted himself to facts and figures. These are clearly presented and supported by excellent photographs. The greater part of the book is concerned with detailed specifications of the structure, the propulsion, the auxiliary machinery, and the complex equipment needed for control, flight management and navigation during the various phases of flight. The book will commend itself primarily to engineers and as a source of information to the growing body of people who will become involved in the operation and maintenance of Concorde.

But even a layman cannot fail to be impressed by the vision of its designers and by the sophistication of its engineering. A minor miracle is the use of air drawn from the engine compressors at 600°C to maintain a cabin temperature of 25°C, with the skin of the aircraft itself well above the boiling point of water. The Concorde will be the most thoroughly tested aircraft ever produced. For years after its introduction into service, full scale

fatigue tests will continue hour after hour accumulating data two years ahead of any operational aircraft—a vital guarantee for safety in flight.

The book does less than justice to the fundamentally new aerodynamic concept which alone has made supersonic flight commercially feasible. During the post-war years many abortive attempts were made to solve the problem with highly swept wings. But although sweep back provides an elegant escape from wave drag up to transonic speeds, beyond 45° the flow tends to break away at large angles of incidence and handling characteristics are unacceptable at landing and take-off.

The breakthrough came in 1956 when the Royal Aircraft Establishment proposed an entirely new approach—the slender wing—in which the flow is deliberately induced to break away from a sharp leading edge. The powerful vortices induced make a major contribution to the lift, and moreover both lift and drag can be smoothly controlled over the entire speed range. In 1961 the HP115 completely verified experimental results in the tunnel, and the slender wing is now the basis not only of the Anglo-French Concorde but also of the Russian Tu 144 and the Boeing supersonic transport.

Mr Blackall has been understandably cautious about the financial return to be expected from this huge investment. So much depends on imponderables such as passenger appeal, load factor, utilization, and above all on the number produced. The VC 10 although of more conservative design, and produced in very much smaller numbers than the Boeing 707, has nevertheless competed well on the transatlantic routes because of a consistently higher load factor. Concorde is at least 5 years ahead of any possible competitor and even if confined to transoceanic and transpolar routes there is a potential demand for several hundreds. We must wait until the cruise performance of Concorde 001 and 002 is established before any reliable market forecast can be made, but so far the omens are good.

ROBERT COCKBURN

Correspondence

Preknowledge Survey for University Science Entrants

SIR,—The preknowledge survey for university science entrants by O'Connell, Wilson and Elton (*Nature*, 222, 526; 1969) is welcome. I must, however, dissent from the authors' views in one respect: a lecturer requires that his students should have a rational understanding of elementary concepts, not just a vague acquaintance with terminology. In this sense it does not appear that the "comprehensive course in basic mechanics" which the students are supposed to have received is generally "adequate to build a university course on".

It is shocking that less than half of the science students tested recognized force and acceleration as vectors, but we must not assume that those who are acquainted with these ideas understand them. It is very usual for students (and their teachers) to find vector sums of forces acting on different bodies. Of the 135 students tested by O'Connell *et al.*, 122 associated force with mass times acceleration. Most students whom I have questioned make the same identification. But this does not prevent almost all of them accepting without question the commonly taught idea that a molecule under the action of a resultant force remains at rest in a state of tension. Reasoned criticism over many years has failed to prevent qualified physicists from continuing to teach and publish (and presumably to believe) this absurdity.

The uncritical acceptance of contradictory beliefs has been shown to be a commonplace in several topics of

elementary physics. It is impossible to regard as rational understanding a mental condition involving simultaneous acceptance of directly contradictory ideas. Yet this is what is exhibited by very many of our university science entrants, and also by some of those who write the sixth-form textbooks. Thus a student may be shown by a simple test to be acquainted with a particular concept, but it may well be that his ideas are so confused that the concept is useless to him.

Yours faithfully,

J. W. WARREN

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London W3.

The Future of Botany

SIR,—We have recently gone through the process of appointing a lecturer to this department. In advertising the post, we made clear that although we were interested in candidates from a broad field there were certain specific requirements, possibly somewhat out of the ordinary. We had a number of applicants for the post and were very surprised to find that a good majority of these made no effort to indicate how they might fit in with our requirements. Furthermore, a good number of the candidates who were either just finishing, or had just finished, their PhD work seemed to think that their only mission in life was to further their postgraduate research and seemed in no way interested or anxious to broaden their interest in botany.

We found this all very disturbing and indeed it seems to us to echo some of the problems which have been discussed about the training of biologists in this country, particularly those made by the Royal Society Committee on Postgraduate Training in Biology and in the Swann Report. The feeling is that the training of PhDs in biological subjects is leading far too frequently to an inflexibility of outlook and a narrow-mindedness which is inherently bad for the progress of the subject.

The situation is becoming critical. Something needs to be done to discourage departments, and those within them who are responsible for training postgraduate students, from allowing these students to have their interests focused on very specialized problems to the neglect of their general biological education. Specialization of work may be a necessary part of achieving a proper scientific training, but if it leads to a narrow outlook then it is very bad training.

Yours faithfully,

D. H. JENNINGS
A. D. BRADSHAW

Department of Botany,
University of Liverpool.

Simplified Notation for Peptides in Computer Compatible Format

SIR,—Without wishing to comment one way or another on the proposals advanced by Revesz¹, it should be pointed out that the IUPAC-IUB tentative rules *A One-Letter Notation for Amino Acid Sequences*² do not contain the letters J, O, U (which she allocates to the also not included Cit, Orn, CyS-SCy) and allocates X to "unknown or other", and not to HyPro. These differences from the IUPAC-IUB tentative rules are presented as if they were part of the latter, in which respect the article is misleading.

Yours faithfully,

O. HOFFMANN-OSTENHOF

IUPAC-IUB Combined Commission
on Biochemical Nomenclature.

¹ Revesz, G. S., *Nature*, **219**, 1113 (1968).

² *Arch. Biochem. Biophys.*, **125** (3), 1 (1968); *Biochemistry*, **7**, 2703 (1968); *Biochim. Biophys. Acta*, **168**, 6 (1968); *Europ. J. Biochem.*, **5**, 151 (1968); *J. Biol. Chem.*, **243**, 3551 (1968).

SIR,—In answer to Dr O. Hoffmann-Ostenhof's letter I would like to point out that the changes made by *Index Chemicus* in IUPAC nomenclature were limited to the use of unused or undefined letters, such as J, O, U and K. To the extent that these changes were not pointed out clearly, there may have been room for misunderstanding.

My article (*Nature*, **219**, 1113; 1968) clearly stated, however, that IC-IUPAC notation is considered an open-ended system to which additions can be made as the need arises for effective computer storage and searching of long chain peptides. Indeed, the following additions have already been made:

- A Cysteic acid
- B β -Aminobutyric acid
- C Homoserine
- D Pyroglutamic acid
- E β -Aminovaleric acid
- F Sarcosine
- G β -Alanine

The addition of these symbols, together with twenty other symbols for substituents, was prompted by their actual occurrence in the peptide literature which the *Index Chemicus Registry System* (ICRS) stores on computer tape. A significant and increasing percentage of the over 150,000 compounds encoded by ICRS each year involve peptides. To deal with such a large amount of new information, the IUPAC IUB system must be open-ended.

Yours faithfully,

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SI Units and Dimensionless Quantities

SIR,—It is probably not generally realized that, because the electromagnetic SI units are associated with a rationalized system (Giorgi), the values of some dimensionless quantities, such as electric and magnetic susceptibilities, are 4π times greater than in the (unrationalized) cgs systems. There is thus a real danger of errors in interpretation if it is wrongly assumed that for dimensionless quantities the units system adopted is irrelevant. So long as rationalized and unrationalized systems coexist it is important that in reporting such quantities the system used should be stated.

Yours faithfully,

J. K. BECCONSALL

Imperial Chemical Industries, Limited,
Petrochemical and Polymer Laboratory.

Policies for Pollution and its Cure

SIR,—Your article on "Policies for Pollution and its Cure" (*Nature*, **222**, 1013; 1969) is a timely reminder of the ineffectiveness of international legislation in controlling oil pollution. Oil pollution is, however, only one aspect of coastal pollution, but one which has great emotional impact. The use of the sea for the disposal of unwanted industrial waste material is an increasing threat to sea fisheries. Yet in Britain pollution of sea fisheries is controlled by the Sea Fisheries Act of 1888. In order to stop polluting discharges, the Sea Fisheries Officers have to "prove that pollution has occurred". This is, of course, exceedingly difficult to do because long term natural fluctuations in marine communities have been little studied. Thus the effect of the effluent can be put down to "natural fluctuations" in the community or species decimated.

Clearly Britain cannot alone strengthen her laws on effluent disposal and require home industries to control discharges if overseas competitors are not required to do