SPECTRUM ANALYSIS IN BIOLOGY AND MEDICINE.

THE late Dr. C. A. MacMunn covered a vast amount of ground in the difficult subject of the spectrum analysis of the pigments that colour both animal and vegetable tissues. It is to him more than to any other worker that we owe most of our knowledge of these complex and varied colouring matters, and a posthumous work,⁸ edited by Dr. J. H. Milroy, has recently appeared in which an account of his activities in this field is given. Dr. MacMunn was devoted to scientific research, but could find time for it only in the brief intervals of leisure snatched from a busy and fully occupied professional life, and he had no adequate library or laboratory facilities to help him. The work begins with a general account of the spectroscopy and the chromatology of plants and animals. Special chapters on chlorophyll, haemoglobin, the histohaematin, and myohaematin follow, and an account of the spectrophotometer employed for quantitative spectrum analysis. The last three chapters deal with fluorescence and phosphorescence, biliary and urinary pigments, and the pigments of invertebrates generally. The book forms stimulating and interesting reading, for its author was a versatile man of wide views, and thoroughly at home in the complications of the apparatus employed by the worker in spectrum analysis. It exhibits a certain incompleteness that is accounted for by the fact that its talented author did not live to see it through the press, yet it is really a valuable contribution to scientific literature. The subject is one that appeals to many besides medical men; the volume is excellently got up and illustrated, and should be in the hands of all who are interested in the study of either pigments or spectroscopy.

NOTES ON BOOKS.

MEDICAL officers of health and students of preventive medicine have of course long been alive to the importance of a knowledge of the methods of constructing and interpreting life tables, while the Insurance Act has made it desirable for other medical men to possess some familiarity with the principles involved in the preparation of morbidity tables. The publication of Messrs. ELDERTON and FIPPARD'S *Construction of Mortality and Sickness Tables*⁹ is therefore opportune. The authors have brought within the compass of 120 small pages a great deal of information and have avoided the introduction of any mathematical formulae which, in this branch of statistics, are apt to be of a kind particularly unpalatable to the ordinary reader. Any one who takes the trouble to read this book through should have no difficulty in following the actuarial discussions provoked by the Insurance Act, or, indeed, the reports of life assurance valuations. On the other hand, the medical officer of health who seeks a guide in the actual work of constructing a life table will not find this book sufficient, and must still refer to such sources of information as the papers of Hayward, Newsholme, and Stevenson in the *Journal of Hygiene*. We think the primer will be of use to many readers and serve as a good introduction to more technical works.

The health and comfort of the infant has been Miss WILENA HITCHING'S first consideration in compiling her book on *Baby-Clothing*,¹⁰ and she has succeeded in designing a layette which should meet the requirements not only of the baby itself but of the most fastidious and exacting mother. Her patterns have the crowning merit of simplicity; and even the least expert of needlewomen should find little difficulty in following her clear and explicit instructions. A large packet of well-cut paper patterns accompanies the volume, which is illustrated with numerous diagrams, and contains a short introduction by Sir James Crichton-Browne.

⁸*Spectrum Analysis Applied to Biology and Medicine*. By the late C. A. MacMunn, M.A., M.D. With a Preface by Professor F. W. Gamble. London: Longmans, Green, and Co. 1914. (Demy 8vo, pp. 125; 21 figures. 5s. net.)

⁹*The Construction of Mortality and Sickness Tables: A Primer*. By W. Palin Elderton and Richard C. Fippard. London: A. and C. Black. 1914. (Cr. 8vo, pp. 126. 2s. 6d. net.)

¹⁰*Baby-Clothing on Healthful, Economical, and Original Lines*. By Wilena Hitching. London and Edinburgh: W. and R. Chambers, Ltd. 1914. (Cr. 8vo, pp. 133; 26 diagrams, 10 patterns, illustrated. 2s. 6d. net.)

MOTOR AMBULANCES IN WAR SERVICE.

By H. MASSAC BUIST.

ALIKE at home and abroad there has arisen a sudden demand for motor ambulances for service with the British forces. The call has come so suddenly that the first method of procedure has been to improvise a number of motor ambulances by adapting various types of pleasure car chassis to the needs of the field, sometimes with the happiest results, at others with anything but a successful issue. The widespread nature of the need was sufficiently illustrated quite early in the war, when some of the wounded from the *Amphion* were taken from the dock to the hospital in the neighbourhood of Chatham in a lorry on a London General Omnibus chassis, a thing by no means suitable for ambulance work of any sort, despite the fact that in this country we have roads that foreigners tell us have surfaces of the billiard table variety. At the other extreme, one has seen examples of light car chassis transformed into ambulances, in which connexion it can only be said that those who have to travel on stretchers in them are to be pitied. Fortunately, whatever may have been left to desire in the necessarily hurried arrangements made at the very outset of war, there are sound grounds for believing that considerable discretion is being displayed in the further orders that are being placed for motor ambulances. Nevertheless, there may continue to be improvised from privately owned vehicles, or what not, various sorts of motor ambulances; therefore, in face of the fact that medical men all over the country may be called on at any time to advise in this capacity, it may be as well to draw attention to one or two points learned already as the result of the war, and to give a few general hints on the principles of constructing ambulances on motor chassis.

POINTS TO BE NOTED.

Among vehicles I have noticed that have gone to the front are sundry ambulances for the Australian contingent. One of these impressed me as being on chassis of too small and weak a character, comparatively ill-sprung, while at the other extreme there is what I consider to be the most intelligent improvisation of a motor ambulance that the campaign has so far afforded. An undertaker had a grey hearse on a Rolls-Royce chassis, so arranged that the back opened to take the coffin in and out. With a minimum of change in the interior arrangements, this has been made into a most perfect ambulance, and is deservedly the pride of the Australian outfit.

We have to remember that, important as it is that cars used for ambulance work at home should be well sprung, since they have to carry men suffering from all sorts of wounds, the issue of life or death from which may depend entirely on the amount of oscillation experienced, that point becomes of double importance on the Continent, where the average of roads to be traversed were, even before they were cut up by supply traffic, of very indifferent surface when compared with our own. It has therefore been recognized on all hands that smoothness of suspension is a very important factor. A mistake has been made in some examples that have come under my notice, however, through ensuring what is a plangent suspension by the use of various auxiliary devices called shock absorbers. Ideal suspension does not consist in supplying a plangent vehicle, because when indifferent road surfaces are traversed that plunges vastly too much.

What is wanted is a suspension that depends as little on auxiliary action as possible, and which itself has a certain amount of stability or stiffness. Therefore, if there is any choice of chassis that are being taken from among vehicles offered or commandeered, it is as well to look for springs having comparatively long leaves, for as broad a track and as long a wheel base as possible, and for large wheel diameter. If the springs prove particularly good, the size of the wheels matters the less. Thus, many large and powerful chassis have proportionately small wheels to give a low centre of gravity; but such wheels will be furnished with very deep section tyres. These, in combination with the springs, will give the necessary softness of action. A point particularly to be looked for in the chassis, especially in face of the fact that the number of really powerful ones available of a refined character will generally be found

comparatively few, is that the wheel base should be proportionately long.

OVERHANG TO BE AVOIDED.

The importance of avoiding overhang has been brought to mind from observing various old-fashioned chassis of short wheel base and of comparatively small size, say, the 16-20 h.p. size of three or four years ago—and limousine motor cars, also a little out-dated, wherein the rear part of the body projects a considerable distance behind the back axle. This is eminently undesirable for ambulance work, because the stretcher is being accommodated in that part of the vehicle which makes the maximum movement in response to the road shocks to which the machine is subjected in the course of travel. This is incidentally one grave disadvantage attending the system of transforming ordinary touring cars with Cape-cart hoods, as they are called, into ambulances by cutting out the back panel in hinged fashion. To overcome this by fitting extremely pliant springs, possibly supplemented by shock absorbers, may do reasonably well so long as the machine has to travel over the very best of our highways at a comparatively slow speed. Even so, however, when the stretcher is thus accommodated so that its mid-length about corresponds with the back axle, an unnecessary amount of side-swaying is occasioned when turnings are negotiated. Therefore, despite the good intentions that have promoted many endeavours in this connexion, all such practices should, if possible, be avoided, and the whole length of the stretcher accommodated forward of the back axle—that is to say, anywhere between the two axles, so that there is no overhang of any sort whereby all shocks, whether lateral or in a vertical direction, are reduced to the minimum.

In orders that have been placed for new vehicles, the authorities have shown an apt appreciation of these points by selecting chassis the springs of which are good as originally designed. It is as grave a fault to have a spring that is too pliant as one that is too stiff. Incidentally, medical men whose opinion is asked about ambulances for foreign service would do well to remember that at least an extra leaf to each spring is needed to achieve equivalent effects of suspension on the Continent to what will be obtained in this country without the use of such extra leaf; in other words, springs must be stiffer.

BRITISH RED CROSS SOCIETY'S SCHEME.

The British Red Cross Society asked *Cooper's Vehicle Journal*, the recognized organ of the coach-building industry, to design a temporary ambulance body for fitting to various sorts of chassis. The working drawings were issued by that journal in August, and may be recommended to the notice of medical men who desire that the approved design should be followed. One of the difficulties was to scheme the body so that it could be built quickly and cheaply, as well as to enable a common scheme to be suitable for fitting to any substantial touring car chassis that might be requisitioned. Nothing would have been easier than to fall into the error of building a top-heavy ambulance. This, however, has been skilfully avoided by providing the body with a well covered by substantial floor-boards which can be hinged back so as to leave an open space along both sides on which men are able to travel in a sitting position. All that is necessary to apply this standard form of ambulance body to various sorts of chassis is the insertion of suitably cut packing pieces.

In my humble judgement, the weak point of the design is that a rather long tail is rendered inevitable by its application to most chassis, for room has necessarily to be provided for stretchers of about 8 ft. in length, slipped in from the back, which is consequently left open save for a waterproofed storm curtain. By reason of adopting this mode of construction the ambulance body is cross-braced at the front. Whatever adaptation of existing body work is made, care should be taken always to ensure that the necessary reinforcement by cross-bracing should be employed to make up for cutting open the back to form doors or hinged flaps. Extended eaves provide ventilation, which can further be furnished at option at the front and sides, which are merely covered over with waterproofed material, such as unbleached calico treated with

boiled linseed oil, quite a cheap, yet eminently a satisfactory and durable job.

The coach-making industry of the country has entered fully into the spirit of the hour. A very considerable number of members of the industry, as well as of motor manufacturers, offered to construct ambulance bodies for the British Red Cross Society free of charge, and the work was put in hand some time ago.

POSSIBILITIES OF LENGTHENING CHASSIS FRAMES.

As previously pointed out, this matter of overhang is really the weak point of nearly all motor ambulances, save those that are constructed on chassis of exceptionally long wheel base. Most of these ambulances are needed quickly. But if a few weeks are provided for the work of adaptation, and only a small chassis or one of comparatively short wheel base is available among either commandeered machines, second-hand or privately owned ones given for the cause, very useful work may be done at comparatively small cost by submitting the chassis to the treatment of such firms as make a practice of adapting old chassis. At a comparatively cheap cost these concerns can lengthen the frame in a manner which would nevertheless be quite a substantial job. This question of carrying the stretcher between the axles, and of therefore having comparatively a long wheel base, is of even greater importance to ensure the maximum comfort than any mere manipulation of springs and spring gear.

SPHERE OF THE LIGHT CAR AMBULANCE.

In a large number of cases it is not necessary for the patient to be at full length, therefore it is not necessary always to have an overhang. This point comes out particularly when considering the many quite interesting schemes that have been brought forward for equipping light car chassis as ambulances. It is always best to secure those with comparatively long wheel base. Some light cars as standardized have come out really quite well under this head. Not much, however, has been done in this direction, and that little is almost entirely intended for home service, where, indeed, it is much more suitable than abroad, for these light car ambulances are primarily and essentially suitable for carrying men in a seated position. They usually have a flap, however, that can be let down into the form of a stretcher, quite two-thirds of which, and in some cases nearly three-quarters, then projects behind the back axle; but to mention this fact is alone sufficient to indicate the unsatisfactory nature of attempted adaptations of this sort.

A much more clever idea on a comparatively small car, and one which for that matter could be adapted to light car chassis, is one I have seen fitted to the smallest Fiat ambulance. In this the necessary length for two stretchers, with scarcely any portion projecting behind the line of the back axle, is ingeniously obtained by having them superposed and at the side of the driver, behind whom sits the attendant, who is therefore beside the heads of his patients as the vehicle travels forward. Like most of the ambulance schemes brought forward, this has canvas side curtains and hood, so that the vehicle can be used either as a wholly open, partially closed, or entirely closed ambulance, according to the condition of the weather.

For the most part, however, the fact that the light car chassis makes quite a good tradesman's delivery van, and that the exterior lines of a delivery van and of an ambulance body may bear a considerable likeness one to another, must not be taken as affording any indication of the suitability of the light car chassis to ambulance work. There is a vast difference between transporting mere goods and human beings who have been injured in battle, generally after experiencing days, if not weeks, of overstrain, often with the most irregular feeding, so that the system is not in the most favourable condition to withstand shocks in any case. The light car chassis should therefore be used only when it is a question of taking that or of having to give up all idea of providing a motor ambulance chassis. These vehicles are extremely valuable accessories to saving life, especially in cases where time is of the utmost moment, therefore a certain amount of evil can be put up with to ensure that end, when it may be a case of improvised motor ambulance of too small a chassis or none at all.

ADAPTING MOTOR CAR BODIES.

There have been sundry examples of adapting covered motor car bodies of middle and large sized chassis to motor ambulances carrying three and sometimes four stretchers. In all cases such instances, however, if the chassis is not a powerful one the body projects considerably behind the back axle line. Owing to the accommodation for the driver's seat, the forward part of the stretcher is only 2 ft. to 2½ ft. in front of the back wheel. When adapting a totally enclosed limousine body, this difficulty does not occur, because two stretchers can be carried, one above the other, quite along beside the driver, as in the case of adapting the small car type of chassis previously described.

It is possible to adapt the ordinary limousine bodies, wherein the drivers' seats are quite separate and are exposed at the sides, by cutting away the seat beside the driver, enclosing the two sides in front by putting up a glass window, and thereby moving forward the two superposed stretchers, care being had to cross-brace the body specially to accommodate the redistribution of load and stresses. This method is infinitely preferable to using the ordinary interior of the limousine or covered coachwork for the stretchers, even though in this, as in most cases we have been considering, we are to assume that sufficient sense is displayed to place the head of the patient in that position which will bring head and body as near as possible between the axles, so that if there is any overhang at all behind the back axle it will be from the waist line downwards.

This method, of course, has to be used in those cases in which ordinary four-seated touring cars with Cape-cart hoods are transformed into ambulances by making the back panel of the body collapsible to afford the necessary length for the stretcher. The patient's head, therefore, lies practically against the back of the front seats. A slight and simple extension of the ordinary rainproof motor car hood to take the place of the back panel when collapsed is easily effected.

THE EMERGENCY AMBULANCE SCHEME OF THE BRITISH
RED CROSS SOCIETY.

It may be as well for medical men to be reminded that the British Red Cross Society is engaged in organizing an extensive emergency service of motor ambulances, all offers in connexion with which should be addressed to Department 8 of the Society at 83, Pall Mall, S.W. The work is being further aided by the Imperial Motor Transport Council; while members of the Royal Automobile Club and of the Automobile Association have come forward in the most generous fashion with offers of vehicles. Any motor owners who discuss with medical men the question of lending cars for this work should be made clearly to understand that the Society only wants vehicles which are unconditionally offered for the whole period during which emergency motor ambulance service may be rendered necessary by the war. The motor owner must therefore be prepared for anything that is considered necessary to be done to his chassis, no matter how that may mutilate it from the point of view of the vehicle as a privately owned motor carriage. Of course, when cars are no longer needed they will be returned to their respective owners, while those owners may further be assured that during use every effort will be made to ensure that the cars will not be abused in any way, but will be submitted only to such legitimate wear and tear as is essential in carrying out the good purpose which can be the sole aim in lending them. The Society is, of course, not responsible in any way for deterioration, or even for the total loss of the car. Loss, however, is extremely improbable in view of the fact that the vehicles are needed only for service in this country. Motorists desirous of offering their cars may communicate direct with the Honorary Secretary, Imperial Transport Council, 173, Fleet Street, London, which, as already stated, is working in co-operation with the Society.

Though the members of the Automobile Association have already lent over 19,000 motor cars and motor cycles for war services, the names of other volunteers are still being taken, so that this organization itself may assist the Imperial Motor Council and the Red Cross Society by classifying the cars that it raises. It is therefore well to note that the make, horse power, date of manufacture,

type of body, and seating capacity should be mentioned, as well as whether the owner or his motor man drives the vehicle, the owner's telephone number, and his telegraphic address. Red Cross work under this head embraces the conveyance of officials to various dépôts, attending ports and railway stations to convey wounded on arrival to hospitals, and removing wounded from London to various convalescent centres. Of course cars with motor ambulance bodies for lying-down patients are in greatest demand. To assist members willing to have their vehicles so converted, the association itself has a variety of designs and estimates to enable such conversion to be achieved with the most moderate outlay, with, nevertheless, quite satisfactory results. Of course, comfortable landaulette, limousine, or cabriolet cars are also needed in numbers for carrying patients who are able to sit up.

A last point worth noting on this subject concerns the Scottish Branch of the British Red Cross Society, which has sanctioned an appeal made by the *Motor World* to open a fund the proceeds of which are being devoted to defraying the expenses of the motor transport work of this branch. Vehicles that have been offered to the Society are being converted into ambulances and all other necessary work carried out to provide a really adequate supply of motor ambulances. Mr. Robert J. Smith, Secretary of the Scottish Automobile Club, has been appointed convener of the Transport Committee. Individual subscriptions, limited to £1, may be sent to the fund being raised by the *Motor World*, 73, Dunlop Street, Glasgow, which has raised several hundred pounds in the course of the first ten days during which the appeal has been made. This is therefore a note for medical men in Scotland who may be asked what those can do to assist motor ambulance work who nevertheless have not cars to give or lend.

SCIENCE NOTES.

IN a communication published in the *Röntgen Society's Journal* for July Mr. Lawrence Bragg points out that not only does the analysis of x rays by crystals yield interesting results, but also the analysis of crystals by x rays. In using various crystals as diffraction gratings in the path of an x -ray beam, many types of spectra have been found, and in almost all cases it has been possible to assign them to corresponding peculiarities of crystal structure. As an instance of the connexion between the character of the spectra and the crystal structure, he refers more particularly to the case of the diamond. The octahedron face—denoted by crystallographers as the index (111)—of this cubic crystal yields a set of spectra which are peculiar in that, while the first, third, fourth, and fifth orders are well marked, the second is missing. If we look at the diamond structure we see that the planes parallel to the face are arranged in pairs in such a way that the distance between the planes of a pair is one-quarter that between successive pairs. In yielding the first spectrum the two planes of a pair do not act exactly in concert, but they do so sufficiently to give a good reflection. In yielding the second spectrum, however, the waves from two planes of a pair fit together crest to trough, and exactly annul each other, thus destroying entirely this reflection. For the third, fourth, and fifth spectra again the reflection is good. It is thus possible to find from the peculiarities of the spectra this paired arrangement of (111) planes, and so arrive at the structure of the diamond. Among other crystals whose structure has been found in this way are the rock-salt series, the calcite series, aragonite, zinc-blende, pyrites, galena, fluor, cuprite, and zincite. In the case of rock-salt structure, when x rays are reflected from a (111) face, the spectra are peculiar in that the first is weaker than the second, instead of the first, second, and third decreasing regularly in intensity as is normal, and this peculiarity is to be traced to the alternate arrangement of the planes of Na and Cl parallel to that face.

MESSRS. LONGMANS, GREEN, AND CO. will issue shortly a new part of *Quain's Anatomy* (eleventh edition, edited by Sir Edward Schäfer, Dr. Johnson Symington, and Dr. T. H. Bryce). This is the second part, vol. ii, and will deal with splanchnology, the author being Dr. Johnson Symington. There are 349 illustrations, many of which are in colour.