The intimate effect of massage upon contused muscles and nerves has been studied experimentally by M. Castex of Paris. He subjected dogs to double and symmetrical traumatizations of the limbs—fractures, sprains, and contusions. One side was massed by a specialist, the other left to spontaneous repair. After some months the dogs were killed, and the traumatized parts examined microscopically by independent histologists, thus eliminating the personal equation. The results were published in the *Archives Générales de Médecine* (1891). The drawings there reproduced show very clearly the following lesions in the muscles not massed:

1. Fibrillation of the muscular fibres.
2. Hyperplasia of the connective tissue, with an increase in the number of nuclei.
3. Interstitial haemorrhages.
4. Engorgement of the blood vessels, with thickening of the outer coat.

The microscopical appearances of the muscles that had been subjected to massage were normal in every respect. Similar phenomena were revealed by the examination of the nerves, but in addition the nerve fibres were compressed by the connective-tissue hyperplasia in the non-massaged limb.

M. Gourewitch of St. Petersburg has carried out a series of experiments on rabbits with analogous results. He produced symmetrical fractures of both fore-limbs, one of which was massaged, the other immobilized. In the massaged limb muscular atrophy was prevented, and bony union took place more firmly and more quickly than in the immobilized limb. These observations are reproduced by Dr. Guermonprez of Lille in his book, *Etudes sur le Traitement des Fractures des Membres*, published during the present year in Paris.

That massage and movement favour osseous repair is confirmed by clinical observation. It is to be accounted for by the removal of the haematoma from the seat of fracture, by the early restoration of the circulation, and by consequence of the nutrition of the limb, and by the stimulating effect upon the formation of callus of the slight movements at the seat of fracture.

Massage shortens the duration of treatment. This is a great practical advantage. Many of the factors we have already considered conduce to it. The chief factor, however, is the condition of the nerves, muscles, and joints of the limb at the moment when bony union is complete. Instead of being crippled by immobilization, they are fit and ready for immediate use. Bennett estimates that the time that requires to elapse before a patient is permitted to resume his ordinary occupation is diminished by at least one-third.

Massage and movement may be employed with advantage in the majority of the cases of fracture. Extreme mobility of the bony fragments or the existence of displacements capable of being reproduced are contraindications to the employment of massage and movement, at least as immediate treatment. But the amount of consolidation necessary to ensure us against these secondary displacements is obtained more quickly than is generally admitted, and both movement and massage may be resumed at an early date with every prospect of success.

The treatment of fractures by the methods of M. Lucas-Championnière has been adopted by certain surgeons in almost every European country, and the published results are sufficiently numerous to place the value of the treatment beyond doubt.

The majority of modern writers admit its efficacy as an accessory method, though sometimes not without an *arrière-pensée* for the time-honoured doctrine of immobilization.

It has been my object in this address to contrast the two methods of treatment which we have been considering. It may be asked whether these two methods are really incompatible with one another—whether it is possible to secure the benefits and at the same time avoid the risks of both.

Uninterrupted immobilization, as defined at the outset of these remarks, is obviously impossible where massage and movement are employed.

But the use of simple means to avoid displacement may usefully be combined with massage and movement—the retentive apparatus being usually removed and replaced daily. Complicated apparatus should be avoided. Extension by weight and pulley and the placing of the

limb in such a position that the muscles are relaxed and the long fragment brought into line with the short one are useful principles applicable to many fractures.

Whatever apparatus is employed should be discontinued at an earlier period than was formerly the practice. Mr. Watson Cheyne, in his *Manual of Surgical Treatment*, 1900, in the course of a judicious appreciation of these methods, writes that while not prepared entirely to discard splints, he is "inclined to think that massage and movement may be largely associated with their use, not only without any risk to the union, but actually with great advantage to the patient."

For ourselves, in our treatment of fractures, while giving due care and attention to the passive organs of motion—the bones—let us not forget the higher physiological value of the active organs—the muscles and nerves.

Let us bear in mind the aphorism inscribed by M. Lucas-Championnière on the title-page of his book, "Le mouvement c'est la vie," and his further comment, "Immobilization is the beginning of death."

NOTE CONCERNING THE BACTERIOSCOPIC ANALYSIS OF EXCREMENTAL POLLUTION.

By E. KLEIN, M.D., F.R.S.

IN the bacterioscopic analysis of shellfish, water, and other materials polluted with excremental matters the MacConkey medium (sodium taurocholate, peptone, glucose, litmus, water) in Durham fermentation tubes is admittedly of advantage, since it allows the free development of *B. coli communis* and other coli-like microbes, whereas it exerts a certain restraining influence on some other microbes. It is now admitted, I think, what I have for many years (since 1895) insisted on—namely, that in judging of excremental pollution the *B. coli communis* or the typical *B. coli* is that species to which our attention should be particularly directed in the analysis, for while we know that this particular species is the typical microbe of sewage and excremental matters the distribution and derivation of other kinds of coli-like microbes is still more or less undetermined. Unfortunately the MacConkey medium makes no selection between typical and atypical *B. coli*, nor does it exclude a number of other microbes capable of producing acid and fermenting glucose, amongst these notably some liquefying microbes present in shellfish as also in other materials.

It is well known that one of the principal differential characters of *B. coli communis* is its power to ferment lactose, a character not possessed by many species of coli-like microbes, which are, nevertheless, possessed of the power of fermenting glucose. This character of lactose fermentation could, therefore, be used at once in the preliminary tests for *B. coli communis* if we substitute glucose for the lactose in the ordinary MacConkey medium; by this a distinct simplifying of the analysis could be achieved. I have put this proposition to the experimental test. Ordinary MacConkey medium (that is, containing glucose) and MacConkey fluid with lactose, instead of glucose, were inoculated in parallel series with high dilutions of sewage, of human faecal matter, with the fluid of shellfish (oysters, cockles, winkles) derived from polluted layings, as also of shellfish (oysters) from clean layings. The results were highly satisfactory, for whenever the lactose MacConkey tubes showed in 24 to 48 hours' incubation at 37° C. redness and gas, subsequent subcultures in the differential media proved the presence of the typical *B. coli communis*, whereas in a considerable number of instances after redness and gas in the glucose, that is, ordinary MacConkey tubes, subsequent subcultures failed to denote the typical *B. coli*—that is, the *B. coli* which changes neutral red broth from cherry colour into fluorescent green, which bubbles ordinary nutrient gelatine, which causes redness in and coagulation of litmus milk, which produces indol in ordinary broth, which on Drigalski-Conradi medium produces at 37° C. in 24 hours largish red colonies with red halo, and which at 37° C. in 24 to 48 hours produces acid and gas in litmus lactose peptone water. In those instances in which the lactose MacConkey tubes remain unchanged, or become bleached and without gas, it may be taken for certain that the *B. coli communis* is not present, although in the parallel ordinary MacConkey tubes redness and gas had been produced.

The second medium which is of great advantage in the analyses is broth with sodium taurocholate. The broth is ordinary nutrient beef broth, to which sodium taurocholate is added in the same proportion as phenol in Parietti broth, that is, 5 c.cm. of a 5 per cent. solution to 400 c.cm. of broth.

B. coli as also *B. typhosus* grow well in this taurocholate broth, making it uniformly turbid in twenty-four hours at 37° C.; but if *B. coli communis* be present, on slightly shaking the tube copious evolution of minute gas bubbles will be noticed on inspection with a hand lens. In a large number of tests made with this medium I have invariably found that if after twenty-four to forty-eight hours' incubation the tubes show marked turbidity, and on slight shaking show copious evolution of gas bubbles, one can be certain that *B. coli communis* is present. This taurocholate broth has one further advantage, it is this: while it allows the growth of faecal streptococci it inhibits some other streptococci. I have made experiments with streptococcus directly isolated from human faecal matter by Drigalski-Conradi plates, with streptococcus of saliva and with *Streptococcus pyogenes*, and I have found that while the streptococcus of human faeces grows well in the taurocholate broth—at 37° C. it produces in forty-eight hours copious growth in the form of granules and flocculi with slight general turbidity of the broth—the others (streptococcus of saliva, *Streptococcus pyogenes*) produce no growth, the broth remaining perfectly clear.

The *B. coli communis* forms indol in the taurocholate broth just as in ordinary broth.

NOTE ON THE ESTIMATION OF BLOOD PRESSURE.

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In estimating the systolic blood pressure by one of the modified methods of Riva-Rocci,¹ it is often difficult to state definitely by palpation the exact instant when the pulse returns at the wrist. Moreover, the blood forces its way through the block on the brachial artery at a pressure slightly below the pressure in the armlet, and in insufficient quantity to produce a definite pulsation in the radial vessel. Estimations are consequently, as a rule, slightly lower than they should be. The difficulty can be overcome by fixing a Dudgeon's sphygmograph upon the radial vessel. When the pressure in the armlet is above systolic pressure, no pulse beats are shown, and the writing point rides below the bottom of the pulse beats (Fig. 4). As the pressure falls in the armlet, the line described gradually rises (as shown in the three steps, a, a, a, of Fig. 4), but pulsation does not appear until a lower armlet pressure is reached. In the figure a control beat is shown, in a patient whose systolic blood pressure was 160 mm. Hg, with the armlet at 0 mm. Hg. The armlet was then raised to 200 mm. Hg, and the pressure allowed to gradually fall to 160 mm. Hg, when the point of the writing lever rose on the paper; this was allowed to proceed in 3 steps, a, a, a, and the pressure was then reduced to 0 mm. Hg, and further control beats were taken. The method is a very accurate one for estimating blood pressures in doubtful cases.

The combined use of the sphygmomanometer and sphygmograph is also of service in demonstrating temporary rises of blood pressure. Some examples of this are given. Fig. 1 shows the rise of pressure occurring at the height of three deep inspirations.² The beats force the block in the armlet at these three points only, the pressure in the armlet being a few millimetres of Hg higher than the original systolic blood pressure.

Fig. 2 shows the two rises of blood pressure in Valsalva's experiment, when a deep inspiration is followed by expiration with the glottis closed.³

Fig. 3 shows a rise of blood pressure consequent upon excitement.⁴ This tracing was obtained accidentally during the course of certain observations upon Valsalva's experiment. The most convenient instrument for obtaining these records is C. J. Martin's modification of the Riva-Rocci instrument.⁵

Fig. 1.

Fig. 2.

Blood Pressure 135
Riva-Rocci at 138

Rise due to excitement.

Fig. 3.

Fig. 4.

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- ¹ Riva-Rocci, *Gaz. Med. di Torino*, 1899. ² Cf. Wertheimer et Meyer, *Archives de Physiol.*, Paris, 1889. ³ Cf. Lewis, *Journal of Physiol.*, 1906. ⁴ Cf. Janeway, New York and London, 1904, p. 119. ⁵ Supplied by Hawksley, London.