'patches' to subroutines, etc., after testing was devised. The absolutely rigid control of this field is a tremendous problem in itself, and no laxity can be allowed. The problems of the effect of changes, both within a programming run and between programming runs, are major ones, and clear-sighted control is imperative.

After the initial few months of operational running, the responsibility of individual programmers was raised to runs instead of subroutines within a run. Currently, the examination of further possible applications is becoming more detailed as some of the experienced programmers are freed from the initial task. Optimization of programs, as and when the opportunity or the need arises, has been and is still a profitable exercise. New languages and programming aids are being reviewed continually. Within the programming organization we have a few non-programmers who maintain test accounts and devise test data for re-written patched routines. They critically examine all the output resulting from testing sessions—in fact they form an integral part of the testing section, and the programming organization.

Concluding remarks

Each of the points mentioned above, for example Coding or Storage Allocation or Machine Testing, is worthy of an hour's talk in itself. I can only hope to have outlined some of the problems and sketched out a possible means of approach.

Book Reviews

Data Acquisition and Processing in Biology and Medicine, Edited by KURT ENSLEIN, 1962; 191 pp. (Oxford: *Pergamon Press*, 50s.)

I was recently approached by the editor of a medical research journal to referee a paper submitted by an author from the United States who was proposing to make a quantitative science of a particular branch of medicine—no British doctor could be found to pass judgement on the paper. As an applied mathematician I was intrigued to find that the non-medical references in the paper were to geological papers. This reflects an attitude of mind on the part of U.S. research workers which is wholly to be applauded and which, outside operational-research circles perhaps, is unfortunately too seldom found in Britain. The explanation, at least in part, of this greater U.S. willingness to cross inter-disciplinary barriers is to be found in the impact which electronic instrumentation in general and computers in particular have had in the U.S. There, good computing facilities in universities and research centres are the norm; here, they are still the exception.

An example of what this means in scientific endeavour is to be found in the book under review, which is the edited proceedings of the 1961 Rochester Conference. The reports cover papers read at five sessions, concerned with computers in biology and medicine, computers and psychiatry, pattern recognition, clinical and research instrumentation for biological systems, and instrumentation for electrocardiography and electroencephalogy. It is interesting to note the degree of automation aimed at—one writer reports that electrocardiograms are already recorded on tape for running into a computer, but it is planned to use the cardiograph as an on-line device to the computer. The combination of intricate medical instrumentation, advanced computer techniques and highly sophisticated statistical treatment in some of the experiments is fascinating.

One of the papers on pattern recognition extends to the study of chest X-ray photographs the techniques used to assess the cloud photographs taken from the Tiros satellite.

The papers on computers have much to interest British readers. To me, most impact was made by the remarks by Lusted on the problems of education facing medical schools. Doctors, he says, must somehow be taught to compute when necessary, and he cites the work of doctors at Tulane University who have developed a computer program called "Probe" which allows the medical researcher who does not know programming to run his own medical data on the computer; they attach great importance to allowing the researcher "to get his hands on the machine."

I am not, of course, competent to review the papers in this volume for their medical contents; but I can wholeheartedly commend the book to British research workers if only for the insight it gives us of the attitude and approach of our transatlantic colleagues to research problems.

Until British universities and research establishments are equipped with computers in depth, as are their U.S. counterparts, one cannot imagine such a volume being written by British research workers.

ANDREW YOUNG.

Modulation and Coding in Information Systems, by GORDON M. RUSSELL, 1962; 260 pp. (London: *Prentice-Hall International Inc.*, 42s.)

The purpose of this book, as stated in the Preface, is "to give an introduction to the theory of information processes, primarily those of modulation and coding . . . applicable to the fields of power-system control, industrial control, data transmission and processing and all types of communication . . .". In saying this, the author does the book a slight disservice, for he suggests that the material is theoretical, dealing perhaps with information theory, coding theory and the like. But there are several excellent texts already on the market dealing with such theoretical aspects of communication and control systems. By contrast, there is a plethora of