which contains a summary of the available experimental information on these parameters for different rock types, the book demands a sound grasp of mathematical physics on the part of the reader. The chapters vary considerably in length. Chapter three by R. R. Rumer ("Resistance to Flow through Porous Media") and chapter five by E. S. Simpson ("Velocity and the Longitudinal Dispersion Coefficient in Flow through Porous Media") form short yet comprehensive treatments of their subjects. Chapter seven by D. Dicker, chapter nine by G. de Josselin de Jong and chapter ten by the editor are longer, and require a good mathematical background to be appreciated fully.

In dealing with unsteady flows in a compressible porous medium in chapter eight, A. Verruijt reviews material drawn from the literature of both soil mechanics and hydrology. A similar interdisciplinary approach is adopted by H. J. Morel-Seytoux in chapter eleven which draws upon experience in the petroleum industry.

Chapter six by D. Swartzendruber ("The Flow of Water in Unsaturated Soils") presents an interesting blend of theory and experimental results; in this respect, this is the most balanced contribution in the book. Finally, in introducing the longest chapter, J. Bear (chapter four) takes care to point out that his review of hydrodynamic dispersion is incomplete, a testimony to the literature explosion on this aspect of porous media flow.

In general, this type of book is prone to lack of uniformity in both notation and the level of competence required of the reader. As the editor, Dr De Wiest is to be congratulated on avoiding these pitfalls. The level of presentation, however, is very high—postdoctoral rather than postgraduate. The standard is certainly above that of most one-year MSc courses, irrespective of basic discipline, and the appeal of the book seems limited to research workers in this particular field. The prospect of a small circulation is reflected in the price. M. J. HALL

COLLECTED EARTHWORKS

The Seismicity of the Earth

1953–1965. By J. P. Rothé. (Earth Sciences, No. 1.) Pp. 336. (Unesco: Paris, 1969.) 48 francs; $12; 72s.

THIS is, against all the odds, a splendid book and one which seismologists may well feel they need themselves as well as having access to in a library. I must admit that at first glance I feared this book would be of little value. It is unashamedly a successor to Gutenberg and Richter's classic *Seismicity of the Earth*, and re-runs do not normally arouse much enthusiasm. Further, the recent compilation of US Coast and Geodetic Survey epicentres since 1961 by Barazangi and Dorman might seem to have saturated the subject. Not at all.

The study of seismicity is more than just a process of geographical cataloguing. Variation in activity with time, loss of life and damage to property, sorting of events by magnitude and the merging of seismic data into tectonic concepts—these are all important aspects of seismicity studies, and Professor Rothé has achieved a good balance of hard facts and general speculation. He has drawn on a wide variety of sources and his bibliography is superb—nobody studying local seismicity should venture on an area until he has followed up all Rothé's leads. Further, he makes wide use of the seismological notes of the *Bulletin of the Seismological Society of America*—an invaluable compilation which earns too little credit for its editor.

After an intelligent introduction surveying global seismic activity, the regions of the world are reviewed in turn, maintaining the same layout as Gutenberg and Richter. Bilingual (English and French) comments follow the listing of all earthquakes between 1953 and 1965 with a magnitude greater than about 6·0. The magnitude criterion is relaxed, however, when small earthquakes have occurred in unusual locations or have wrought considerable damage. At the end of the book a set of maps show locations, together with some notable faults and nuclear tests.

The whole is well produced and handsomely printed. The translation is first-rate. It is difficult to find fault with this invaluable work of reference, which is going to save hours of thumbing through journals, maps and cards. D. DAVIES

TRIANGULAR PUZZLES

Geometric Inequalities

By O. Bottema, R. Ž. Djordjević, R. R. Janić, D. S. Mitrinović and P. M. Vasić. Pp. 151. (Wolters–Noordhoff: Groningen, 1969.) $4.90.

THE book consists of a list of some four hundred inequalities on triangles and a further sixty on quadrilaterals, polygons and circles. A good many have a proof or some indication of a proof and nearly all are elementary in nature. Some, however, would provide testing exercises for any mathematician, even though the majority would be of most interest to secondary school students. Hardly any of the examples require any previous knowledge. Many are of the type which says that there is a maximum or minimum in the most symmetric case. For example, if A, B, C are the angles of a triangle, then

$$\sin A + \sin B + \sin C \leq 3\sqrt{3}/2;$$

or, if h_a, h_b, h_c are the altitudes of a triangle, then

$$(3r)^3 \leqslant h_a h_b h_c \leqslant (3R/2)^3$$

where r and R are the radii of the incircle and circumcircle respectively; or, the area of an n-gon inscribed in a unit circle is at most that of the regular one, namely, $(n/2)\sin(2\pi/n)$. It is mentioned that the last example was set in a high school students' competition in China in 1957. The book would be a useful addition to any school library although, it must be said, it does not greatly extend the imagination, which a book of puzzles ought to do. More precisely, even though most of the book is devoted to triangles, the more interesting examples are in the last three sections of the book. For example, if a regular hexagon of area F contains non-intersecting circles of radii $r_1, \ldots, r_n$, then

$$(r_1 + \ldots + r_n)^2 \leq nF/\sqrt{12}$$

References to all the results are given. Finally, the authors are to be admired for their assiduity in achieving such a complete collection. JAMES HIRSCHFELD

Obituaries

Dr G. S. Carter

GEORGE STUART CARTER was born on September 15, 1893, the son of the Rev. G. C. Carter and Hilda E. Keane. His schooling was at Marlborough College and it was probably there that he gave his first scientific paper, as evidenced by the entry "G. S. Carter . . . Ants" in the record of the Marlborough College Natural History Society for February 5, 1912. This youthful endeavour was the precursor of a lifetime's work in biology.

He went up to Gonville and Caius College, Cambridge, and read for Part I of the Mathematics Tripos in 1913. The First World War then called him to serve until 1919, first in the Leicestershire Regiment and later in the Royal Engineers. Returning to Cambridge he read for Part II of the Natural Sciences Tripos in Zoology, gaining a First and being awarded the Frank Smart Prize and Student-

ship in 1921. His highly productive career started with the publication, while he still held the studentship at Gonville and Caius, of papers on the structure and movement of cilia in *Mytilus* and on the early development of the echinoderm egg. Two other papers on veliger cilia followed after his move to a lectureship at Glasgow, and it is clear that this early work was influenced by Sir James Gray, who was two years his senior and held the Balfour Studentship at Cambridge during Carter's time as a Part II student. His work from Glasgow at the Millport Marine Station, where he was much encouraged by Richard Elmhirst, and at Naples, led to a further nine papers on sperm and fertilization in *Echinus* and *Asterias* and concluded the first recognizable phase in his work, largely concerned with invertebrate physiology. He returned to a lectureship in Cambridge and a fellowship at Corpus Christi College in 1930, holding the former to his retirement in 1960 and the latter until his death.

A new facet of Carter's wide ranging biological interests opened up with his expeditions in the 1920s and 1930s to Brazil, the Paraguayan Chaco and to British Guiana, and subsequently in the middle 1950s to Jinja and the papyrus swamps on Lake Victoria. Substantial papers with Beadle on the South American work, a biological review, and other papers of his own followed, covering all aspects of that fascinating environment, the tropical swamp, and dealing with adaptations largely of fish and oligochaetes to this taxing mode of life. It would seem clear that his great interest in evolution arose during this work. The material collected on these expeditions was worked upon by Gurney, Lowndes and Jepps, among others, and was of wide influence.

It was perhaps in his final and maturest phase, as a writer of substantial general texts, that Carter exerted his most profound influence on the development and teaching of zoology. His *General Zoology of the Invertebrates*, first published in 1940 and running to four editions by 1961, remains a model of readable analysis and instructive information, and his *Animal Evolution* (1951) and *A Hundred Years of Evolution* (1957) were of equal value to the student and the general reader respectively. He continued writing until the beginnings of his final illness and happily saw *Structure and Habit in Vertebrate Evolution* published in 1967. This late work is perhaps the best tribute to his versatile and enquiring mind, for it forms a synthesis of physiological, structural and behavioural knowledge in this field which shows most clearly his ability to develop a new and profitable approach to an old problem in the light of a lifetime's experience of enquiry.

Although this is meant primarily to be an account of his published contributions to knowledge, the moment cannot be allowed to pass without also recording the appreciation of generations of undergraduates and colleagues who were alike given his stimulating, critical but kindly advice and encouragement. He was much loved and will be much missed by many friends.

Correspondence

Should Slides be seen Blind ?

SIR,—I fully endorse the views expressed by Roe *et al.*[1] on the subject of histological examination using a "blind" technique.

In this sort of examination the pathologist often has to decide whether the abnormality he finds could have been the result of a natural disease process rather than of a specific insult from administration of the test substance. Such a distinction may be difficult or even impossible without a knowledge of necropsy findings and of lesions in the other animals on the same regimen of treatment.

Assessment of minor degrees of change resulting from toxic damage is one of the principal objects of safety evaluation tests. Such minor changes often cannot be readily distinguished from variations in the normal appearance of tissues, or from a processing artefact, without information relating to level of treatment, state of health of the animals, and necropsy findings.

In the clinical field the pathologist relates his findings and opinion to the clinical history and biochemical results. Only by following the same procedure in experimental animal studies can a sound pathological opinion be given of any lesions.

Efforts to examine pathological material from toxicity tests "blind" have been made in the past and they have been met with unqualified disfavour by pathologists. Dr A. A. Nelson, one of the pioneers in the field of pathological examination of animal tissues from toxicity tests, when asked whether he would advise this sort of procedure[2] replied, ". . . my own feeling is that a person that couldn't give a reliable opinion if he had the data would give a worse one without it. . . . The truly blind and random reading, I think, will result in the pathologist having wider limits of normality than he otherwise would have, and eventually what is actually a mild but definite effect will be passed off as within those broad normal limits"[1].

Yours faithfully,

P. GRASSO

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[1] Roe, F. J. C., Carter, R. L., Cotchin, E., and Bonser, G. M., *Nature*, **225**, 1081 (1970).

[2] Nelson, A. A., in *The Pathology of Laboratory Animals: the Recording and Reporting of Pathological Data* (edit. by Ribelin, W. E., and McCoy, J. R.) (1965).

Another *Acanthaster* Disaster

SIR,—Possible biological consequences of establishing an open waterway between the eastern Pacific and the Caribbean have recently been pointed out by several scientists[1–5]. These consequences include interactions between closely related species as well as between unrelated species. Conceivably the results of either could, from man's viewpoint, be detrimental or beneficial. Generally biologists have warned of possible bad effects of uncontrolled biological exchange between the two oceans, although Topp[4] offers a guarded opinion that the characteristics of the fish faunas, at least, will not be drastically altered.

Introductions of foreign species leading to undesirable results are well known, and to ignore the probability of a plethora of serious problems resulting from free migrations through a sea-level canal is the height of folly, but unfortunately it is difficult to predict which organisms will cause trouble in new environments. Without intensive study, only obviously inimical species can be singled out.

Weathersbee[5] has valid fears about the possible introduction of the poisonous sea snake, *Pelamis platurus*, into the Caribbean through a sea-level canal, but *Acanthaster ellisi* (Gray), the eastern Pacific crown-of-thorns starfish, may present an even greater potential danger to the Caribbean. Wholesale destruction of coral reefs by the Indo-Pacific crown-of-thorns, *A. planci*, has received considerable attention recently[6–9] and the problem has become so acute that Chesher[6] has expressed fears for the future of Pacific reefs. *Acanthaster ellisi* is so similar to its Indo-Pacific relative that separation of the two species has been questioned (personal communication with J. Halpern, University of Miami). Presumably it eats coral, although nothing is known about its biology. It is thought to be rare[10], and population growth is possibly limited by a lack of suitable coral growth in the eastern Pacific.