and bronchial irritation. Troublesome cough is readily controlled by the old-fashioned Brown's mixture, or by small doses of codeine in syrup of wild cherry.

In recent epidemics the writer has gotten excellent results from heroin (gr. $\frac{1}{12}$–$\frac{1}{24}$) either alone, or when secretion was free, in combination with ammonium chloride (gr. v.–x.) and syrup of squills (♏ x.–xv.).

In the graver types of influenza, or when the course is anomalous, care must be taken not to overlook complications, which often, especially those of intrathoracic origin, steal on insidiously. These must be managed according to the principles of treatment laid down on other pages of this HANDBOOK.

Delayed convalescence will call for a prolonged course of tonics, and, in many cases, for an outing at the seashore or in the mountains. *William Judkins Conklin.*

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INGROWN TOE-NAIL.—This affection is characterized by an inflammation of the soft parts underneath and alongside the edge of the toe-nail. It may be congenital, but more commonly it is met with in adults. In occasional instances it would seem to be hereditary. Its most frequent location is on the outer side of the great toe, although it not infrequently involves both sides of the toe, and even of both large toes. The disease seldom occurs in the smaller toes, and is of comparatively slight importance when it does.

Beginning insidiously with pain and soreness underneath the side of the nail, which are increased by pressure, the affection often terminates in suppuration and ulceration. The granulations become exuberant, the parts about the nail become hypertrophied, and the whole toe is swollen, tender, and painful, rendering the patient totally unable to wear a boot, or even to walk. The nail also becomes deformed. Its edges curve in and act as a foreign body, constantly irritating the inflamed tissues. Pus collects underneath the nail, decomposes, and tends not only to aggravate the suffering, but to keep the toe in a filthy condition. The duration of the disease is often protracted, many people suffering from it for months or even years, before obtaining permanent relief.

CAUSE.—Tight or ill-fitting boots are frequently the cause of this affection. High and narrow heels, narrowness of toe, and insufficient length, are common and important defects in boots, shoes, and slippers. Every step taken upon a high heel tends to push the foot farther into the shoe, and thus to crowd and cramp the toes, and not infrequently the affection under consideration is the result. The accumulation of dried epithelial débris under the nail also acts as an irritant. Paring the corner of the nail too closely tends to produce this disease by allowing the soft parts which grow more rapidly, to rise up and obliterate the groove that the nail should occupy. As this latter comes forward again it necessarily impinges upon the soft tissues, and may excite inflammation. A markedly convex nail bordered by thick masses of soft tissues predisposes the toe to this affection.

TREATMENT.—This may be palliative or radical. The cause should be removed, if practicable. The nail should be trimmed squarely across the end, and the edges should be allowed to project beyond the free margin of the flesh.

The soft parts are to be kept well pressed back from the nail at its root and sides, and the epithelial débris is to be frequently removed. The boots should be of good length, wide across the toes, and should have low, broad heels.

In the lighter cases relief may at times be obtained by scraping the nail thin with a knife or, better, with a piece of glass, and cutting a deep notch in the centre of the free border. A bit of lint or of cotton may be drawn under the edge of the nail to raise it from the sensitive matrix, and to give exit to any pus which may have accumulated underneath. The same object may be obtained by means of an elastic cord passed under the border of the nail, the ends being secured to the dorsum of the foot by adhesive plaster. Agnew made use of a piece of cork, cut in a peculiar shape, to separate the nail and the flesh. Should there be much inflammation at any time, it is to be treated with water dressings, or with flaxseed-meal poultices. A starch poultice is also an admirable application in many cases.

One of the best local applications to repress exuberant granulations is the powdered nitrate of lead. It is to be dusted upon the parts every day, until a crust is formed, underneath which healing will frequently take place. Should the crust become loosened by the suppuration, it may be removed and fresh powder applied, until the granulations show a tendency to a healthy cicatrization.

The cause of the affection having been removed, many cases of only moderate severity may be satisfactorily managed in the manner above described. Not infrequently, however, either from neglect or from improper treatment, the tissues have become so extensively inflamed that more radical measures are required. Several methods for obtaining a permanent cure have been recommended. The old one of splitting the nail and removing a portion without destroying the matrix has very properly been discarded, as the benefit derived from the procedure was usually only temporary, and the trouble was very apt to reappear with the growth of the nail. Removal of the entire nail with destruction of the matrix is seldom, if ever, necessary.

The operation which was brought to the notice of the profession many years ago by Dr. B. E. Cotting, is efficient, and, barring a rather tedious convalescence in some

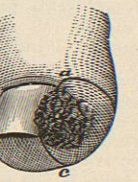

FIG. 2799.

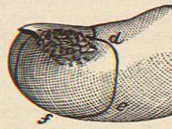

FIG. 2800.

cases, is satisfactory. It consists in removing all of the soft parts overlying the infleshed nail, leaving the latter uncovered and freely exposed, as is indicated in Figs. 2799 and 2800. The cicatricial contraction following the healing of this wound tends to prevent the nail from again becoming embedded in the soft tissues. This is a

very good operation, but the following is preferable from the fact that the convalescence is much shorter, and the results are as good.

The nail is split so as to remove about one-quarter of it on the affected side. The incision is to be extended well back toward, but not into, the joint. Another incision extends from this one along the side of the toe near the nail, thus removing a very thin strip of the inflamed tissues, leaving a clean fresh wound. Particular care should be taken to remove the matrix along with the bit of nail. Unless this is done thoroughly, the new growth of nail will very likely give the same trouble as the present one. This is the key to the success of the operation. The wound is to be closed with sutures, one or two of which may be passed through the nail, or that portion of the flap may be kept in place with adhesive plaster. If the operation is done under careful aseptic precautions, the wound should be well in a week, and the patient enabled to wear a loose shoe soon after. This is the best operation thus far suggested for a radical cure of this troublesome affection. *George W. Gay.*

INHIBITION.—Inhibition is derived from the Latin word meaning restraint. It refers to any influence which controls or retards. From a physiological standpoint, inhibition is commonly referred to as any influence which restrains or even prohibits movement of the parts concerned. Although some of the most striking illustrations of inhibition have to do with the retardation of movement, it by no means follows that inhibition should be limited to this kind of phenomenon alone. There is some evidence that under certain conditions, or in particularly susceptible individuals, sensation (pain, etc.) and chemical activity, as represented by changed secretions, may be inhibited to a greater or less extent. The term inhibition in its physiological sense first came into use from the study of the action of the vagus nerves upon the heart. This phase of the subject will therefore be dwelt upon in some detail.

HISTORICAL.—In their experiments in 1845 the Weber brothers showed that when an interrupted electric current was used for stimulation, and one electrode was placed within the nostril of a frog and the other on a cross section of the myel at the level of the fourth or sixth vertebra, the stimulus caused the heart to stop beating. This experiment led to the discovery of the function of inhibition. By further experiments the Webers localized more definitely the source of inhibitory power as being situated between the optic lobes and the calamus scriptorius—or, in other words, in the region of the oblongata. Later, Eckhard, by using a mechanical stimulus—the prick of a needle,—more minutely localized the inhibitory centre in the frog, and found it to be between the cerebellum and the tip of the calamus scriptorius. Labordi, also by the needle method of excitation, located the vagus centre in the cat at a point in the middle of the spinal bulb, lying in the lateral part of the floor of the fourth ventricle. At this spot there is situated a mass of gray matter, which forms the accessory nuclei of the hypoglossal, spinal accessory, and glossopharyngeal nerves.

COMPARATIVE.—The different conditions existing in the various groups of animals respecting the form, structure, innervation, and temperature of the heart itself, are naturally correlated with some difference in reaction to inhibitory influences. As will be shown later on, different parts of the heart will respond in a different degree to inhibitory stimuli. Even among the various Invertebrates investigated, some have been shown to possess a regulative mechanism for the heart. Ransom has shown that in the octopus and in the squid, both inhibitory and accelerator nerves are present. The American crab, *Callinectes hastatus*, is also provided with accelerator and inhibitory nerves which pass into a pericardial plexus. The land snail, *Helix*, possesses cardiac inhibitory nerves as shown by numerous observers. The sea snail, *Aplysia*, on the other hand, has been found to possess an accelerator but no inhibitory nerve

The presence of a cardiac inhibitory mechanism in numerous Invertebrates would naturally strengthen the supposition that a similar condition should exist in the Vertebrates. Such an assumption has hitherto been generally accepted without question or proof to the contrary. A recent article by Greene (*Amer. Jour. Physiol.*, 1902) shows that in the hagfish, *Polistotrema stouti*, there are no cardiac regulative nerves whatever. In the literature at present available the writer has been unable to find any other record of the absence of an inhibitory cardiac mechanism among the Vertebrates. There are, of course, examples where much cardiac resistance has been shown toward inhibitory influences, but some restraining effect has been obtainable. Greene concludes that in the hagfish, one of the lowest of the Vertebrates, a condition exists comparable to the heart of an embryo before the nerves have entered it, and that any regulation of the heart's action must depend upon conditions which affect the cardiac muscle directly, such as tension, nutrition, etc. The volume and pressure of the blood coming to the heart and the changes in the pressure upon the viscera by the body movements undoubtedly exert a decided influence upon the hagfish heart.

Gaskell concludes, from his observations among the cold-blooded animals, that, with the exception of the Amphibia, stimulation of the vagus has little or no inhibitory effect upon the ventricle, although other parts of the heart are affected.

Greene states that among the Elasmobranchs several sharks and rays have been shown to possess inhibitory nerves for the heart, and has himself demonstrated the presence of such nerves in one species of shark, but any specific action upon the ventricle itself is not mentioned. Among the Teleosts, Gaskell mentions the eel and toadfish as examples of this group in which the ventricle shows little or no inhibitory effects. Fishes are mentioned in the original list of animals given by the Weber brothers in which cardiac inhibition was produced by vagus stimulation, but here again there is no specific mention of the ventricle. In the Amphibia (frog, toad, newt, and necturus), on the other hand, the ventricle is inhibited in the same way as is the auricle.

Knoll (*Arch. f. d. ges. Physiol.*, Bonn, Bd. xlvii., S. 595), among other things, states that in the heart of the pigeon, which was included in his experiments, the ventricles reacted normally to vagus stimulation in the same way as the atropinized ventricles of the mammal. As atropine paralyzes the inhibitory nerve endings, stimulation of the vagus, under this condition, exerts no inhibitory effect upon the mammalian ventricles. It seems reasonable, therefore, that the inference to be drawn is that the pigeon ventricle is normally insensible to inhibitory influences from excitation of the vagus. This fact has an interesting relationship to the view commonly held that the birds sprang from the reptiles.

In the group of Mammals (cat, dog, rabbit, rat, hedgehog, guinea-pig) it has been well demonstrated that vagal stimulation inhibits the action of the ventricles as well as the auricles.

In classifying the results obtained, so far as ventricular inhibition is concerned, the Amphibia and Mammals may be placed in one group, characterized by ready ventricular response to vagal excitation; and, following Gaskell, the Teleosts, Reptiles, and pigeon may be placed in another group in which there is little or no ventricular response when the vagus is excited.

As the writer is unable at the present time to obtain definite information with regard to the specific effects of vagal stimulation upon the ventricle of the Elasmobranchs, it is doubtful to which group they should be assigned. Nor is there any information available as to the effects upon the ventricle of the Dipnoans—the lung-breathing fishes. Gaskell suggests that it may be assumed that the same phenomena may be found in this group as in the Amphibia. The hagfish apparently holds a unique position among Vertebrates, on account of the absence of any extrinsic nervous mechanism for regulating the action of the heart.

Cardiac Inhibitory Mechanism.—A cardio-inhibitory centre in the oblongata with afferent and efferent nerves and the heart itself represent the various parts, two or

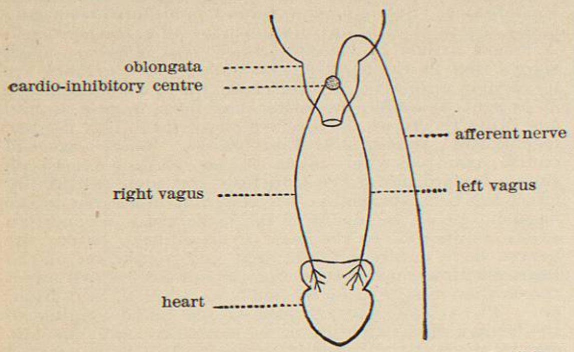

Fig. 2801.—Schema Showing the Relation of the Cardio-Inhibitory Centre, Afferent and Vagus Nerves to the Heart.

more of which are necessary to accomplish inhibition. In experiments, stimulation of the vagus nerve which contains the efferent or inhibitory fibres and the heart itself represent the two necessary parts of the mechanism concerned in the process. Direct excitation of the centre would involve three of the parts, and reflex stimuli would necessitate the use of all of the parts above mentioned.

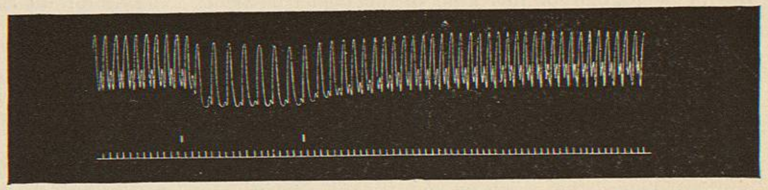

Fig. 2804.—Vagus Excited by Weak Interrupted Current. The short verticals between the heart and time tracings show when the stimulus was applied and removed; secondary coil 15 cm. from the primary. (Brodie.)

The Weber brothers pointed out the fact that a weak stimulation of the vagus nerve of the frog not only slows the heart, but also weakens the contractions. The latter fact was largely overlooked in the various controversies that followed, until Coats, in 1869, showed that the contractions of the heart, as registered by a mercurial manometer, were markedly diminished in force upon stimulation of the vagus nerve. These observations were followed by those of Nuel, who also noted that the contractions of the auricle were diminished to a greater extent than those of the ventricle. Gaskell and Heidenhain, in 1881 and 1882, confirmed the above phenomena.

Fig. 2802.—Tracing Showing the Diminished Force and Frequency of the Heart Beat when the Vago-Sympathetic is Stimulated.

If one vagus be cut there will be but little change in the beat of the heart—probably a slight acceleration. If the other vagus be also divided there will be a marked increase in the heart's action. Such an experiment shows that the vagi serve as channels for restraining or inhibitory influences keeping the heart's movements in check. With these influences removed, the movements occur with greater frequency.

Stimulation of the vagus from the centre downward causes the heart to beat more slowly or arrests its action in diastole. The result depends upon the strength of the stimulus employed; feeble stimuli slow the heart, while strong stimuli arrest it in diastole. "Division of the vagi lets the heart go; their stimulation holds the heart in." In this respect there is a phenomenon totally opposite to that possessed by the motor nerves and muscles in general; the vagi do not excite but restrain the contraction of cardiac muscle, or, if the stimuli be sufficiently strong, will cause an actual relaxation.

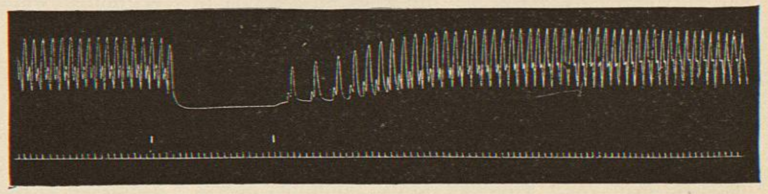

Fig. 2805.—Vagus Excited by Slightly Stronger Interrupted Current. Secondary coil 14 cm. from the primary. The short verticals between the heart and time tracings indicate when the stimulus was applied and when removed. (Brodie.)

Stimulation of the vagus does not produce an immediate effect upon the heart. Donders, Prahl, and Nuel observed a latent period between the moment of excitation and any visible response on the part of the heart. This

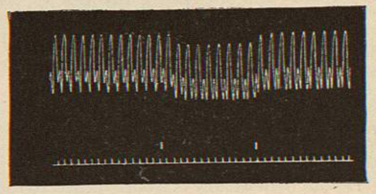

Fig. 2803.—Showing the Effect of a Very Weak Interrupted Current upon the Heart's Action. The lower line is the time tracing in seconds; the two short verticals just above it show when the stimulus was applied to the vagus and when it was removed; secondary coil 19 cm. from the primary. (Brodie.)

period has been variously estimated as lasting from one-twentieth to one-fifth of a second—much longer than the latent period of a voluntary muscle. It is usually of such length that at least one heart beat or cardiac cycle occurs after the commencement of stimulation.

On the other hand, the effect upon the heart is not removed immediately upon the withdrawal of the stimulus, so that the heart is still inhibited for a time after all excitation has ceased. This is described as the "after-effect," and, in its most typical form, is a continuation of arrest followed by recovery to and beyond the normal.

It has also been found that a prolonged stimulation of the vagus is not able to keep the heart in a state of arrest for an indefinite period, but that it will "escape" from the inhibitory influence, and although the stimulation is kept up the heart will recommence its beating, and may even beat more strongly than before. A most interesting feature in this connection is that if stimulation of one vagus is kept up until the vagus arrest has come to an end, stimulation of the second vagus will stop the heart.

The two vagus nerves, however, are not equal in power. Stimulation of the right nerve is usually more effective than that of the left, though the reverse is sometimes true, and again there may be no perceptible

difference between the two. Differences of this kind have also been noted according to the species of animal experimented upon.

A partial explanation for some of the variable inhibitory results, and also having a bearing upon the escape of the heart from vagus control, is the presence in the vagus of accelerator fibres, which come into action as the true inhibitory action wears off. Such accelerator fibres have been isolated in the frog, and their existence, experimentally at least, in the mammalian vagus, if not proved, is highly probable.

In Mammals the inhibitory fibres are derived from the spinal accessory by its internal branch; if the spinal ac-

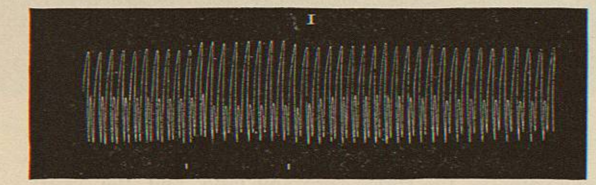

Fig. 2806.—Stimulation of the Right Vagus. The accelerator fibres overshadow the inhibitory fibres in this case and acceleration is produced instead of inhibition. The short verticals just below the heart tracing show when the stimulus was applied and when removed. (Brodie.)

cessory be torn out by the roots and its fibres allowed to degenerate, stimulation of the vagus will no longer produce cardiac inhibition (Waller, 1856).

In general, either one of two effects may be noted upon the amphibian or mammalian heart with a moderate stimulation of the vagus: there is usually diminished force and frequency of the auricular as well as the ventricular beats, followed by increased force and frequency; or there may be exceptionally no primary diminution, but an immediate increase of force and frequency.

These results also indicate the presence of two kinds of fibres in the vagus—or more properly the vago-sympathetic—viz., the inhibitors which give the usual, and the

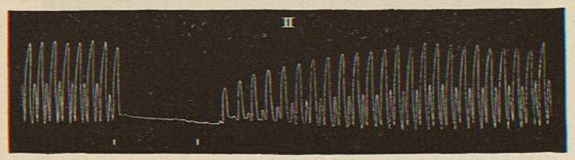

Fig. 2807.—Stimulation of the Left Vagus. In this case the inhibitory fibres overshadow the accelerator and the heart is stopped in diastole. Stimulus applied and removed as shown by the short verticals. (Brodie.)

accelerators which give the exceptional results. In the usual results the accelerators are overshadowed for the time being by the inhibitors. Stimulation of a fresh vagus nerve in connection with a vigorous heart gives the usual inhibitory effects; stimulation of a fatigued or otherwise weakened vagus with a sluggish heart is quite likely to give the exceptional effects. Direct excitation of the normally beating heart generally gives inhibition; direct excitation of a dying heart, which has almost or just ceased to beat, temporarily restores the rhythmic beat.

According to Waller, the cardiac muscle within certain limits is more or less easily modified by inhibitory as well as accelerator influences, according to a higher or lower temperature.

Cardiac inhibition has been noted in man by Czermak and Concato, by compressing the vagus in the neck with the finger; but the experiment is accompanied by danger and ought not to be undertaken. Waller has also referred to experiments in which inhibition was produced upon the heart of executed criminals, the inference being commonly held that inhibitory phenomena occur in the heart of man similar to those in the hearts of other Mammals.

Parts of the Heart Principally Affected.—Experimental evidence points to the fact that in all cases the auricles are inhibited to a much greater extent than the ventricles, even in the Amphibia and Mammals in which both portions easily respond; in certain other Vertebrates, as has been stated, inhibition is inclined to stop in the auricles and hesitates or does not pass over into the ventricle. Much discussion has arisen as to whether the inhibitory effects, arising from excitation of the vagus, are brought about by the action of the vagus upon the cardiac ganglia—the intrinsic nervous mechanism,—or if there is direct action of the vagus upon the muscle itself. There seems to be increasing evidence that the latter view is correct. As pointed out by Gaskell, the fact that a diminution in strength of contraction as well as in rate, taken with the well-known fact that the force of the cardiac contraction does not vary with the strength of the stimulus, would indicate that the inhibitory nerve acts on the muscle itself, and not by decreasing a stimulus from motor ganglia. This view rejects the idea that inhibition is caused by merely diminishing the impulses to the muscle, but favors the conception of direct vagus (inhibitory) action upon the muscle substance.

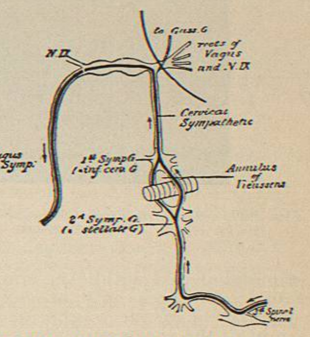

Fig. 2808.—Cardiac Nerves of the Frog. (Foster.)

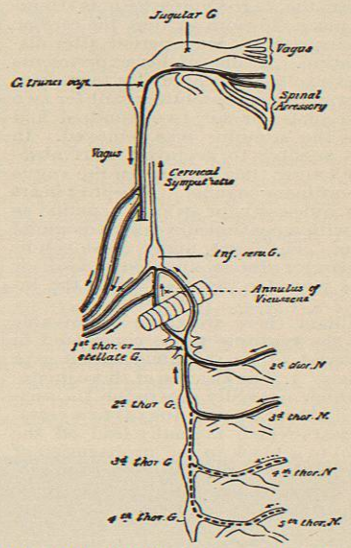

Fig. 2809.—Cardiac Nerves of the Dog. (Foster.)

Quite early in researches concerned with inhibition, it was noted by Schiff that the cardiac muscle both of auricle and ventricle in the frog responded less readily to a stimulus during standstill, or even would not respond at all, although the stimulus might be a strong one. Eckhard confirmed this, and the fact is now generally accepted, and is taken as evidence that the vagus diminishes the excitability of the muscular tissues.

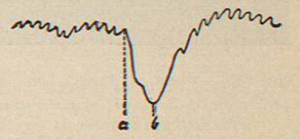

Fig. 2810.—The Effect of Vagal Stimulation upon Blood Pressure. *a*, Vagus excited; *b*, excitation removed.

Later came the work of Gaskell and Heidenhain, which emphasized the importance of separating the inhibitory from the accelerator fibres in the vago-sympathetic nerve of the