bowling green. As in the former case, this man has never had symptoms of necrosis of the jaw.

That these two men, doing exactly the same work, should suffer in this singular manner I could not regard as purely accidental. I found corroboration of this view in the report to the Home Secretary on the Use of Phosphorus in the Manufacture of Lucifer Matches, which has recently been issued. Dr. Oliver there states that Dr. Magitot, of Paris, was the first to draw attention to the ease with which long bones could be fractured among workers in phosphorus, and a special note is made of the experience of Dr. Boocorens, of Grammont, in Belgium, who "met with and treated in twenty-three years 30 cases of spontaneous fracture of the long bones caused by muscular effort effecting exclusively the lower limbs of workmen who had been employed for years in dangerous departments and who had also suffered from necrosis of the jaw." Dr. Kocher, of Berne, is mentioned as having experience of a matchmaker who broke his thigh-bone five times. In this country Dr. Garman, of Bow Road, is reported to have come across nine cases of fracture of the long bones of the arm or leg occurring amongst workers at this trade.

I think it may be concluded that we have sufficient presumptive evidence to show that the osseous tissues of the body generally can be so altered by the prolonged action of phosphorus or its compounds as to render them less resistant to the application of external violence.

Six months after his second fracture, my younger patient had the further ill-luck, through the agency of a wood shaving machine, to lose the distal phalanx of his right forefinger. Being fortunate enough to secure the bone, I submitted it, along with a corresponding one of the same age, which I obtained, for purposes of comparison, from a dissecting-room subject, to Mr. John Allan, of the Manchester Technical School, for chemical examination. In the following table I show Mr. Allan's results, along with the old standard analysis of Berzelius, and the more modern one of Landois and Stirling. The component parts in the latter analysis are given in the textbooks, in terms of their probable combinations, so in order to show a proper comparison, I have, by recalculation, reduced them to the primitive state in which they come out in actual estimation. It should be stated that Mr. Allan did not find any metallic phosphorus whatever in either of the samples which he analysed, also that it was only thought necessary to estimate the earthy constituents of the bones.

	Match-makers' Bone (J. Allan).	Healthy Bone.		
		J. Allan.	Landois and Stirling.	Berzelius.
Lime	53.67	54.03	53.66	53.11
Magnesia	0.73	0.82	0.88	0.80
Phosphoric acid ...	40.01	39.51	39.70	36.00
Carbonic acid ...	5.24	5.07	4.67	7.45
Chlorine, fluorine, etc.	0.35	0.57	—	—
Fluorine	—	—	0.52	0.78
Soda and sodium chloride ...	—	—	—	1.80
Sodium chloride ...	—	—	1.00	—
	100.00	100.00	99.94	99.94

From this table it is seen that the relative proportion of phosphoric acid to lime, according to Mr. Allan's analyses, is distinctly greater in the "dipper's" bone than in the healthy one, the difference amounting to nearly 1 per cent. This is not quite so well marked when we compare with Landois and Stirling; but when it is noted that this column shows more magnesia, which is generally assigned to the phosphoric acid in combination, and less carbonic acid, which is supposed to combine with the lime, we find the difference more real than apparent. The same deductions are arrived at in comparing the first with the last column. The conclusion I prefer to adopt at is that this excess of phosphoric acid combines with the pre-existing neutral phosphate of lime to form a slightly acid salt.

Though I am of opinion that the formation of a compound of

phosphorus, most probably acid phosphate of calcium, in bone is a most reasonable explanation of this peculiar condition of fragilitas ossium, before my deductions can be accepted more analyses may be required. The chemical examination of a necrotic sequestrum from a "phossy jaw" would, I think, if carefully executed, yield important results. As I know from experience, the requisite material is difficult to obtain, but I trust when the opportunity does present itself to anyone it will not be lost.

The importance of investigation in this direction can readily be appreciated when it is pointed out that this chemical alteration of the bone tissue, even if it be not a necessary adjunct, must have an important bearing upon the causation of necrosis of the jaw. It can easily be understood that bone interfered with in the manner described would be less able to resist local irritation, less prone to repair after inflammation, and thus more ready to take on necrotic changes.

There is a strong modern tendency to ignore the share which constitutional changes might have in bringing about this condition in favour of the purely local action of phosphorus or phosphoric acid through the medium of a carious tooth or exposure of bone after an extraction. The recognised course of events is irritation followed by periostitis, suppuration, and ultimate necrosis. I would point out that in certain trades workpeople are exposed a great deal to the action of hydrochloric acid fumes, and their teeth suffer much in consequence. I have seen men who are under the influence of this kind of local irritation affected with the same train of symptoms, excepting the ultimate result, which would follow if the acid were phosphoric instead of hydrochloric.

Again, if we except the tuberculous theory, which I think we may with safety, we get not the slightest support of the solely local causation from bacteriological examination of the pus of affected subjects. The bacteria, streptococci and staphylococci found are the ordinary micro-organisms associated with suppuration. Granting this general alteration in the osseous tissue of workers amongst phosphorus, it would be the only condition not common to both classes mentioned, and would thus supply the missing link in explaining the cause of what could properly be termed a severe scourge to an important industry.

THE MECHANICAL FACTOR IN SURGERY.*

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At the present time, when bacteriology and the nervous system are being so freely invoked to explain the manifestations of disease, there is a great tendency to overlook the action of simple mechanical causes. Without for a moment wishing to minimise the importance of bacteria or the nervous system, I propose briefly to discuss the action of what I have termed, for want of a better name, the mechanical factor.

Ununited Fracture of Long Bones.—Every now and again the surgeon has a case of apparently simple fracture in a long bone, which, after a prolonged period of rest and splinting, fails to unite. Various explanations for the non-union are given—such as restlessness or ill-health of the patient, idiosyncrasy, deficient formation of callus, etc.—nearly always erroneous, as, on cutting down on the fracture, the usual thing is to find a pad of muscle, with sometimes a splinter of bone, interposed between the two ends, due to one end of the bone having perforated an adjacent muscle at the time of the original injury. On refreshing the ends of the bone and placing them in apposition union usually takes place, in spite of any idiosyncrasy or ill-health, which, in the case of the lower extremity, has certainly not been improved by a long confinement to bed.

Mechanical Obstruction of Respiration during the Administration of Chloroform.—Obstruction of the air passages by foreign bodies or the base of the tongue is well recognised; the valve-like action of deep and flabby lips in edentulous patients is sometimes overlooked. I have seen a patient getting black

* Read before the South-Western Branch of the British Medical Association.

in the face, with the chin held well away from the sternum and the anæsthetist wondering what on earth is happening. At last, quite empirically, he pulls the tongue forward with forceps; the cyanosis disappears and the patient is said to have been "swallowing his tongue." What really happened was that the flabby lips permitted expiration, but on inspiration were sucked in and, meeting at their edges, acted as valves, effectually stopping all entry of air by the mouth. Pulling forward the tongue acts in this case by separating the lips; but a finger between the lips is equally efficacious and saves the patient a sore tongue.

Treatment of Simple Ulcers with Ointment spread on Lint.—How often is a circular ulcer seen dressed with a square piece of lint, instead of the lint being cut to exactly fit the ulcer, the dresser forgetting that the continued application of strong ointment to intact epithelium does not improve its power of healthy growth. Even when the lint is cut to fit the ulcer, how often are holes made in the lint to allow of the direct escape from the granulating surface of the inevitable discharges which, mechanically obstructed by the greased surface, are at first pounded up on the ulcer, and ultimately escaping at the edge of the lint, damage and render sodden the ingrowing epithelium, on which depends the ultimate healing of the wound.

The Permanent Suture (Silk) Buried in Muscular Tissues.—The adjective permanent is frequently applied to unabsorbable buried sutures which are expected to hold soft parts, such as muscle and fascia, together indefinitely. My own conviction is that they do nothing of the kind. Their action is very similar to that of superficial sutures. No one thinks of leaving skin sutures indefinitely. At the end of a fortnight or three weeks the tissues have grown together, and remain united perfectly well without the further aid of sutures, which are then removed. If there has been tension on these sutures they have gradually cut through the tissues, and either lie loose among them or come away on their own account. Exactly the same process occurs with the buried sutures, such as are often employed in the cure of a ventral hernia. An unabsorbable suture lying loose among the tissues, although it is supposed to be encapsuled, is always liable to wander, and months or years afterwards make its reappearance to the disgust of everyone concerned. In other words, the "permanent buried suture," after a short time, fails to act as a suture, and not infrequently declines to remain permanently buried. The moral is obvious—dispense with buried sutures as far as possible, and, where they are a *sine quâ non*, employ material capable of being absorbed.

Solution of Chemical Antiseptics for Wound Irrigation.—The use of chemical solutions, such as carbolic acid and corrosive sublimate for the irrigation of wounds, is illogical. For several years I have used simply boiled water. To be strictly physiological, a 1 per cent. solution of sodium chloride should be used, and lately I have used this with most satisfactory results. The effects of irrigating a wound with perchloride of mercury 1 in 2,000 is, as far as bacteria are concerned, mainly mechanical. The antiseptic damages the cut tissue without destroying the bacteria, which are washed out together with the blood clots by the solution. Halsted has shown that irrigation of fresh wounds with a corrosive sublimate solution as weak as 1 in 10,000 is followed by a distinct necrosis demonstrable under the microscope. This necrotic material may retard the healing process and act as a culture medium for any bacteria deposited in the wound subsequently. The surgeon is apt to dwell too much on the supposed germicidal power of the one part of antiseptic, and too little on the mechanical effect of the 1,999 parts of water. He also underrates the germicidal powers of the body cells, which are far superior to any dilute chemical antiseptic.

Strangulated Hernia and Peritonitis.—In an ordinary case of strangulated hernia it is often impossible to tell from the symptoms whether only omentum or intestine is involved. We used to be told that the symptoms of obstruction caused by strangulated omentum were due to the omentum and intestine having a common nerve supply. But the fact that strangulation of omentum by a ligature failed to produce obstruction remained unexplained. Surgeons now recognise that traction on the omentum produces kinking of the colon, and in exceptional cases even of the stomach. Sometimes also small intestine becomes strangulated by slipping beneath the

tight band of omentum. In cases of general peritonitis with distension of the intestines, it is not always recognised that there is a real obstruction to the passage of bowel contents caused by a succession of partial kinks, due to the intestines becoming distended in a closed cavity, and having a mesentery attached to one border. The disordered action of the thoracic viscera is also not solely due to the effects of absorbed toxins, but is partly caused by the distended intestines pushing up the diaphragm.

Another factor in acute peritonitis and intestinal obstruction, and one which I do not remember to have seen in the textbooks, is that the patient, in addition to being poisoned, is suffering from a large loss of fluid by diarrhoea and vomiting. One cause of the cardiac failure is the absence of sufficient fluid in the circulation for the heart to contract upon. By large intravenous injections of hot saline solution this want is supplied, and the excretory organs, especially the kidneys, get a chance of acting freely, and so excreting the poisons absorbed from the intestines and peritoneum. I have recently had two cases of this nature in which, after operation, this treatment by intravenous injection saved the patients.

AN INOPERABLE CASE OF EPITHELIOMA OF THE LARYNX AND NECK TREATED WITH FORMALIN INJECTIONS.

By J. D. McFEELY, F.R.C.S.,
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For some years I have been so much impressed with the remarkable effects of formalin on the tissues, that it has seemed to me, if its action on the living tissues could be demonstrated to be non-toxic, it might prove useful in treating malignant growths, those which are inoperable, and in preventing or retarding the local recurrence after removal of such as could be removed, and in addition from its styptic action in treating non-malignant vascular tumours such as nævi and uterine fibroids.

That formalin is practically non-toxic in convenient doses the following case demonstrates:

T.M., aged 53, plumber, was admitted into hospital on December 13th, 1898, presenting a tumour on left side of neck, growing beneath the sternomastoid, nearly opposite the thyroid cartilage, extending in front to within half an inch of the trachea, and posteriorly to near anterior border of the trapezius. On the right side there was a smaller tumour, rather less than a tangerine orange, and situated somewhat higher in the neck. Both growths were firm in consistence, the larger one adherent to the subjacent structures, although the skin over it was quite movable. There was also well-marked aphonia, occasionally an inspiratory stridor, and marked dysphagia. Four months previously he noticed the swelling on the neck, and soon after observed that he was getting thin. About a week before admission he noticed his "voice had changed," and was "getting hoarse." The patient was sent to Dr. Woods, Laryngologist to the Richmond and Whitworth Hospitals, who diagnosed a carcinoma involving the larynx, and thought it inoperable, but suggested syphilis as possible.

The patient had well-marked arcus senilis. His arteries were atheromatous and cord-like. The urine had a specific gravity of 1010, and contained a trace of albumen. Mercury and potassium iodide were given for ten days without any beneficial result.

Acting on Dr. Woods's suggestion, I decided not to operate, but as his breathing was becoming daily more embarrassed, on December 21st I performed tracheotomy. The tumour on the left side continued to grow with great rapidity. He frequently begged to have something done, and wished to know when I intended to remove it. About the first week in February he was almost asphyxiated. It was found on removing the tube that the trachea was almost blocked up by some foreign body; this turned out to be a mass of necrosed tissue about the size of a florin which must have sloughed from the primary growth in the larynx. The rate of growth in the smaller tumour was slower.

As it seemed hopeless to attempt removal of the tumour, I had frequently thought of tying the common carotid with the hope of lessening the very rapid rate of growth. It was now evident that in a short time the tumour must displace if not overgrow the tracheal tube. I finally determined to inject either absolute alcohol or formalin. Of the toxic action of the latter I could find no reliable statistics until I saw in the BRITISH MEDICAL JOURNAL of February 11th a valuable paper by Dr. Mitchell on Formalin in the Treatment and Removal of Malignant Growths. Up to this time the skin had not broken, but the tumour looked so excessively vascular that, should it have burst, the hæmorrhage must have been appalling. Accordingly on February 18th I injected into the most vascular part of the tumour 5 minims of a 25 per cent. solution of formalin, having first rendered the part anæsthetic