of the route of infection in the case of the gall ducts also.

It has hitherto been generally supposed that pathogenic organisms find their way into the blood stream from the intestinal canal and so reach the liver, and in the course of their passage with the bile along the liver ducts, after excretion, cause the symptoms referable to inflammation of those canals.

The observed facts, however, do not favour such an explanation. For instance, in all cases in which we know for certain that the organisms are conveyed to the organ in question, the liver or kidney, by means of the blood stream—in cases, in fact, in which the organ is affected as part of a generalized systemic affection—it is the cortical or secreting portion of the organ which first becomes affected and suffers most. Large or small, isolated or multiple, embolic suppurating foci form in the cortex while the excretory canals escape, or only suffer later. This is well shown in the case of the multiple abscesses of the liver occurring in the course of portal pyæmia. On the other hand, the comparative rarity of liver complications and abscesses in cholangitis and cholelithiasis is very remarkable.

I think also other experiments described in the address to which I have already alluded confirm, in the case of the gall bladder and biliary ducts, the conclusions which we have already come to in the case of the kidneys and urinary tract. Indigo taken by the stomach was recovered through a gall bladder fistula, and had evidently been carried up from the duodenum along the common bile duct, and so into the cystic duct and gall bladder.

Where inert powdered indigo is carried, pathogenic organisms can be carried also, provided that the arrest or reversal (temporary or otherwise) of the mucous current in the bile ducts is brought about from pathological causes, such as obstruction at the outlet, in the same way that it is brought about surgically in the case of the gall-bladder fistula.

Moreover, I think we may extend this theory of duct infection to other affections besides those caused by the pus-forming organisms. Take, for instance, the tubercle bacillus and the manner in which it attacks the testicle. Tuberculosis of the testicle commences in the epididymis at the upper or blind end as it were, of the genital duct, the vas deferens, and not in the body of the testis itself, where we should expect it to begin if the organism were brought by the blood stream.

Surely, too, in cases of tuberculous fistula *in ano*, the organism reaches the atraded mucous membrane from the intestinal canal and not from the blood stream, and I am inclined to think that in cases of tuberculous disease of the kidney, the bladder or the testis, the organism will eventually be shown in some cases to have ascended the mucous canal from external contamination instead of having descended it after excretion by, and passage through, the kidney. In fact, I would be inclined to put forward the following suggestion:

Infective processes originating in the excretory ducts of organs or glands or in mucous canals probably depend on these mucous canals as the route of invasion, while infective processes originating in the parenchyma or cortical portion of the same glands or organs depend on the blood stream for the entrance of pathogenic organisms.

This view is also in harmony with the observed phenomena of toxic processes. Cytotoxins circulating in the blood exert their cytolytic action primarily and chiefly on the epithelial cells of the cortex of an organ—the tubules in the case of the kidney, the secretory epithelium in the case of the liver—while the epithelium of the excretory ducts at first escapes injury, thus showing that the resisting power of the latter is at least as great as, and probably greater than, that of the secretory epithelium. Whereas in all the cases we have been considering of pyelitis, cholangitis, etc., due to mucous invasion, this duct epithelium has been the first to suffer.

In thus attempting to focus attention on the mucous canals as routes of invasion by micro-organisms I am hopeful that the importance of safeguarding the orifices of these canals opening on the surface of the body will become more manifest. Frequent bathing, rigid cleanliness, and personal hygiene will do much if regularly practised among hospital patients, indeed, among all classes of patients, to prevent infection of these canals.

It may be urged that tuberculosis of the kidney or of

the epididymis occurs only in persons with a lowered resistance to the tubercle bacillus, and, in most cases, in those who are already the subjects of tuberculous disease in other organs which may serve as foci of infection. This, of course, is only saying in other words, in the language of the mucous canal invasion hypothesis, that a manufactory exists in these patients for the multiplication and liberation of the tubercle bacillus, and the pouring out of numbers of these organisms on the surface of the body by way of the mouth or the anus. Organisms so liberated may easily reach the urethral orifice, male or female, by direct contact, or by contaminated fingers, while the diminished resistance of epithelium is necessary in either case, in order that the organisms so conveyed may grow and flourish.

To return to the analogous case of the gall bladder: organisms, probably of special virulence, must first be grown in the bowel during some attack of local intestinal catarrh or indigestion. These are carried up the common bile duct, and only produce symptoms or set up a cholangitis in those cases in which the resistance of the lining epithelium has been diminished by distension, or stagnation of secretion, or by the contact of a secretion (of the bile in this case) of a chemically irritating or toxic character.

Finally, this view of the mucous canal as opposed to the blood stream route of invasion by micro-organisms suggests possibilities of treatment which are absent in the latter supposition.

The preventive methods of cleanliness and personal hygiene in the case of the external orifices have been pointed out. The question of the arrest of the growth of the organism while still in the lower portions of the urinary tract, and in the earliest beginnings of the attack, by altering the constitution of the excretory fluid—the urine in the case of the bladder—by the administration of urotropine or other urinary sterilizing drugs, is worthy of serious consideration. Moreover, the power to control the growth of the intestinal flora would doubtless very materially aid in diminishing biliary complications also.

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AN UNUSUAL MOTOR-CAR ACCIDENT.

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ON October 26th, 1906, about 11 p.m., there was admitted to my ward in the Glasgow Western Infirmary, W. O., aged 36, suffering from a perforating wound of his left buttock caused by the shaft of a spring-van. On admission he was quite conscious, and was not suffering from any symptoms of shock. He gave the following account of the accident. While driving in a motor-car, and sitting in front on the left of the chauffeur, the car came into collision with a spring-van that had no lights, and was on the wrong side of the road. One of the shafts of the van penetrated his left thigh and buttock, and then passed through the back of the seat on which he was sitting, so that he was pinned down to the seat and could not move. To allow of his removal from the motor-car the back of the seat on which he was sitting had to be cut through, and the van shaft that penetrated his thigh and buttock had also to be sawn across.

The photograph, taken by magnesium light, shows the state of matters on patient's admission. The van-shaft with some of its harness is in the position it was in when the patient was brought in. It will be seen that it has passed through the left buttock, and that its free end, with the patient in the recumbent posture, lies along his left side as high as his left armpit, while the other sawn end reaches as far down as the foot. About 9 in. of the centre of the shaft are embedded in the soft tissues of the buttock, and these are somewhat tightly stretched over it. There was no hæmorrhage and the patient made no complaint of pain, except when the leg was moved. Around the wound of entrance of the shaft there was considerable bruising of the tissues.

The removal of the shaft was accomplished by cutting through the raised bridge of skin, fat and torn muscle.

The flap thus separated was fully 6 in. wide, while the whole wound was 12 in. in length, and it was found that the tissues were more widely undermined than the external wound showed, particularly downwards along the outer aspect of the femur. The gluteus maximus was a good deal torn superficially, and its fibres, as well as the subcutaneous fat and skin, were all regained with dirt.

This was carefully and laboriously pared away, and the tissues were made as far as possible aseptic. The edges of the flaps were adjusted and sutured, two long drainage tubes being introduced from the lower aspect of the wound, one passing in an upward and forward, and the other in an upward and backward, direction.

The after-progress of the case was satisfactory. There was some sloughing of the edges of the wound, and on November 1st, 1906, a considerable area of skin around its lower angle had to be cut away. This was soon replaced

by healthy granulation tissue, and on November 28th Dr. Arch. Young grafted the wound with portions of skin from the right thigh, applied in eight pieces over the larger raw surface, and three pieces over smaller areas at the upper angle of the original wound. The grafts did well in spite of dependent position, and within one month of the grafting (December 27th, 1906) the patient was dis-

missed with the wound completely healed, and with a very useful limb.

I have put the case on record as being one of an unusual character, and almost incredible. It is difficult to realize the combination of circumstances that could bring about such an accident. It seems quite clear that the motor car must have been going at great speed, as the shaft seemed to have passed through the tissues very much as a bullet would, instead of tearing a ragged and irregular wound as one would have expected.

OBSERVATIONS ON THE OPHTHALMO-REACTION TO TUBERCULIN.

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THE early diagnosis of tuberculous affections is often attended with the greatest difficulty. More especially is this the case when we have to deal with obscure lesions other than in the lungs, for example, in the abdomen and nervous system. We are often very suspicious that certain chronic conditions, associated with debility and emaciation, but without localizing or diagnostic symptoms, may be of tuberculous origin. In such cases we would welcome a simple test that would enable us to make an earlier and more certain diagnosis. In the "ophthalmo-reaction" to tuberculin we have probably just such an agent.

The oculo-reaction to tuberculin was, as is now well known, introduced last summer by Calmette, of the Pasteur Institute of Lille, as a diagnostic test for the presence of tuberculosis. That able worker in the field of tuberculosis claimed for it certain advantages over other tests hitherto in vogue. These may thus be summarized:

(1) It is absolutely safe; (2) it is so easy of application that any one can carry it out; (3) it produces no constitutional disturbance, and locally usually nothing more than a slight ocular discomfort and lacrymation; (4) it is as accurate and delicate as the hypodermic injection, if not more so.

The technique, as described by Calmette, consists in instilling one drop of a 1 per cent. solution of his tuberculin into the inner half of the conjunctiva.

With a view to ascertaining the accuracy of Calmette's claims, I have made over 100 observations. 70 with the Calmette tuberculin, 25 with the "old," and 10 with the "new" tuberculin. In from three to ten hours, sometimes rather sooner and not infrequently rather later, the positive reaction manifests itself. This consists at first

of a slight injection of the conjunctiva near the caruncle, with a little lacrymation.

From first to last in the "slightest reactions" that is all that may be seen. In these light reactions the congestion is confined to the inner part of the conjunctiva, and unless it is looked for carefully it may be missed. It is, however, a quite characteristic redness, and can easily be recognized by comparing it with the normal untreated eye. The amount of reaction is most variable, and, so far as my experience goes, it does not bear a demonstrable relation to the severity of the lesion from a clinical point of view. Some of the most pronounced reactions I have seen were in cases in which there were no physical signs or clinical evidence of the presence of tubercle. We may get all degrees of inflammation, from the smallest amount of local conjunctival injection to redness extending over the entire eye, and having all the appearance of acute conjunctivitis. There is occasionally some purulent discharge, and much photophobia and swelling of the caruncle. None of these reactions, even the most severe, have given rise to any trouble, and almost all have, in a period of from two to ten days, completely cleared up. This occasional over-violent reaction is the only drawback to the test that I have observed. Perhaps it may be eliminated by giving always in the first instance a weaker solution, say a 1 in 200, as a preliminary test. Indeed, Comby seems to have found that this strength of solution was, in a large series of tests applied to children, as reliable as the stronger solution, and that in no instance did it produce any excessive reaction. My own experience tends to confirm this view, as will be seen by a reference to the summary of cases. It should be mentioned, however, that Oliver and Terras, who tried a solution of Calmette's tuberculin 1 in 150, obtained, in adults, only doubtful results.

The applicability and the delicacy of this test depends on the integrity of the eyes. Any ocular lesion, according to Comby, whether it be acute or chronic, contraindicates its employment. In my own cases only eyes that were perfectly healthy were subjected to the test. Brunetiere thinks the test may be applied if one eye be intact by dropping the solution of tuberculin into the sound eye. But as the reaction, especially when slight, is only appreciated by comparison with the sound eye, it is obvious