

serum contains demonstrable antitoxin; and likewise that immunity to bacteria is not in all cases antibacterial, in the sense that the serum contains substances which are able to kill the bacteria in test-tube experiments.

There is another factor, however, which may throw light on the type of natural immunity just considered. We know that tetanus toxin causes tetanus through its power of uniting with the nerve cells, and we may consider that tetanus is a very fatal disease primarily because of the vital nature of the tissue which it attacks. Now, if the toxin, instead of uniting with the cells of a vital organ, were to combine with cells of less importance to the economy, as, for example, the cells of the subcutaneous tissue, it is probable that we should have no tetanus. In some of the lower animals there is reason to believe that the toxin of tetanus does unite with such tissue (Metchnikoff). Roux and Borrel believe that the greater degree of immunity which the rabbit has over the guinea-pig is due largely to the fact that the rabbit's liver is able to fix a great deal of the toxin. And Metchnikoff has found that the liver of the scorpion, which has an absolute immunity to tetanus, absorbs the toxin and retains it for months.

By way of summary, then, we may say that the natural blood immunity and tissue (histogenic, Behring) immunity depend on the following factors: Bactericidal and antitoxic powers of the serum

Summary. and plasma, the destructive effect of the cells, especially the phagocytes, on both bacteria and toxins; a possible absolute non-susceptibility in some cases (the absolute non-existence of suitable cell receptors); the overwhelming distribution of the suitable receptors for the toxin in organs of less vital necessity for the individual, thus diverting it from more important organs.

In order that a pathogenic organism produce a progressively fatal disease in a susceptible animal the following obstacles must be surmounted: The strong defenses of the body surfaces must first be overcome; a local inflammatory reaction which may have been excited must first prove itself to be inadequate for the limitation of the infection; there must be an insufficient supply or activity of antimicrobial and antitoxic processes in the body fluids and cells.

In view of the wide variations in the nature of different pathogenic agents it is evident that the defensive means which would counteract one might be inadequate for another; and inasmuch as animals appear to differ as much in the character of their defensive as microbes do in their offensive powers, there is abundant room for the display of the various phenomena of natural immunity and of natural susceptibility with which we have become familiar.

In addition to the bactericidal and antitoxic action of many normal serums, they often possess other characteristics which are of the highest interest in the

Hemolysins. study of immunity. In earlier days it had been noted that the transfusion of blood from one species to another was often fatal to the injected animal. Later investigations showed that this was due to toxic substances in the transfused blood; substances which, above all, destroyed the red blood cells of the injected animal. This action, in which the hemoglobin is dissolved out of the red blood cells, may be reproduced in test-tube experiments by mixing the blood cells of one animal with the serum of another which is toxic (e. g., rabbit blood + goat serum). This is the phenomenon of hemolysis, and the appearance of such a tube is exactly like that seen when blood is mixed with distilled water or even with tap water; i. e., it is a laking of the blood, it loses its opacity and assumes a beautiful cherry-red color. The serum of practically every species contains a hemolytic substance (a serum hemolysin) for some kind of erythrocyte.

Some serums also contain toxic agents for other cells; they are generally called serum cytotoxins.

Cytotoxins. The serum of the eel not only contains a strong hemolysin, or hemotoxin, but also a powerful poison for nervous tissue, neurotoxin. Similarly

we have normal leucotoxins for leucocytes, nephrotoxin for kidney tissue, etc.

Another property of many normal serums is that which causes the agglutination or clumping of bacteria, as one sees it in the Gruber-Widal test for typhoid.

Agglutinins. Even normal human serum may agglutinate the typhoid bacillus, but to a less degree than that of a typhoid patient.

One serum often causes a precipitate in the serum of another animal, or in a bacterial culture filtrate.

Precipitins. In considering these facts one becomes conscious of the great complexity of that substance which plays so important a part in immunity and its study—i. e., the blood serum.

(To be continued.)

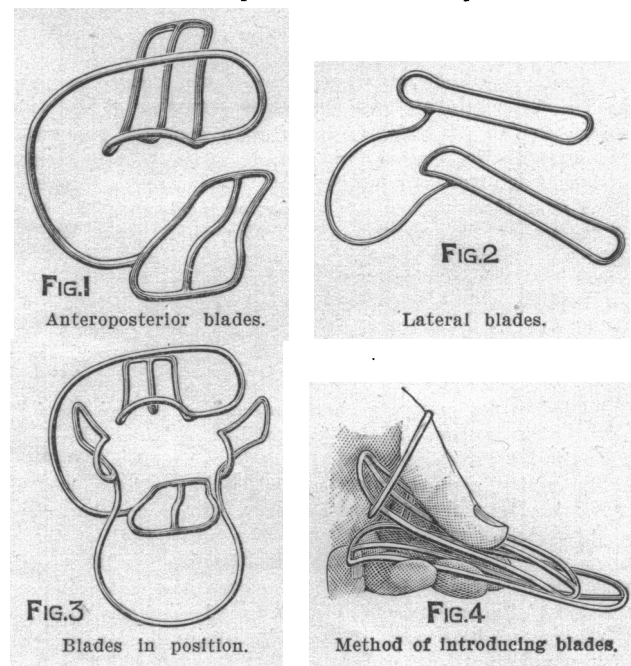
New Instruments.

COMBINATION QUADVALVE WIRE SPECULUM AND BIVALVE SPECULUM RETRACTOR.*

CHARLES F. SPANGLER, M.D.

KANE, PA.

This instrument is designed to facilitate the inspection of the vulva, vagina and cervix. It is especially serviceable in stout patients, or in patients with relaxed vaginal walls, which close in between the expanded blades of a speculum and ob-



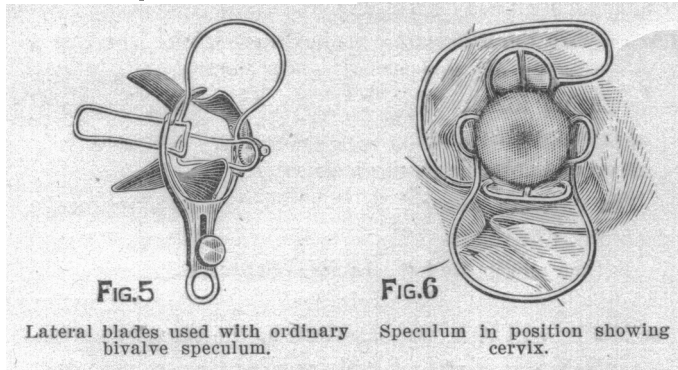
struct the field of vision. It should be constructed of the most durable quality of steel wire. It is easily rendered aseptic, is self-retaining, and is readily introduced and withdrawn without pinching the tissues. The adjustment is such that the distension of the vaginal vault by the expanded blades draws the cervix well forward within the speculum and toward the vulvar outlet.

The spring loop or vulvar extremities of both sections are intended to be permanently expanded and not compressed for introduction. The location of the cervix is ascertained with the index finger, the anteroposterior blades (Fig. 1) are introduced by placing the thumb through the loop on the anterior blade and the fingers of the same hand under the posterior blade, pressing together the distal extremity only as in Figure 4. This movement carries the blades through the vulva, then the pressure on the blades by the fingers is released and

* Exhibited before the McKean County Medical Society, at Bradford, Pa., Nov. 1, 1904.

the speculum gently pushed into position. The lateral blades (Fig. 2) are next introduced in like manner (Fig. 3).

In removing the instrument, the lateral blades are removed first by withdrawing them one-half or two-thirds and then compressing the distal ends as when introducing. The antero-posterior blades are sufficiently withdrawn, but the distal ends can be compressed in like manner.



In office examinations, in many instances, there is difficulty in securing satisfactory exposure of the cervix without the aid of an assistant. The lateral blades or retractors used in conjunction with any suitable bivalve speculum, as in Figure 5, constitutes a thoroughly efficient quadvalve speculum insuring complete exposure of the cervix, particularly in cases of laceration or of enlargement of the cervix or of undue relaxation of the vaginal walls (Fig. 6).

A NEW SAW ESPECIALLY ADAPTED TO CRANIAL SURGERY.*

H. C. MASLAND, A.M., M.D.
PHILADELPHIA.

It is a matter of common knowledge that the present instruments for opening the skull in cranial surgery are crude and unsatisfactory from many points of view, and some months ago, in making certain bone sections, the idea of utilizing the circular saw occurred to me. This new saw which I have devised (Fig. 1) has a handle heavy enough to prevent vibration, and of such shape as to permit a firm grasp with the hand. On the upper part of the handle there is a shoulder to accommodate the thumb. On the lower aspect of the handle are grooves for the fingers, with a ring for the index finger. This ring protects the finger absolutely from the rapidly revolving saw, and also gives a rigid base to brace, when desired, the handle against the head. I originally provided a sharp pin on the lower edge of this ring to press into the bone to anchor the instrument, thereby preventing slipping of the saw in starting the incision. This was found in practice, however, to be unnecessary, the saw proving to be under perfect control. The gauge to regulate the depth of cut of the saw slides at the side of the saw, and is accommodated in a dovetailed groove at the side of the handle. The end of the gauge shaft is threaded and accommodates a nut set in a recess in the handle. By turning this nut, the gauge slides in or out and permits the saw to cut to any depth, to the finest fraction of an inch.¹ The saw is set in a recess in the handle, and this, with the gauge just described, protects the operator's fingers perfectly from any injury. The saw is attached to a short shaft held in place by a set-screw through the top of the nose-piece of the handle. A thread on the other end of the shaft, with a surrounding threaded collar permits of connection with the flexible shaft and its sheath respectively of an electric motor or dental engine.

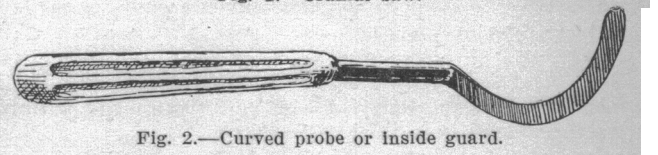
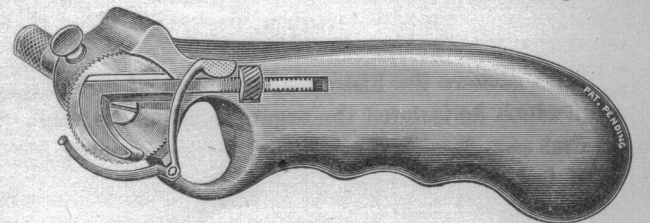
This instrument will cut as rapidly as desired through bone of any density. I have had the saw revolving 3,400 revolutions a minute with all vibration a negligible quantity. With a circular saw, of course, one must make incisions in a straight

line, but a moment's reflection will show that the curved incision has no real advantage, and is but an inheritance of the compulsory cut of the obsolete trephine. With this new saw, a bone flap of any size may be made, with the least possible amount of bone destruction, and without interference with the vitality of the flap. By making a triangular flap, and then instead of cutting through the last angle breaking it off with a chisel, the periosteal connection is preserved. By tilting the saw a beveled cut can be made, thereby securing a shelf and preventing undue sinking of the bone flap after replacement.

This instrument makes an incision of but one millimeter in width, and it can readily be seen that this promises the very greatest likelihood of union occurring in the healing process.

Inasmuch as the saw can be regulated to cut the finest shades of difference in depth we have ample protection against injuring the brain substance. Even when there are internal ridges of bone if the operator does not choose to spring these loose with his chisel, he can pass a delicate curved probe around the ridge between the dura and the skull and then by pressing the dura away cut the obstructing ridge with impunity (Fig. 2).

I have thus far refrained from referring to the inside guard because many surgeons feel confident enough to control their cuts without its use. However, I have devised it in order to answer every requirement that might arise. This guard is composed of the protecting arm with a T-shaped end, a pivot joint and a handle arm. The joint is of the French lock pattern,



with a sufficiently wide bearing surface to prevent lateral motion. The French lock permits the ready removal or placing of the guard in position. The handle arm turns up over the instrument to the shoulder where it is operated by the thumb.

To operate this guard an opening is first made to admit the T-shaped tip, the tip is then adjusted in position between the skull and the dura. Constant pressure of the thumb is necessary to keep the tip in proper apposition to the inner wall of the skull. Suitable stops placed at the joint prevent the arm from contact with the teeth, and also from unnecessary motion in the opposite direction. A spring² attached to the arm assists the thumb in constantly drawing up the tip toward the saw. It is necessary to withdraw the tip and to readjust it when starting on a new line of incision, as the narrow cut made prevents the guard from turning corners. A contrivance has been devised for transmitting the power through the handle to the short saw shaft. As, however, the mechanism for this is more complicated and less durable, and as by experience the lateral transmission has not proved objectionable, it has appeared wiser to use the simpler construction.

To sterilize the instrument here shown, it is only necessary to unthread and withdraw the guard, loosen the set-screw holding the shaft, and then to draw out the saw and shaft; all the parts are then exposed and can be thoroughly cleansed.

In closing I might say that though this saw was primarily devised for cranial surgery it will no doubt prove useful in operations on various bones. Its usefulness in removing the calvarium at autopsy is apparent.

An instrument dealer thought that this instrument would prove an admirable saw to cut plaster-of-paris casts.

* Shown before the Philadelphia County Medical Society, Jan. 25, 1905. The discussion by members of the society was printed in THE JOURNAL, February 18, p. 569.

1. Not desiring to obscure the view the inner guard spring is not shown in Figure 1.