treatment, but if serum is then withheld it not infrequently happens that the patient becomes worse.

It is unfortunate that no reliable method of standardization has yet been arrived at. Many of the commercial serums on the market are quite useless, and may lull the administrator into a false sense of security. It is to be hoped, and I believe justifiably, that the Ministry of Health or the Medical Research Council will undertake to standardize and guarantee as far as possible all varieties of therapeutic serums.

Dr. GARDNER ROBB (Belfast) agreed with Dr. Arkwright that polyvalent serums were of more general use than monovalent serums. Had he Dr. Gordon at his elbow to type the organism it might be a different matter, but left to his own devices he would certainly use the polyvalent serum. In his opinion the results with polyvalent were as good as those with monovalent serum if the statistics were carefully studied. The disadvantages and want of experience of early workers must be remembered. Fallacies might arise if age periods were not taken into account. In infants, for instance, the mortality was much higher than in people of military age. In infants an early diagnosis was much more difficult. They were brought to hospital late in the disease, and the results of treatment could not be as good. The death rate of cerebro-spinal meningitis at Belfast, taking all cases, was 27 per cent. In military cases it was 12 per cent. But when infants were excluded the civilian death rate was only slightly above that of the military.

Dr. SCOTT agreed with Dr. Arkwright as to the difficulties of separating the different strains of meningococci. He did not think there were any magic number of types. The four types described by Gordon were the commoner ones. The meningococcus was a common inhabitant of the nasopharynx. Under conditions of overcrowding it passed rapidly from one individual to another and thereby acquired special virulence. If the passage of the coccus from one individual to another could be prevented its virulence did not increase.

OPENERS' REPLIES.

Dr. ARKWRIGHT, in reply, remarked that there were many things he would like to say but time did not suffice. In reply to Dr. Tulloch, he thought the latter had misunderstood his statement about *B. tetani*. He had quoted Dr. Tulloch's own work. The character of toxin production did not correspond to the varieties of agglutination reaction. With regard to the figures on the board to which Dr. Tulloch took objection, he had merely put them up to show that there were a certain number of strains which Dr. Tulloch had been unable to group. He assured Dr. Tulloch that it was not of Schmitz's bacillus that he was speaking when he referred to the difficulties of agglutinating varieties of *B. dysenteriae* (Shiga). In classification one must take several characters into account. To trust to one character alone was rather like putting the leopard and the giraffe into the same group because they both had spots. Agglutination alone was not a safe guide. For finding similarities one method, simple agglutination, was good, for finding differences absorption was useful. Gordon's groups were too hard and fast. The real importance of grouping lay in its practical application to clinical considerations and to the manufacture of therapeutic serums. So far, the division into numerous subgroups had not been proved to have practical results. He wished there had been time to discuss other aspects of the subject. It would have been interesting to get more evidence as to the mode of entry of the organism.

Dr. GORDON said that any effort to limit the spread of the meningococcus must take into account the varying susceptibilities of different classes of individuals. Recruits were much more susceptible than old soldiers. Prevention of overcrowding was the most important measure. The steam spray was only advised when overcrowding was unavoidable. It was effective in lowering the incidence of the disease. Vaccination was inadvisable. Prophylactic inoculations were tried in one brigade, but the results were not encouraging. The war was a test of bacteriological efficiency. The crucial test was the ability to prevent

and cure cerebro-spinal fever. The differentiation of the meningococcus into four main groups by agglutination (and absorption) in 1915 was confirmed by the experience of four succeeding years. At the present time four groups of meningococci were recognized in France and apparently in America also. He thought Dr. Arkwright's doubts were answered by the results summarized in his paper. No doubt the groups of meningococci could be subdivided still further. The complexity of Type II had always been insisted on. For the successful identification of the meningococcus in practice the same standard procedure was used throughout. The same medium—namely, tryptic agar, which contains pea extract—was employed, and care was taken to obtain monovalent agglutinating serums representative of current strains. It was a testimony to the care taken by Major Bell, who prepared these agglutinating serums latterly, that out of the last 200 meningococci received at the Central Laboratory only one was unplaced. In practice the identification of meningococci was simple; there were needed: (1) suspensions of meningococci of four types (2,000 million per cubic centimetre); (2) monotypic agglutinating serums for these types of known titre; (3) control normal serum; (4) small tubes, racks, pipettes, saline, and 55° C. incubator. The procedure was so simple that bacteriologists who had never done it before were taught it in a few days. As regards monovalent *versus* polyvalent serums, monovalent serums were only undertaken as a preliminary to producing an efficient polyvalent serum later of standard quality.

A PHYSICAL THERAPEUTIC CENTRE:

AN EXPERIMENT BY THE NORTH STAFFORDSHIRE COAL AND IRON MASTERS ALONG THE SUGGESTED LINES OF FUTURE MEDICAL SERVICE.

BY

T. LISTER LLEWELLYN, M.D. LOND.,

MEDICAL OFFICER TO THE NORTH STAFFORDSHIRE COAL AND IRON MASTERS.

In view of the great interest which is being taken in the interim report of the Medical Consultative Council,¹ and of the report of the Departmental Committee on Workmen's Compensation,² the following account of the establishment and the results of the first year's working of a "massage centre" for the treatment of injured workmen will be interesting both to medical men and to employers of labour.

In the interim report great stress is laid on the establishment of local centres; in the report of the Departmental Committee it is recommended that any medical and surgical aid necessary in addition to the medical treatment already available under the National Insurance Act should be provided at the cost of the employer under a comprehensive scheme to be worked out in co-operation with the Ministry of Health (2, paragraph 75).

The employers of the coal and iron industries are united in this district in a mutual indemnity society, and the "centre" has been established and financed by them for the free treatment of injured workmen in receipt of compensation. Although the methods of treatment employed are in common use to-day, it is thought that the "centre" in question is the first of its kind in this country, combining in itself the two principles of local centralization of the future scheme of the Ministry of Health and of medical responsibility of the employers under future Workmen's Compensation Acts.

Reasons for Formation of Centre.

It was pointed out to the employers that much time was lost by the workmen from lack of what might be called intensive after-treatment of injuries by daily massage, suggestion, and exercises. It was shown that the local institutions, largely from overcrowding by pensioners, were overworked, and that the panel practitioners were not in the position to carry out the necessary treatment. The employers realized that any efforts on their part to alleviate the sufferings and bring about the return to normal function of their injured workmen would be greatly appreciated by the workmen themselves.

Establishment of Centre.

The district is comparatively compact, and the train and tram services are good. The number of employees is

45,000, and 80 per cent. live within a five-mile radius of the centre. The President and Past-President of the local Branch of the British Medical Association were asked to advise as to procedure. It was decided that, if the employers' medical officer thought that any man attending for examination in accordance with the regulations of the Workmen's Compensation Act would be benefited by special treatment at the centre—the medical practitioner in attendance should be notified and his permission obtained. The following letter was drawn up (to be sent by post):

-Dr.

I saw your patient this morning, and think a course of massage (and electrical treatment) would accelerate his recovery. With your permission I will arrange this course of treatment at our centre (address given). If you agree, no answer need be sent to this letter, but I should be pleased to receive any suggestion you desire to make.

(Signed)

.....
Medical Officer.

Once the permission was given, the man was then considered to be under the care of the employers' medical officer. The staff and equipment of the centre was as follows:

Personnel.

Employers' medical officer in charge.
Two masseurs, both ex-sergeants of the R.A.M.C., with special experience of massage, physical drill, general athletic training, and electrical treatment.

Equipment.

One large furnished room in the local Church Institute was hired at a rent which included cleaning, light, and a supply of hot water, and equipped as follows:

Two couches for massage.
One Mennell's combination apparatus.
One bicycle on rollers (home-made at inclusive cost of £5 10s.).
Two pairs of Indian clubs (one very light—sceptres).
One pair of grip dumbbells.
One pair of Terry's spring developer.
Rubber balls and home-made finger exerciser.
One galvano set with hospital outfit complete—faradic coil, metronome, set of Schnee baths, etc.
One electrical vibrator.
One cupboard containing: Two blankets, four pillows, one dozen towels, four white coats, nail-brush and soap, box with cards and card index, stationery, olive oil, boracic powder, two driers, solutions of sodium iodide, sodium salicylate, and sodium chloride for ionic medication, iodine, lint, bandages.

ROUTINE OF TREATMENT.

The injured workman received, either directly or through his medical attendant, a slip containing diagnosis, prescribed treatment, and directions for finding the centre. Particulars of each patient were entered on a separate card, which was stamped for every attendance. Each week the workman was given a certificate by the masseur, stating the number of attendances and entitling him to travelling expenses.

The object of the treatment was explained to the man, and every effort was made to secure his intelligent co-operation. On his first visit successful cases were brought to his notice, and the influence of suggestion was employed whenever possible. Great stress was laid on the use of exercises which could be repeated by the patient at home. In the early stages of active movements the necessity for mental concentration on the movement is insisted on; for instance, if the man has to dorsiflex his foot he is told to say to himself with each movement "I am bending my foot."

Cases Illustrating the Results of Daily Massage and Exercises.

J. H. July 18th, 1919, fracture of femur, upper third. September 29th, treatment started. December 16th, resumed light work.

J. B. April 9th, 1919, fracture of left tibia. January 8th, 1920, treatment started. April 28th, resumed work.

J. K. January 9th, 1920, dislocated shoulder. January 20th, treatment started. February 6th, resumed work.

G. M., aged 61. August 16th, 1919, dislocated shoulder. August 20th, treatment started. September 8th, resumed work.

Compare the last two cases where treatment was started soon after injury with the following:

J. L., aged 64. Dislocation of shoulder one year ago. Marked limitation of movement and wasting of muscles of shoulder girdle. No work since accident. July 8th, 1919, treatment started. August 10th, resumed light work with good range of movement of shoulder.

One of the most striking cases was the rapid recovery of a crushed hand with marked swelling of all the fingers

and complete loss of movement. There was no fracture, but all the finger-joints were swollen. Treatment was started two days after injury and there was complete movement in all the joints in twelve days.

Walking Exercises.—Special attention has been paid to walking exercises. Patients continue to use their crutches for long periods because they are afraid to trust to their injured leg, and forget how to use it properly. All men arriving on crutches are given walking exercise at once. They are taught to walk by numbers, and the results of a few lessons are very striking.

J. T. April 14th, 1920, fracture of second metatarsal bone. May 21st, came to centre on two crutches. May 26th, walking with one stick. June 5th, resumed work.

D. S. September 4th, 1919, sprained ankle and contused foot. September 24th, came to centre on crutches quite unable to walk. September 25th, walked across room without help. October 13th, resumed work.

Directions for Exercise.—From position of hips firm. One, the whole weight resting on the right leg, carry the left foot forward about twelve inches, toe raised, heel touching ground. Two, whole weight remains on right leg, left foot flat on ground, both legs braced. Three, weight transferred to left leg, right heel raised, both legs well braced. Four, flex right knee and prepare to carry right foot forward at "one."

In all cases massage was started in the proximal segment of the limb, and the value of "taking the stopper out of the bottle" (Mennell)³—that is, starting with massage to the thigh for injuries to the ankle—was strikingly proved in many cases.

H. B. February 17th, 1920, contusion of leg with septic wound on outer side of ankle, oedema of the leg, and varicose veins. May 27th, massage to thigh started. The wound, which had been open for over two months, healed soundly in a week. June 14th, resumed work.

W. P. January 11th, 1919, fracture of femur. June 24th, brought to centre in a chair. Marked oedema and swelling of the whole of the left leg. Movement at knee-joint lost. July 6th, the leg is still swollen but the man is able to get about on crutches. Movement at knee, 25 degrees. August 15th, walking with sticks. September 26th, started light work. Knee movement complete.

J. L. October 6th, 1919, laceration of hand. The wound, which extended across the back of the hand, refused to heal. December 3rd, massage started. The wound healed in less than one week.

Resistance Exercises.—Two cases of disordered action of the heart resulting from strain were treated with graduated resistance exercises combined with light massage and faradism over the cardiac area. The results were not satisfactory, although the men eventually returned to work.

Electrical Treatment.

In all cases where there had been marked wasting of the muscles interrupted galvanism was given in addition to massage and exercises.

J. D. Severe contusion of right leg with drop-foot and R.D. in anterior tibial group of muscles; resumed work in four and a half months.

G. F. January 9th, 1920, operated on for exostosis of femur said to have been caused by a blow. March 4th, very marked wasting of muscles of thigh with stiffness of knee-joint; treatment started. March 11th, knee can be completely flexed. May 1st, resumed work.

In the early stages of injury to the back, treatment with massage, exercises, and vibration was generally successful. In the more chronic cases, and especially where a state of neurasthenia had followed an old back injury, general galvanism with Schnee baths, and faradism to the spine were employed with a certain amount of success.

A. P. December 10th, 1918, strained back. July 12th, 1919, typical neurasthenic, complaining of general pains, palpitation, nervousness, and inability to bend back. Treated with general massage, suggestion, galvanism, with Schnee baths, vibration, and general exercises. He resumed work after three months, and is now working five turns a week driving an underground haulage engine.

G. B. October 30th, 1919, general bruising of body. April 14th, 1920, no work since accident. General pains in the back. Unable to lift any weights. Treated with general massage, exercises, and galvanism to spine. May 1st, resumed work.

W. D. January 24th, 1919, strained back shortly after return to civil life. Complaints of constant pain in the back, increased on movement; unable to lift anything or to lace his own shoes. Magnificent physique—sergeant-major, drill instructor. No physical signs, except a pulse rate of 100. August 11th, massage to spine and mild faradism through hand of operator. The man refused to attend after the second day. Pressure was put upon him and he attended irregularly for four months without any improvement. The case was then commuted.

J. L. January 14th, 1919, strained back lifting load. Kept in bed in cottage hospital for several weeks. October 8th,

complains of pain and weakness of the back. Walks bent up with the help of a stick. Schnee baths and general massage. He attended regularly, and made such marked progress that he resumed work at the coal-face on February 13th, 1920. He was unable to satisfy his fellow workers, and gave up work on March 23rd. The man is quite fit for light work, but is still unable to follow his old employment.

Ionic Medication.—Treatment with ionic medication was carried out in cases of synovitis of the knee-joint which did not yield to the ordinary treatment. Ionization with sodium salicylate was used in painful affections of the joints. In three cases of chronic suppuration near the ankle ionic medication gave temporary relief, but all three cases were eventually transferred back for surgical treatment. One interesting case of miner's elbow yielded to ionization with sodium iodide:

G. N., whilst attending the centre for contusion of the right shoulder, suddenly developed a large bursa over the left elbow. Ionization with sodium iodide cleared up the condition in one week. The man returned to work and the bursa reappeared. It was again successfully treated in the same manner. The chief interest of the case is the sudden appearance of the bursa while the man was "playing."

GENERAL RESULTS OF TREATMENT.

It is interesting to note, as showing the growth of the centre in the esteem of the local medical men and the workmen, that 181 cases were treated in the first six months and 310 in the second six months. The appreciation shown by the workmen for the efforts made by the employers on their behalf has been very gratifying. It is important to note that many long-standing cases were taken over by the centre and that return to work does not necessarily mean return to old employment.

Table Showing the Number of Workmen Treated, the Average Attendance, with an Analysis of the Cases.

Total number of cases treated	...	491
Number of attendances	...	7,558
Number of working days	...	300
Average weekly attendance	...	145
Average daily attendance	...	25
Average attendance per case	...	15.4

All Cases.

Completed cases	...	446
Still under treatment at centre	...	42
Transferred for surgical treatment	...	3

Completed Cases.

Returned to work	...	425
Settled for lump sum	...	12
Not improved	...	6
Refused treatment	...	3

Analysis of Completed Cases.

Upper Extremity:		Average Attendance.	
Contusion of fingers or hand	...	61	6.7
Cellulitis of hand	...	10	31.0
Fracture of thumb	...	2	16.0
Fracture of fingers	...	16	15.0
Fracture of metacarpals	...	13	15.0
Amputation of finger	...	9	12.0
Contusion of wrist	...	15	12.0
Contusion of forearm and elbow	...	11	9.0
Fracture of forearm	...	18	13.5
Dislocation of elbow-joint	...	3	27.0
Fracture of humerus	...	3	13.0
Contusion of shoulder	...	12	13.0
Dislocation of shoulder	...	9	27.0
Fracture of clavicle	...	2	5.0
Lower Extremity:			
Contusion of foot	...	21	7.0
Fracture of metatarsal	...	10	18.0
Fracture of astragalus	...	1	32.0
Contusion of ankle	...	11	5.5
Fracture of leg	...	33	30.0
Synovitis of knee	...	46	16.0
Contusion of thigh	...	9	10.5
Dislocation of hip	...	1	7.0
Fracture of femur	...	5	46.0
Fracture of pelvis	...	1	48.0
General:			
Contusion of chest	...	9	8.0
Strained back	...	64	9.5
Neurasthenia following old back injury	...	9	48.0
Miner's elbow	...	1	9.0
Post-operative muscular wasting	...	1	24.0
Paralysis of anterior tibial nerve	...	1	64.0

Settled Cases.—Twelve cases were settled; all of these showed considerable improvement, but no suitable work could be found.

Injury to back 6 (3 neurasthenics who only showed slight improvement).

Fracture of pelvis 1, fracture of femur 2, fracture of leg 1 (all these men were able to do light work).

Fracture of thumb 2 (settled for small sums).

Not Improved (6 cases).—Injury to back 3, old dislocation of shoulder 1, old fracture of wrist 1, contraction of hand due to cellulitis 1.

Refused Treatment (3 cases).—Neurasthenia following injury to back 3.

Still under Treatment at End of Year (42 cases).—Twenty-three cases returned to work at the end of the thirteenth month, and in only two cases is complete failure anticipated. These are two cases of rheumatoid arthritis of the knee-joint where injury has supervened.

COST OF ESTABLISHMENT AND CURRENT EXPENSES.

The apparatus and electrical outfit cost £92. The current expenses were: Wages £366, rent £39, sundries (drugs, dressings, etc.) £14—a total of £419.

Allowing one quarter of the original cost for depreciation, the total cost of the year's working was £23 + £419 = £442. As the total number of cases treated was 491, the average cost per case was 18s. The cost of travelling expenses is not included, and will of course vary with each district. Where the medical officer is not a full-time official, it will also be necessary to add his pay to the current expenses.

With the present high wages the full compensation of 35s. a week is paid to everybody. It is only necessary, then, to expedite the injured man's return to work by one week to make the massage centre a financial success. The employers are quite convinced that this result has been achieved. If the recommendation of the Departmental Committee becomes law, compensation will be paid at the rate of £3 per week, and the saving effected correspondingly greater.

GENERAL CONCLUSIONS.

The loss of function which results from disuse, formation of adhesions in joints, and, above all, from the mental inertia which follows most serious injuries, can only be satisfactorily treated in large infirmaries, hospitals, or specially provided local centres. Treatment should be given daily, and begun as soon as possible after the accident. Return of normal function should be the only aim; it is useless to obtain perfect alignment of a broken bone with stiffness of adjacent joints or to preserve a finger which cannot be flexed into the palm. The results of the first year's working of this centre show that both employer and employee have benefited.

In this district the centre is no longer an experiment, and the employers have recently purchased accommodation for its permanent establishment.

REFERENCES.

- ¹ Report of Medical Consultative Council to the Minister of Health.
- ² Report of Departmental Committee on Workmen's Compensation, Cmd. 816.
- ³ Mennell, *Massage: Its Principles and Practice*, p. 19.

NEUROLOGICAL JOTTINGS.—II.

BY

JAMES TAYLOR, C.B.E., M.D., F.R.C.P.,

PHYSICIAN TO THE NATIONAL HOSPITAL, QUEEN SQUARE; CONSULTING PHYSICIAN TO MOORFIELDS EYE HOSPITAL AND TO THE QUEEN'S HOSPITAL FOR CHILDREN.

Chicken-pox and Herpes.

SINCE the publication of my paper on "Neurological Jottings" ¹ I have had several communications on one of the subjects on which I wrote—namely, the curious connexion between herpes and chicken-pox, and there have also been several communications to the JOURNAL on the subject. In my former paper I referred to several instances of chicken-pox occurring in the same house in which herpes had been present at or about the time at which chicken-pox occurred. In all the cases which had come under my observation or of which I had authentic first-hand information, herpes had occurred in an adult, and had been followed by chicken-pox in younger persons, chiefly children.

Dr. Ingram Cooke ² relates the case of a girl of 16 who came to his surgery for some medicine for her father, who had developed shingles about two weeks before. She asked