

$\mathbf{b} = b^r \mathbf{e}_r = b_s \mathbf{e}^s$, the tensor $T = (\mathbf{a}; \mathbf{b})$ can be expressed in the three forms

$${}_x T = a^r b^s (\mathbf{e}_r; \mathbf{e}_s) = a^r b_s (\mathbf{e}_r; \mathbf{e}^s) = a_r b_s (\mathbf{e}^r; \mathbf{e}^s),$$

which show the so-called contravariant, mixed and covariant indices, and the relative unimportance of these adjectives.

To define the Christoffel symbol of the second kind (the first kind has no essential applications) we write as definition

$$\frac{\partial \mathbf{e}_r}{\partial x^s} = \frac{\partial^2 \mathbf{s}}{\partial x^s \partial x^r} = \left\{ \begin{matrix} t \\ rs \end{matrix} \right\} \mathbf{e}_t, \text{ whence } \frac{\partial \mathbf{e}^r}{\partial x^s} = - \left\{ \begin{matrix} r \\ ts \end{matrix} \right\} \mathbf{e}^t.$$

These results together with the vector differentiation operator $\nabla = e^i \partial / \partial x^i$ contain the whole manipulation of differentiation. For example, we have the tensor

$$\nabla; \mathbf{a} = e^i \frac{\partial}{\partial x^i}; a_r \mathbf{e}^r = (e^i; \mathbf{e}^r) \left[\frac{\partial a_r}{\partial x^i} - a_s \left\{ \begin{matrix} s \\ ir \end{matrix} \right\} \right],$$

which gives the covariant derivative and shows that it is a tensor.

The considerations thus briefly indicated are of general application to n -space and to tensors of any order. Moreover, they render obvious the proof of, and the connexion between, such theorems as 16.6 and 17.6, which in spite of their dissimilar enunciations are merely statements regarding the basis and its reciprocal. Similarly, the Frenet formulæ in general co-ordinates follow at once from their ordinary vector form.

The book is beautifully printed and has many excellent diagrams and illustrations. It has also another claim to the student's attention, namely, the large number of exercises, many of which contain important theorems. There are a bibliography of works to which the author refers and a useful index.

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FORENSIC SCIENCE

Science for the Prosecution

By Dr. Julius Grant. Pp. vii+302+25 pl. (London: Chapman and Hall, Ltd., 1941.) 15s. net.

FORENSIC science, or the application of scientific investigation to the purposes of the law and the administration of justice, is an outcome of the older subject of forensic medicine or medical jurisprudence. Whereas forensic medicine deals primarily with offences against the person, forensic science covers a somewhat wider field and includes the investigation of offences against property.

It is only within comparatively recent years that the latter subject has assumed an important position in the investigation of criminal offences. The importance of forensic medicine, on the other hand, was recognized in Great Britain so long ago as the end of the eighteenth century, when voluntary lectures were given on it at Edinburgh, and were followed by the establishment by the Crown of a chair of forensic medicine in 1807 at the University of Edinburgh. This was the first of its kind in any English-speaking community. Although this subject has now become an integral part of the medical curriculum, and each medical school now has its lectureship on the subject, there is only one other full-time chair complete with its department in Great Britain, namely, that of the University of Glasgow.

Forensic science has gradually evolved from the

older subject, and in connexion with this may be mentioned the names of Lombroso of Turin, Locard of Lyons and Söderman of Stockholm. Institutions for the study of forensic science are (or were) in active operation in Paris, Lyons and Lille, that of Paris being founded in 1912. In Great Britain, the Metropolitan Police Laboratory was established in 1935, and this was followed by the establishment by the Home Office of Regional Forensic Science Laboratories at Nottingham, Cardiff, Birmingham, Preston and Wakefield. Although these laboratories are there to assist the police, the reports issued from them are naturally entirely independent as to whether they favour the prosecution or the defence, and they may be used therefore afterwards in a court of justice by either side.

Dr. Julius Grant has written a most interesting and valuable book on the methods used in forensic science. As he says in his preface, he has adopted a semi-popular treatment of the subject, the book being primarily intended for the lay reader and to introduce the subject to the lawyer. One feels that although it has this general appeal, it would be better for the reader to have some knowledge and interest in science before he could fully understand and appreciate its contents. It covers a wide field, embracing the work of the physicist, the chemist, the biologist, the pathologist and the psychiatrist. In other words, there are various chapters on optical methods, including ultra-violet and infra-red rays, X-rays, spectroscopy, the microscope and the camera, chemical methods, blood-group tests and serum analysis, and lastly psychology and crime. Of all the methods discussed, probably the most important and the one most frequently used is that of microscopy. This is fully admitted by the author, especially when the microscope is used in conjunction with the camera; but even the camera may not always be necessary.

Methods of examination by ultra-violet and infra-red rays are extensively used in this type of work, and the chapters dealing with these give a very clear outline of their importance and use. Although X-rays have not been used to any great extent up to the present, the most striking results have been obtained from the examination of oil paintings of the 'Old Masters'. The pioneer work of Prof. A. P. Laurie must always be remembered with regard to this type of investigation.

The chapter on chemical methods covers a wide field, from the detection of poisons to the decipherment of charred documents, the latter having assumed a certain degree of importance during the past two years. The blood-alcohol test is also dealt with, and one is glad to see the very fair opinion given of the value of the test.

The general reader will also obtain a good knowledge of the blood-grouping tests with regard to blood stains and paternity cases, and finally there is an interesting discussion on psychology and crime. It is doubtful whether such methods as those described in the use of the 'lie detector' would ever be tolerated in Great Britain.

In conclusion, it must be said that this book contains an amount of interesting information, interestingly set forth within a comparatively limited space, and can be recommended not only to those for whom it was apparently written, but also to those who are actively engaged in forensic laboratory work. The book is well illustrated with plates and diagrams.

J. DAVIDSON.