their experiments were not sufficient to decide the cause of this fall. That augmentation has taken place in many of François-Franck's experiments is quite clear from his own tracings, for where he includes the volume-curve of the lung there is always a quite marked increase in the volume-pulse which can only indicate an increased output from the right heart.

Turning next to our own experiments we have stimulated the white rami communicantes of the upper thoracic nerves, the sympathetic chain itself, and the fibres from the ganglion stellatum. We have also attempted to exclude any possible cardiac action by a preliminary division of all the branches of the sympathetic that we could find running into the heart. We have, however, found that it is quite impossible to divide all these fibres without injuring those running to the root of the lung. We have also stimulated the fibres at the root of the lung, but in this position we have only obtained completely negative results. The usual effect of stimulating the fibres leaving the ganglion stellatum is a fall in the volume of the lung, quickly followed by an increase. In some cases we recorded an increase in the volume of the lung from the start, and in a few cases, which, however, are very rare, we have observed a diminution in the volume of the lung during the whole time of stimulation. Wherever we got a diminution in the volume of the lung we invariably found an increased volume pulse, and simultaneously a rise in the aortic pressure. We think that the whole effect is best explained by the cardiac augmentation which these results indicate, and that it is not necessary to invoke any action upon the pulmonary vessels for their explanation. In those cases in which there is an increase in volume of the lung from the start there is usually an increased volume pulse and the aortic pressure shows in many cases practically no change, and lastly in those cases, the commonest, in which a preliminary diminution is followed by an increase in the volume of the lung the increase in volume pulse is well marked, especially at first, and there is a decided rise in aortic pressure, followed by a gradual fall as the volume of the lung increases. Stimulation of the accelerator nerve itself, after it has left the ganglion stellatum, produces as a rule an increased volume of the lung, with increased volume pulse. Hence we conclude that all the results that we have obtained can also be explained in the simplest manner as of purely cardiac origin, and we therefore attempted to detect vaso-constrictor nerves, if any are present, by a different type of experiment. The nerves to be stimulated having been isolated the animal was killed by bleeding; the blood was whipped and was placed in a reservoir. Meanwhile cannulae were tied in the pulmonary artery and in the left auricle. One lung was then ligatured at the root. The cannula in the artery was then connected to the reservoir and blood perfused at constant pressure through the intact lung. The outflow was then recorded by a graphic method. We never obtained the least effect on stimulating any of the fibres leaving the ganglion stellatum, and hence we conclude that there are no vaso-constrictor fibres to the pulmonary vessels. Experiments of this type, we think, would certainly have given us a positive result had such fibres been present, for it is easy to obtain such results with, for instance, the nerves to the vessels of a limb.

THE ACTION OF SOME DRUGS UPON THE PULMONARY CIRCULATION.

We have already stated the general effects of suprarenal extract upon the lung and pulmonary circulation. We have also investigated the action of the suprarenal on the pulmonary arteries by direct perfusion. It gives us a very striking result; whereas perfusion of very dilute suprarenal extract through any of the systemic vessels causes their almost complete closure, the effect upon the pulmonary vessels is in nearly all cases exactly the opposite—namely, a markedly increased rate of flow. Only in one instance have we obtained constriction, and then the effect, though marked, was in no degree comparable to that which we should obtain, for instance, upon a limb. These experiments are, of course, of importance in considering whether suprarenal extract is of value in hæmorrhage from the lungs, but our conclusions up to the present must be somewhat guarded because our experiments have not yet sufficiently decided the action of small doses. With regard to the volume changes produced in the lung by suprarenal extract the dog again shows a difference from the cat. The changes, though in the same direction, are very much smaller and the dilatation is more accentuated if

the vagi have been previously subdivided—a result which we should naturally expect from the much greater and more prolonged rise of aortic pressure that occurs under these circumstances.

The action of nicotine is somewhat similar to that of suprarenal extract, though, as it exerts less effect upon the heart, its action being mainly confined to the peripheral blood-vessels, the results are rather simpler. Still, they are in the same direction—that is, to the rise in the aortic pressure there follows a congestion of the lung and simultaneously a rise in the pulmonary vein pressure and pulmonary artery pressure.

Pilocarpine gives interesting results in that it tends to produce systemic vaso-constriction, the effect of which is, however, obscured by the marked cardiac inhibition simultaneously produced. If the cardiac inhibitory fibres be paralysed by atropine, pilocarpine produces practically the same results as nicotine. When given with the cardio-inhibitory mechanism intact it produces a great increase in the volume of the lung which is due to the cardiac inhibition. As this decrease in volume takes place it must mean that the output from the left heart is less diminished than is that from the right heart. Muscarine produces the same effects as pilocarpine.

THE EDUCATION OF EPILEPTICS.

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TWELVE years ago the first step in improving the position and comfort of epileptics in England was taken at Liverpool by the establishing of the epileptic homes at Maghull. Previously to that time our epileptics, if they were poor, were consigned to the imbecile wards of the workhouse, and if they were rich they were looked after by relatives or by attendants, or were taken as boarders by people of various classes of life, who for a consideration relieved the parents of trouble and responsibility without being always qualified for the duties which they thus undertook. The condition of those epileptics whose relatives were unable to engage caretakers and who did not wish to send them to the workhouse was often miserable in the extreme. The relatives were always kept in a state of constant anxiety and dread, and the patients were frequently so confined to limited surroundings and denied all liberty that it was no wonder that they became imbecile, stupid, or even insane. In spite of all the precautions of anxious relatives and attendants dangerous and sometimes fatal accidents frequently occurred, and the death of the unfortunate patient was too often considered a special providence and relief to all concerned. In the workhouses the patients were simply "herded" with the imbeciles and the harmless insane inmates, without any effort being made for instruction, employment, or amusements. The primary objects of the establishment of the colony at Maghull were to keep epileptic patients safe, to occupy and to train their bodies and minds, and to give them as much liberty as possible with due regard to their safety and to the feelings and prejudices of their neighbours. These objects have been successfully carried out and to an unexpected extent. But it was found as the work of mental and physical training progressed that the education of the patients was often in a very backward state and required to be dealt with.

Defective education arose from various causes. In a considerable number of cases the patients were kept from school by order of their medical attendants, under the plea that the brain must not be excited or that the patient must not be "bothered." The patient was allowed to do whatever was most agreeable—and education that necessitates "going to school" is not generally agreeable to a large majority of young children. The relatives, following up the professional advice to its logical conclusion, allowed the patients to do as they liked in all other matters as well as in regard to education, and the little rascals soon found out that they could compel the relatives to give them whatsoever they wanted by simulating the symptoms of the onset of an attack. This course of treatment of young epileptics cannot be too

strongly or too publicly condemned. The growing brain that has been disturbed by a fit can only be strengthened and improved by judicious education, especially by teaching habits of self-control and of self-denial such as have to be taught to all other children. It cannot be wondered at that the very opposite treatment produces little savages that have developed habits very difficult to eradicate, and that any information which they possess is very often useless or of an undesirable kind. The most frequent cause of deficient education was, however, found to be the direct effect of the epileptic attacks. We have had several examples of patients who before epilepsy developed were bright, intelligent, and even precocious children, and who promised to become good scholars and to be a credit to their parents and their teachers. Sometimes after the first attack, or sometimes after a series of attacks at the onset of the disease, the brains of these children have been, as it were, swept clean like that of a baby, and the patients have become suddenly dispossessed of all the knowledge they had acquired. In many of these cases, however, only certain of the mental faculties are impaired. The faculty of computation suffers very frequently (in some notable exceptions this faculty curiously has remained strongly developed amidst a very general wreck), and memory also suffers severely.

Re-education is a slow, difficult, and irksome process under such cerebral conditions and requires to be intelligently carried on and in directions suitable to each case. Sometimes re-education has to be entirely of a mechanical kind as the patient does not appear to have any powers of continuous thinking but is well able to direct his physical energies. Others learn with avidity and soon regain what has been lost. In other cases certain faculties are highly developed; the musical, the imitative, and introspective faculties are instances of this. In the latter most minute self-analyses are constantly being made and these do not conduce to the patient's happiness and welfare. Other children will labour diligently to re-learn to write, to read, and to cipher, but the task is a very uphill one on account of the great defectiveness of their memory. The lessons of the day, that seem at the time to be thoroughly studied and acquired, are to a large extent forgotten by the next afternoon, and teachers are prone to give way to despair until they find out that the normal rate of progress is necessarily slow; but still there is progress and that progress increases as the experience of the teacher in teaching epileptics increases. The education of epileptics can best be carried on after close consultation between the medical officer and the teachers, so that the latter may be prevented from wasting strength and enthusiasm in trying to educate a faculty of the brain that has been entirely lost and may devote their energies to the education of those powers which still remain, and so to educate them that they may be of practical use to the patient in after years. The education of our patients resolves itself into two classes—first, of all those who are of the ordinary school age, and secondly of older patients whose education has been defective, or in whom the results of early education have been lost through the disease from which they suffer.

The great majority of the patients at Maghull have had opportunities of being educated and have been to school up to puberty. An analysis of the notes of 385 patients shows that 162 did not leave school till the age of 15 years, that 63 did not leave school till they were 12 years of age, and that 58 did not leave school till they were 10 years old; 18 have been educated at home, while 37 have either not been at school at all or were so irregular that they had no education whatever. Of 39 we have no information as to how they have been educated. The state of the education of these patients when they were admitted to the home was in 45 cases *nil*, in 87 imperfect, in 119 fair, and in 134 good. In these 385 cases we find that in 47 cases epilepsy began soon after birth, in 38 cases before five years of age, in 87 cases before 10 years of age, in 25 cases before 12 years of age, in 39 cases before 14 years of age, and in 122 cases after 14 years of age, so that in 186 cases epilepsy did not set in till the children were over 10 years of age.

The children of school age whom we have at Maghull are under the care of a teacher who trains them as far as possible according to the capacities of their minds and with whom they spend a certain number of hours daily either at work or at play. The adults whose education has been defective or has been impaired by the disease go to an evening continuation school managed by teachers according to the requirements of the Board of Education. This

continuation school has been very satisfactory in every way. It interests the patients, it improves their education, and it occupies in a useful way a certain number of evenings during the winter season. The school inspectors approved of it very highly and we have been able to obtain a small grant from the Education Department. The subjects taught are reading, writing, arithmetic, wood-carving, joinery, and different technical subjects.

The day-school for the children has been equally beneficial from every point of view, except that of the Education Department. When we applied to that Department for a grant to our day-school we found that we had to comply with certain regulations which seemed to us very unnecessary and even undesirable. Our establishment has *grown* up, the buildings being added according to what we, from experience, decided would best supply our wants. The Department has, however, laid down certain arbitrary rules for the education of epileptic children, conspicuous amongst them being the following—viz., that the children must live entirely on the ground floor, and not have to ascend stairs of any kind; that not more than 15 are to live in one cottage; and that there are not to be more than four cottages in any one establishment. The children must also be completely isolated from adults during the whole course of their school life. Now, we could not fulfil these conditions without recasting our colony, incurring great expense, and giving up principles of management too precious in our opinion to be abandoned without sufficient practical reasons for the change. At the time that we made this application the only other home in England was that at Chalfont, and on applying to the authorities there we found that although they had built cottages much smaller than any of our buildings and could have managed to comply with the "ground-floor law" they could not fulfil the requirements of the Education Department, and we believe that they have consequently arranged not to undertake the task of educating epileptic children under the Department. We persevered, however, with our application and the Department sent down an inspector. The final decision was that the Department would not assist us by any grant in educating the few children whom we had at our home at Maghull unless we would spend a large amount of money that we could ill afford to use for this purpose.

Now, the question that has sorely puzzled us is where the experience that dictated the regulations for the treatment of epileptic children was obtained. Our home at Maghull was the first establishment of its kind in Great Britain, and that at Chalfont the second, and although there are others being constructed none of them have yet come before the public as working institutions. The Maghull Home has been in existence for 12 years and now contains about 140 patients of all ages and sizes who have been going up and down stairs all these years, and we have not found that the stairs are so dangerous as to require their abolition. Indeed, as far as our experience actually goes, the patients seem to be safer on the stairs than they are on the ground floor. Of course, this seems a ridiculous statement, but it has reason on its side, as patients when exercising their faculties do not as a rule have attacks. It proves that this idea of no stairs, as far as danger to epileptics is concerned, is an old woman's fancy. It is a view that appeals to the ladies and we have had often great difficulty in freeing strong and vigorous epileptics from the thrall of affectionate relatives who are only content when their epileptic, the object of their care, is on a bed or a sofa with somebody sitting alongside. We have occasionally seen epileptic patients going down the stairs in their own houses. A nervous mother or other relative stands at the foot of the stairs calling out from below in a tone of anguish, "Be careful," or "Take care"; two other relatives hold the patient at either side, all in a state of dread and excitement that certainly should be sufficient to induce a fit if anything could possibly induce one; and probably a fourth walks behind calling out directions from above. The patients are, of course, very indignant—and, I think, justly indignant—at being treated as such helpless objects, and would it be any wonder if after years of such precautions such patients would actually at the last find themselves unable to go up or down stairs at all? Where did the Department of Education learn this experience of the dangers of stairs? Certainly not in Germany, for we have been through a good number of the institutions in that country, and we have not found any epileptic institutions where they have not stairs. In fact, the stairs seem to be

more in evidence there than in any home in this country. We do not advise steep stairs. We have made safe stairs, and we take care that certain patients go down stairs in the morning and stay down as far as possible till the evening, and that they are watched by nurses during the time that they are going up or down stairs, and we do not think that anything more is necessary in regard to stairs. An epileptic may easily lose his life even in a padded room unless he is looked after, and when well looked after epileptics are safe under all usual conditions of life. We believe in supervision, and not in architecture, for our patients' safety, and our experience has fully justified our faith.

The Education Department does not propose that these children shall be kept in stairless houses all their days. They will grow up to adult life. They will go home or they will go to other institutions, and it is not practical to insist that people who have epileptics in their family must keep them down stairs all the time, or that institutions or people who have anything to do with adult epileptics should have rooms for them on the ground floor, and yet such would be the logical inference to be drawn from such regulations. If not, it is certain that if children are not allowed to go up and down stairs during their school life they will be very much less fitted for going up and down stairs safely if they only begin the ascent and descent when their habits have been acquired. I think that we may therefore call upon the Education Department to show some valid reasons for this regulation or to delete it from the conditions of epileptic schools. Besides, at the present stage, when the practical education of epileptics is really confined to one or two institutions, it seems a mistake not to encourage efforts to correct this defect of the educational system until the Government or a local authority has established schools.

We now come to the second regulation—of not having more than 15 children in a cottage, and of their being entirely separate from adults. Of course, the idea of the Education Department is to imitate family life. Well, 15 is a large family, and the idea of calling this "family life" pleases philanthropists who have a crank that way more than it really imitates in any sense of the term what we understand by family life. Family life means father and mother, big brothers and sisters, and small brothers and sisters, and servants and attendants of various kinds. The big ones look after the little ones and they do each other good in their offices towards each other. In family life they go to schools, they mix in the playground with all sorts of boys and girls, at home they come in contact with relatives and friends, and in the streets and lanes they meet with strangers old and young. In these Government epileptic schools, limited by sex and by age, and with strangers looking after such a large number, where does the family life come in? The children in these schools will be useless and helpless noodles unless after leaving such a school they are "licked" into human shape by the influences that mould the best humanity. We maintain that we have the best family life at Maghull. The boys and the girls live in separate buildings, where they sleep, of course, in separate rooms from the adults. From each building they go to school—a mixed school. Here they are under the teacher for the day, but in the evenings they take part in social life, and share in entertainments with the bigger boys and girls, due precautions being taken through the constant supervision of nurses that the companions are suitable and that the bigger patients who would take up with a younger child are suitable for that companionship. We know that special care has to be taken with epileptics in these matters, but knowing that we think in this respect also that the careful looking after by attendants is far better for the training of all classes and both sexes under natural conditions than is government by stone walls.

Then, again, the schools to be recognised by the Education Department are not to have more than 60 children altogether. Now, it has been hinted at in the beginning how the minds of epileptics are altered by the disease and how various must be the means of education, how numerous must be the classifications, and how many teachers there must be to instruct each classified group in a school of only 60 children. The necessary teaching would be most unnecessarily expensive under such restrictions. Some classes would only consist of two or three children and in all cases the classes must be necessarily small. But if we had a larger number of children to group we could then manage to give each teacher the full number of children who can be taught together and so limit the expense in a reasonable

way. At the same time we would be able to maintain the necessary amount of emulation in large classes that could not be kept up if the number in each class were too small.

We are looking at the matter from a practical point of view. We have no rates to fall back upon, and the regulations which I have described really put it out of the power of philanthropic institutions to overtake the education of the children according to the rules of the Education Department. But teaching the children as well as the adults is a therapeutic measure. We believe that it tends to the recovery of the children that they should be educated, and for this reason we are retaining our school unassisted by the Education Department. We think, however, that an unnecessary obstacle has been placed in our way and that institutions having the care of epileptics have been discouraged where they should have been encouraged.

Liverpool.

A SHORT CONTRIBUTION TO THE STUDY OF GENERAL INFECTIONS PRODUCED BY THE STAPHYLOCOCCUS AUREUS AND BY THE STREPTOCOCCUS.

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THE general infections produced by the pyogenic micro-organisms (staphylococcus and streptococcus) are well known; there is therefore no necessity to speak of them in general. But the narration of particular cases is always, I think, of great utility because in them it is often possible to find some interesting feature. For this reason I wish to describe briefly some cases that have come under my notice in the course of my practice. Two of these, which I published in an Italian medical journal, *Il Policlinico*, in 1898, were caused by the staphylococcus aureus.

CASE 1.—The first of these two patients was a medical man who suffered from a spot of chronic eczema behind the left ear. This spot was very irritable and he was constantly scratching it, sometimes producing excoriations. One day he opened an abscess on the arm of a female servant and then went to disinfect his hands, but on the way he scratched the spot behind his ear. Two days afterwards he noticed near this spot a very red painful swelling which rapidly became larger and more painful and his temperature rose to about 102° F. A surgeon who was called in three days afterwards made a deep incision in the phlegmon, but very little pus came out. The wound was dressed frequently during the ensuing week and appeared to improve. In spite of this the general state of my patient became worse and worse and his temperature continued very high (from 102° to 104°). It was not possible to find a local condition adequate to account for this high temperature, so I supposed that a general infection had resulted from this abscess. A vein of one of his arms was punctured in order that a bacteriological diagnosis might be made and at the same time care was taken to isolate the micro-organism which caused the abscess in the woman. In both cases I found the staphylococcus pyogenes aureus in pure culture. Some days afterwards small abscesses were observed in different parts of the male patient's body, all of them being caused by the staphylococcus pyogenes aureus. The only internal lesion that he presented was a serous pleurisy, in which I found, not the staphylococcus aureus, but the staphylococcus albus. The abscesses that I opened, some of them as large as a man's fist, from the beginning to the end of the illness were about 60 in number. The patient's temperature remained always very high and he died in two months with symptoms of cardiac paralysis.

The woman had many other abscesses in different parts of her body after the one in her arm, but she made a good recovery, and it is necessary to observe that except for the pain caused by some large abscesses she was always free from fever or other complications and was able to attend to her work.

From this case two inferences may be drawn. 1. Considering that the staphylococcus pyogenes aureus produced