the day given below *in extenso*. (This was the first day, and our observation started at 9.30 a.m., whereas work actually began at 8 a.m., as shown in the week's summary.)

H., aged 65; Weight, 10 st.; Height, 5 ft. 8 in.; Surface, 1.71 M.
February 16th, 1920.

Time.	Ventilation.		CO ₂ .		Calories.
	Per Minute. 8.5 litres	Per Second. 142 c.cm.	Per Cent. 2.4	Per Second. 3.4 c.cm.	
9.30	12.0 ..	200 ..	3.0	6.0 ..	383
10... ..	9.0 ..	150 ..	3.2	4.8 ..	
11... ..	11.5 ..	192 ..	3.0	5.8 ..	
1... ..	12.0 ..	200 ..	3.2	6.4 ..	
Dinner hour ...	—	—	—	—	
2... ..	9.0 ..	150 ..	3.2	4.8 ..	478
3... ..	12.0 ..	200 ..	3.0	6.0 ..	
4... ..	12.0 ..	203 ..	3.5	7.0 ..	
5... ..	11.0 ..	183 ..	3.0	5.5 ..	
6... ..	12.0 ..	200 ..	3.0	6.0 ..	861

The working out of this day's calories is as follows:

Morning: 47 + 60 + 96 + 116 + 64 = 383

Afternoon: 48 + 120 + 140 + 110 + 60 = 478

861

Total: 861 calories in 7½ hours, or 115 calories per hour.

The summary account of the results of six days of observation on four workers, recorded and calculated as above, is given in graphic form on the preceding page:

Summary for the Week February 16th to 21st, 1920.

Subject.	Day.	Calories per Day.	Hours.	Calories per Hour.
No. 1, H. Age 65. Weight 63.5. Height 1.73. Surface 1.71.	Monday ...	861	7.5	115
	Tuesday ...	733	8.75	84
	Wednesday ...	467	5.75	81
	Thursday ...	790	9.25	85
	Friday ...	771	8.75	88
	Saturday ...	281	3.5	80
No. 2, C. Age 51. Weight 62.6. Height 1.70. Surface 1.68.	Monday ...	955	7.5	127
	Tuesday ...	1,024	8.75	117
	Wednesday ...	1,003	8.75	115
	Thursday ...	1,061	9.25	115
	Friday ...	833	8.75	95
	Saturday ...	337	3.5	96
No. 3, S. Age 26. Weight 63.5. Height 1.80. Surface 1.77.	Monday ...	843	7.5	112
	Tuesday ...	737	8.75	84
	Wednesday ...	878	8.75	100
	Thursday ...	792	9.25	85
	Friday ...	736	8.75	84
	Saturday ...	269	3.5	77
No. 4, B. Age 26. Weight 72.6. Height 1.78. Surface 1.86.	Monday ...	857	7.5	114
	Tuesday ...	965	8.75	110
	Wednesday ...	1,035	8.75	125
	Thursday ...	1,229	9.25	133
	Friday ...	892	8.75	102
	Saturday ...	380	3.5	109
		18,789	183.0	103 ± 2

18,789 calories in 183 hours = 103 calories per hour.

CONCLUSION.

The average rate of energy-output (gross) at the printing rooms of the BRITISH MEDICAL JOURNAL, gauged as described above on four compositors for one week, comes out as: 101 to 105 calories per hour.

I shall be very interested to learn from your own observations at the Chelsea Polytechnic what are the average rates of energy-output per head:

(a) For a class of students sitting at lecture.

(b) For a class of students during physical exercise drill.

AN ATTENUATED TUBERCLE VACCINE.

BY

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THE object of this short paper is to bring to the notice of the profession a vaccine which in my own experience has been of great service in the treatment of tuberculosis.

Whilst not claiming it to be a specific remedy, it has a remarkable power of controlling the disease and of limiting the spread of the infection in the human body. As is well known, tuberculosis has a tendency to spontaneous cure, and if we can in any way limit the spread of the infection we are placing the patient in a better position by his natural powers of resistance to deal successfully with the original focus. In the BRITISH MEDICAL JOURNAL of January 31st, 1903, I expressed the opinion (as I believe for the first time, and based almost exclusively on clinical and pathological evidence) that

Human and bovine tuberculosis were separate and distinct diseases, but that the human body was susceptible to both, and especially to bovine tuberculosis in the early periods of life. The two diseases were so rarely seen together in the human subject that there seemed strong grounds for presuming that they were antagonistic to each other, and that bovine tuberculosis may confer an immunity against human tuberculosis, and vice versa.

To take an example: A child with primary abdominal tuberculosis or tuberculous glands in the neck—both bovine infections caused by tuberculous milk—is protected against a primary pulmonary tuberculosis; on the other hand, a case of primary pulmonary tuberculosis from inhalation—always caused by the human bacillus—is protected against the lesions caused by the bovine bacillus. In other words, the two types of the bacillus—human and bovine—cannot exist in the body at the same time, and I have never been able to recover both types from the same patient.

The lungs are frequently attacked in the course of a bovine infection either by direct lymphatic extension from the abdomen to the bronchial glands; by direct extension to the apex of the lung from glands in the neck; or in the course of a general blood-stream infection.

For these reasons, and after treating over 3,000 cases of tuberculosis in hospital with tuberculin from various sources, I have come to the conclusion that the best results are obtained by treating human infections with bovine tuberculin, and bovine infections with human tuberculin. Although the results in many cases were good, I must confess on the whole to a feeling of disappointment, and I attributed it to the uncertainty of origin of the tuberculin, which was prepared in many instances from a highly virulent culture, and also to the tuberculin becoming stale and inert by lapse of time. In many cases acute and serious reactions followed its use; in others it seemed to be inert.

For these reasons I decided over fourteen years ago to endeavour to obtain attenuated cultures of bacilli, and to try the effects of a tuberculin prepared from cultures of low virulence and less toxicity. The late Professor Koch gave me in 1905 a pure culture of human tubercle prepared from the sputum of pulmonary tuberculosis; Professor Calmette of Lille, one of bovine tubercle; and Professor Bang of Copenhagen, one of avian tubercle. These original cultures have been subcultured every month since 1905 without any intermission, and to-day they grow true to type, quite normally, although not quite so luxuriantly. The present cultures, which are growing at the Lister Institute, are, of course, highly attenuated and of very low virulence. I have injected them into animals, and they are practically non-pathogenic.

I treated several patients with this tuberculin in 1914, but the war came, and my work was interrupted by a long residence in France. The results were most satisfactory, but I propose to wait for some time before coming to a definite decision.

Tuberculosis is seriously increasing in all the late belligerent countries, due to the stress and rigour of war conditions and the malnutrition of the people, more especially children. We have not yet discovered a specific remedy for the disease, but it is our duty to adopt every possible means to prevent its further spread, and in my

opinion the careful administration of tuberculin on scientific lines will do a great deal to limit the infection.

I venture to make the following suggestions regarding its use:

1. Tuberculin should be prepared from attenuated and non-virulent cultures of bacilli.
2. It should be freshly prepared and used within a week.
3. Given in graduated and increasing doses at intervals of seven days.
4. Acute reactions are not necessary.
5. Not less than twelve injections should be given at intervals of one week, but in some cases a great many more injections are required.
6. The most favourable cases for treatment are local lesions, but early cases of pulmonary tuberculosis may be limited and a further spread to other parts of the lung prevented.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

PARAFFIN WAX FOR FIRST-AID TREATMENT IN BURNS.

THE use of paraffin No. 7 in the treatment of burns and various forms of ulceration is well known, but it has occurred to me that ordinary hard paraffin would be an ideal first dressing for a burn through the protection it would afford and the complete absence of pain on removal. Paraffin candles, found in most houses, afford the material necessary, and it is simplicity itself to light the candle and allow the wax to gutter on to the burn.

Attention must be given to several small points: The candle must be held at a fair distance—about 10 in.—so that the paraffin is not too hot when it falls upon the injured part, and it is well not to keep dropping on one place but to dodge about over the surface; a mass of melted wax in one place is painful. The dressing can be completed by putting a small piece of clean linen or cotton-wool over the wax and dropping some more upon it. The heat of the burning candle seems to be sufficient to sterilize the wax, and, in any case, I should suppose that paraffin is not a substance likely to afford much nourishment to micro-organisms.

I have tried this method in a number of cases and found no ill effects; perhaps the healing action is not quite so rapid as with paraffin No. 7, but the painlessness is equal.

Alconbury Hill, Hunts.

J. R. GARROD, M.D.

PARENTAL BLOOD IN HAEMORRHAGE OF THE NEWBORN.

I HAVE met with three cases of haemorrhage of the newborn during my twenty-one years of practice here. The first case died, the two last recovered.

The first case, a female infant, was treated on the usual old-fashioned lines of drug treatment, but died in spite of every effort. The necropsy revealed only the ordinary negative findings.

The two later cases were treated by the subcutaneous injection of the parent's blood, of the father in the first case and of the mother in the second. Magnesium sulphate solution, saturated, was employed to prevent clotting. The effect was immediate and successful.

The notes of the third case are these:

A female infant, full term, well nourished, was born after normal labour on March 8th, 1920. The mother's age was 40. Eight years had elapsed since the previous confinement.

At 1 a.m. on March 11th the child vomited blood and passed some eight or nine abundant stools of blood. I saw her at 1 p.m. and found her feeble and passive—in the condition, in fact, of a child who had lost a great quantity of blood.

I immediately gave the infant an injection of 6 c.cm. of the mother's blood in the right flank. To obtain this blood, some saturated solution of magnesium sulphate was placed in an egg-cup in a saucepan of boiling water, and the 5 c.cm. Record syringe was sterilized in the boiling water. Half a cubic centimetre of the magnesium sulphate solution was drawn into the syringe, and this was then filled with the mother's blood taken from the median basilic vein in the usual manner.

The next action of the bowels was at 7 p.m., and during the night there were four other stools. A stool was passed at 9 a.m. the next day, and again at 7 p.m. All these were black, but

contained no fresh blood. A stool passed at 10 p.m. was of the normal character and yellow colour. That at 7 p.m. was a mixture of black and yellow. The child, being too feeble to suck, had been fed by the spoon with mother's milk, drawn by the breast pump; as the quantity was scanty it was supplemented by diluted cow's milk. All the warm water possible was given also, between the feeds. The further progress to recovery was sure and uneventful.

It is extraordinary that since writing the above I have met with my fourth case. A male infant, born on March 31st, vomited blood on April 1st. In this case I was unable to obtain more than 1 c.cm. from the father; as he had a very serious convulsive seizure—due, I presume, to the cerebral ischaemia of a grave faint brought on by the operation—whilst I was drawing off the blood from his arm. I therefore supplemented this by a further 2 c.cm. from the mother, thus giving 3 c.cm. in all. The progress of the case was uneventfully successful.

In the first, third, and fourth cases here recorded the child was the second of the family. In the second case I am unable to trace the parents, and do not recollect what place in the family the child took, and I cannot find any note on the point.

MONTAGUE DIXON, M.D., B.Sc.Lond.,
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Reports of Societies.

MODES OF ANAESTHESIA.

At a meeting of the Sheffield Medico-Chirurgical Society on April 1st a discussion was held on anaesthetics.

Mr. HERBERT HALLAM, after comparing the merits of ether and chloroform, said that the only two safeguards against overdose of the latter were a knowledge of its physiological action and the maintenance of a free airway. He enunciated his theory of the cause of chloroform overdose as follows:

Air containing chloroform enters the lung alveoli and the vapour is absorbed by the blood, such absorption depending on (1) the percentage of chloroform in the inhaled air, (2) the air pressure in the alveoli. Thus a current of air containing chloroform goes in and out of the lung alveoli, and as more vapour is absorbed the characteristic signs of anaesthesia develop. If this exchange occurs with freedom all is well, but if any interference with respiration occurs through obstruction the situation becomes one of extreme danger. Nature's remedy for obstruction is expiratory effort, and the combination of expiratory effort and obstruction raises the alveolar pressure and alters the composition of the residual air; consequently rapid absorption of chloroform occurs leading to an overdose. The patient is poisoned not from the chloroform on the mask, but from that in his alveoli.

Illustrations in support of this theory were: (1) In the operation for tonsils and adenoids a patient "lightly under" might through lingual obstruction or the manipulations of the surgeon become suddenly poisoned. (2) The absence of poisoning where intratracheal administration by catheter was employed and there was free airway. (3) The rapid recovery from poisoning when by removing obstruction and performing artificial respiration intrapulmonary pressure was rectified. Mr. Hallam also referred to the question of idiosyncrasy to chloroform and the value of suggestion before operation.

Dr. W. DAKIN MART demonstrated Boyle's gas and oxygen apparatus, laying stress on the importance of systematic preliminary arrangement of the accessory appliances. He advocated preliminary medication with morphine $\frac{1}{4}$ grain and atropine $\frac{1}{150}$ grain, twenty minutes before the start of the operation. In abdominal operations the abdominal wall should be anaesthetized (after the patient was under) by means of $\frac{1}{2}$ per cent. novocain and $\frac{1}{2}$ per cent. potassium sulphate given independently and injected layer by layer. This prevented the occurrence of pain after coming round, and so enabled the patient to breathe more deeply, and clear the lungs more quickly. It was desirable to start the induction with a pressure of one "hole" of oxygen and three of nitrous oxide. The patient first breathed air until the bag was three-quarters full of this mixture, when the valves were turned on and he breathed from the bag and into the air. Then rebreathing in and out of the bag began. The colour of the ears should be watched; if they became dusky more oxygen should be given.