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and of the Origin of Reflex  
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BY

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A CLINICAL STUDY OF NEURALGIAS,  
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BY C. L. DANA, M. D.

SOME excuse may be expected for presenting so hackneyed a subject as neuralgia. I have found, however, that the literature on this topic for a good many years has been mainly devoted to the therapeutics, and it has seemed to me possible that a new study of some of the clinical aspects of the disease might be of interest. In particular, I have hoped to begin at least a collection of facts which might show us whether neuralgia in this country and climate presents the same physiognomy that it does in Europe, whence has been got the basis of most American writings and views of the disease.

In the second place, I have taken up with especial care the subject of the so-called reflex origin of neuralgia and neuralgic pains, and I trust that my investigations in this line may be of some value.

True idiopathic neuralgia is a rare disease, making up not over 2 or 3 per cent. of the various forms of nervous disorder. Symptomatic neuralgias, reflex or transferred pains, and neuralgic pains from toxic causes are extremely

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frequent, and make up over 10 per cent. of the total of diseases for which the neurologist is consulted.

The statistics on which I base my remarks include all the neuralgias treated by myself for the past two or three years in dispensary, hospital, and private practice, of which I have preserved notes; also records of statistical value, in some directions, of the neuralgias treated during one year at the Nervous Department of the Manhattan Eye and Ear Hospital ("Annual Report," 1884-'85), the Mount Sinai Dispensary ("Annual Report"), Demilt Dispensary (from records kindly furnished by my friend, Dr. William M. Leszynsky), and the Out-patient Department of Bellevue Hospital. My own cases amount to 260, while the total number of cases collected is 453.

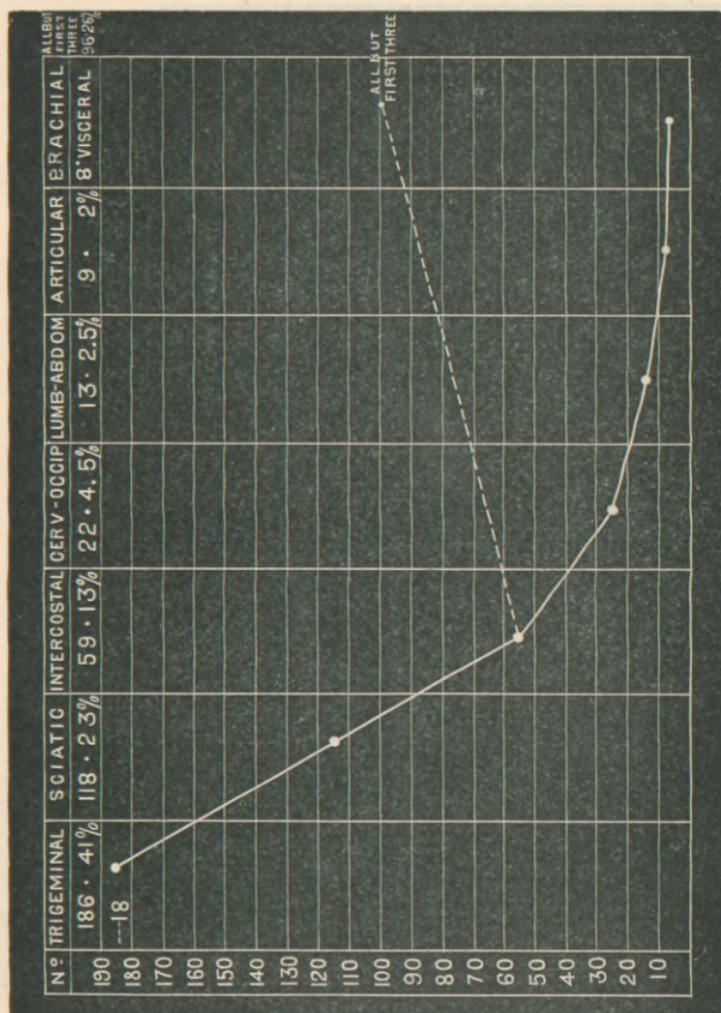
I shall proceed, first, to present the facts obtained by studying these cases of neuralgia as a whole.

*Frequency.*—The table and chart which I have here show that, of 453 cases of neuralgia, 186, or 41 per cent., were of the trigeminal nerve; next to this come the sciatic, with 23 per cent., and the intercostal, with 13 per cent.; then follow the cervico-occipital, 4.5 per cent., the lumbo-abdominal, 2.5 per cent., and the articular, 2 per cent. The brachial is slightly less, while none of the other different neuralgias form much more than a fraction of a per cent. of the whole. This distribution of neuralgias is not in any striking way at variance with those of such other observers as I could find.

*Form of Neuralgia.*—Trigeminal of all forms, 186 (41 per cent.); supra-orbital, 39; migraine, 31; mixed, 17; infra-orbital, 3; infra-maxillary, 5; tic douloureux, 5—100.

Sciatica, 118 (23 per cent.); intercostal, 59 (13 per cent.); cervico-occipital, 22 (5 per cent.); lumbo-abdominal, 13; angina pectoris, 7; gastralgia and neuralgia, 8; articular, 9; crural, 6; brachial and cervico-brachial, 8; testes,

2; urethral, 1; parietal, 2; digital, 1; plantar, 1; palmar, 1; pododynia, 1; coccygodynia, 1; universalis, 1; epigastric,



1; ovarian, 3; larynx, 1; lingual, 1; spinal, 4. All neuralgias, except trigeminal, intercostal, and sciatic, 26 per cent.

As compared with the statistics of Dr. J. Classin, of

Kiel, who collected 434 cases, it seems that we have 10 per cent. more trigeminal neuralgias, and slightly more inter-

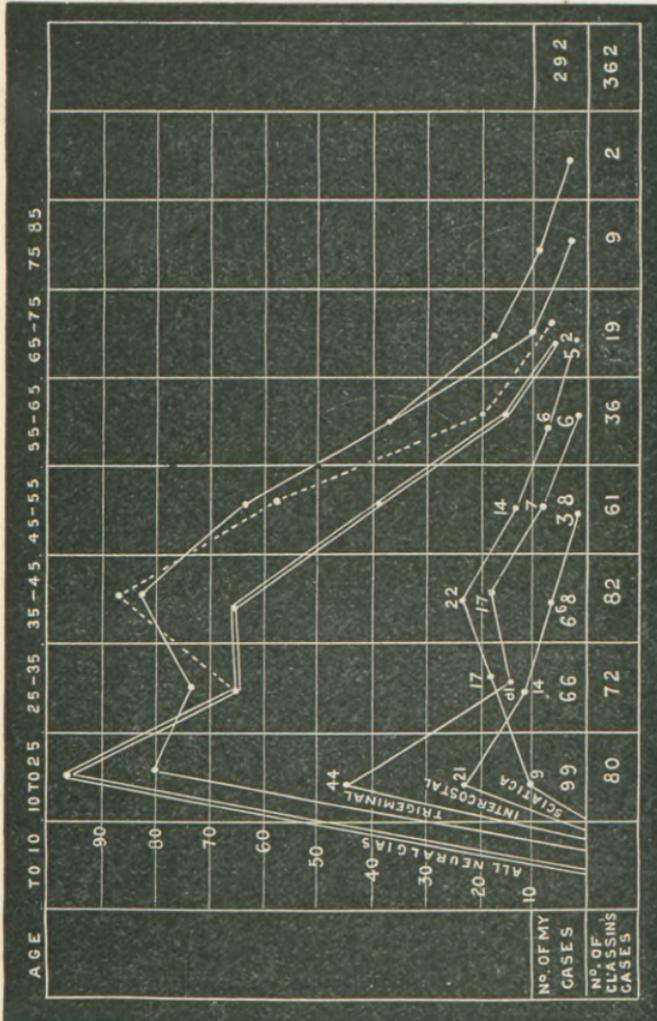


Chart showing the absolute and relative prevalence of neuralgia with reference to age. The double line represents my own cases; the upper single line, Classin's. The dotted line shows the relative number of neuralgias to persons living at ages indicated. (Of 1,000 persons born, 714 are alive at the 15th year, 500 at the 40th, and 323 at the 65th year.) Classin arranges his ages from the tenth, twentieth, thirtieth, etc., years. I have been obliged to change this and give approximate figures, for the sake of comparison.

costal neuralgias, while the per cent. which he gives of sciaticas (24+ per cent.), and of all neuralgias except trigeminal, sciatic, and intercostal (26+ per cent.), is almost

exactly the same as my own, proving, in a striking way, the general representative nature of my collected cases.

With regard to age, the following figures are obtained :

*Age.*—10 to 25, 99 ; 25 to 35, 66 ; 35 to 45, 68 ; 45 to 55, 38 ; 55 to 65, 16 ; 65, 5—292.

A comparison of these figures with those of other observers will show that neuralgias in this city attack persons at an earlier period of life than is the case with patients observed by French and German physicians. Thus, among 543 cases collected by Erb and reported by Valleix, Eulenburg, and Erb, only 171 occurred before the thirtieth year, and about 235 before the thirty-fifth year, while in my cases there were 165 out of a total of 265, or nearly two thirds, before the thirty-fifth year. In my cases one third occurred before the twenty-fifth year, while in Erb's one fifth occurred before that time.

In comparison with Classin's statistics the same result is shown. Thus, 30 per cent. of his cases and 45 per cent. of my own occurred before the thirtieth year.

*Sex.*—As regards sex, I find that there were 122 males and 199 females, giving a proportion of about 3 to 5. In Erb's 821 collected cases the ratio was about as 4 to 5 (364 to 457). In Classin's cases the males formed 37·8 per cent. (160), the females 62·2 per cent. (263). These figures are absolutely identical with mine, confirming again the representative character of my cases, and they enable us to say, with much definiteness, that women are more affected with neuralgias than men in the proportion of 5 to 3. If anything, women in this country are attacked in a larger proportional amount than men.

With regard to seasonal influence, not much that is definite has, so far, been established. In my own cases I found the figures as follows : Winter, 93 ; spring, 49 ; summer, 50 ; fall, 76—271.

From this it will be seen that the greatest number of cases occur in the winter months; that there is then a sharp fall in the spring, when the number reaches its lowest point. The number then slightly increases in summer, and reaches a still higher point in the autumn.

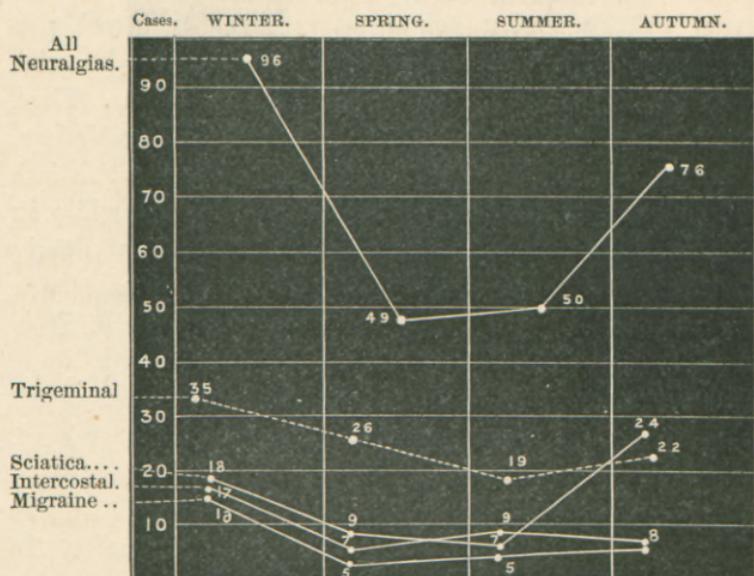


Chart showing the relation of neuralgias to the season—271 cases.

The figures of Classin show the greatest number in summer, 117; next in winter, 109; then spring, 107; and last in the autumn, 101. There is certainly, therefore, an increase in neuralgias in summer over the number in spring, while, doubtless owing to our climate, we have a much greater proportional number in the autumn and winter season than is the case abroad. The maximum number of cases in any one month in Classin's tables was in June, and the next in January.

It is at least interesting to establish the fact that in this city neuralgias do not bloom in the spring, but delay their

efflorescence until summer, from which time they steadily increase in number in this climate until the end of winter is reached.

Of the special forms of neuralgia, those affecting the different branches of the fifth pair of cranial nerves are by far the most frequent, even excluding, as we do, the numerous diffuse head-pains of all kinds.

*Neuralgias of the Fifth Pair.*—The fifth pair of cranial nerves is affected with neuralgias of widely different types. They may be classed as follows:

1. The supra-orbital neuralgias. These are the most frequent in number. Supra-orbital neuralgia may occur as the expression of a constitutional neuropathic state—it may, in other words, be a true neurosis; but far more frequently it is symptomatic of some toxic or anæmic state.

2. Infra-orbital or supra-maxillary neuralgia.

3. Infra-maxillary neuralgia.

4. The mixed forms.

5. True tic douloureux. This is a comparatively rare disease, which may take the form of any of the above-mentioned types.

6. Migraine. This generally affects nearly all the branches of the fifth, radiating to the occipital nerves, but it often localizes itself in the upper ophthalmic branches.

We may have, then, true neuralgic neuroses, clinically different from tic douloureux, affecting one or other branch of the fifth. These are not very rare. We have true *tics*, which are rare. Then we have symptomatic neuralgias affecting the different branches, and these are very common.

Finally, we have migraines which are also common. The comparative number is shown by the following ratio in 100 cases,

Supra-orbital neuralgias (all forms) . . . . .	39	per cent.
Migraine . . . . .	31	“ “
Mixed trigeminal neuralgias . . . . .	17	“ “
Infra-maxillary . . . . .	5	“ “
Tic douloureux . . . . .	5	“ “
Infra-orbital . . . . .	3	“ “

Trigeminal neuralgias affect the female sex more than the male in the proportion of 49 to 23, or 2 to 1.

The effect of the winter season in bringing out trigeminal neuralgias is very marked, as shown by the following: Winter, 35 (35 per cent.); spring, 26 (23 per cent.); summer, 19 (19 per cent.); autumn, 22 (22 per cent.).

Winter and spring are therefore the worst seasons for the trigeminal nerve, and this is especially the case with tics. Patients suffering from tic generally get some relief in the summer months.

With migraines this is not the case. As will be shown later, summer stands close to winter in the number of these cases.

The trigeminal nerve is the one earliest in life affected with neuralgia, which then shows itself generally in the form of migraine. Aside from the painful *tics*, trigeminal neuralgias are oftenest met with in persons under twenty-five or thirty years, as shown by the following: 10 to 25, 44 cases; 25 to 35, 16; 35 to 45, 17; 45 to 55, 7; 55 to 65, 1—85.

There is an increase in trigeminal neuralgias after the age of thirty-five, due to the development of *tics* and toxic neuralgias. Relatively to the population the number is nearly one third greater between the years 35 and 45 than between 25 and 35.

In supra-orbital neuralgias the left side is affected more than the right in the proportion of 14 to 9. This fact has been observed by others, and recently by Faucheron, who

analyzed 100 cases. In the other forms no definite rule can be laid down.

Taking all forms, a preponderance is shown in favor of the left side 31 to 23. In migraines and *tics* the sides are about equally affected (right side 14, left 13).

In most migraines and most supra-orbital neuralgias the attacks were worse or began in the mornings. This was especially the case with those supra-orbital neuralgias curable with quinine and arsenic.

On the other hand, most of the infra-orbital, infra-maxillary, and mixed trigeminal neuralgias were worse in the afternoon and night, especially those forms showing a rheumatic origin. Some indication for treatment is furnished by these facts, for, if the observations are corroborated, they show that rheumatic influences affect the lower two branches of the fifth in a proportionally greater frequency.

A study of the causes of my cases does not furnish anything especially new.

I could only find 5 cases—4 supra- and 1 infra-orbital—that I felt at all sure were due to malaria.

Child-bearing, anæmia, and exposure were prominent causes.

Heredity is a very indirect element except in migraines. On the other hand, the nervous temperament is very often present, and the trigeminal nerve indeed seems to be the first station at which is waved aloft the signal that another victim has been haled into the neuropathic circle.

*Migraine.*—This form of neuralgia occurs oftener in the female in the proportion of 1 to 3 (males, 8; females, 28).

These attacks occur oftenest in the winter, least in the spring, more in summer, and still more in the autumn: Winter, 16; spring, 5; summer, 7; autumn, 8—36.

So far as I could find, in all my cases except one there was in the main an angeiospastic condition of the arteries of

the head. Angeiospastic migraine is the characteristic form in America.

In almost all cases migraine was an hereditary or at least a family disease, alternating sometimes with other neuroses, especially asthma and other neuralgias.

I found two cases only which appeared to be due to asthenia and refractive errors of the eye. Almost all responded well to treatment, and I was not able to convince myself of any peculiar nasal or pharyngeal irritations.

Permit me to add here that the idea that migraine is a disease of the sympathetic system is one of the old medical superstitions which, with the old idea of the sympathetic system, ought to be done away with entirely, and which hardly deserves to be discussed with seriousness. Migraine is a general neurosis like epilepsy, showing itself in nervous discharges, mainly in the area of the fifth. Symptomatically, therefore, it is to be spoken of as a form of trigeminal neuralgia whose manifestations are strikingly associated with vascular and secretory and sometimes motor, visual, and auditory disturbances.

But migraines may occur with very little vascular change, and there are nervous or sick headaches which stand half-way between typical migraine and ordinary rheumatic or gastric headaches.

To illustrate this: There is in particular a form of neuralgia which is often called migraine, and is popularly known as one form of sick headache. In this the pain begins in the back of the head on one side and speedily radiates over to the face on the same side, affecting sometimes the orbital and ciliary nerves, sometimes all the branches of the fifth. It is sometimes accompanied by nausea and even vomiting (especially if right-sided?), but this is not always the case. The face is generally somewhat pale, but not unilaterally so; the eyes are not suffused,

nor is there often any visual or aural disturbance as in migraine. Sometimes the pain remains in the occipital nerves, and I have met with one patient who localizes her pain there entirely, and who always vomits during the attack. The paroxysms are brought on oftenest by barometrical disturbances at the onset of cold, damp weather, or in other cases by the approach of the menses, or by emotional excitement. In some cases the attacks are mild and consist only of some dull pains in the occipital and facial regions. While some of these cases may be diagnosticated as migraine, others resemble ordinary attacks of cervico-occipital neuralgia radiating to the fifth nerve, and other cases are likened to bilious headaches.

These pains are all, in my opinion, migrainous in character, though often not recognized as such. They stand in the same relation to typical migraine as hysteroid convulsions stand to the true epileptic attack. They should be treated on this theory.

*Intercostal Neuralgia.*—This form of neuralgia was met with in 45 cases, of which there were 5 in males and 37 in females. This gives a larger proportion to females than the statistics of Valleix and Bassereau (11 male to 51 female).

The seasonal influence shows a great preponderance in favor of the winter months: Winter, 17; spring, 7; summer, 9; autumn, 8. The attacks occur in the left side more than the right in the proportion of 1 to 3 (right side, 6; left, 19).

*Age.*—From 12 to 25, 21; 25 to 35, 14; 35 to 45, 6; over 45, 4—45. Most are between the ages of 20 and 35.

*Sex.*—Male, 5; female, 37.

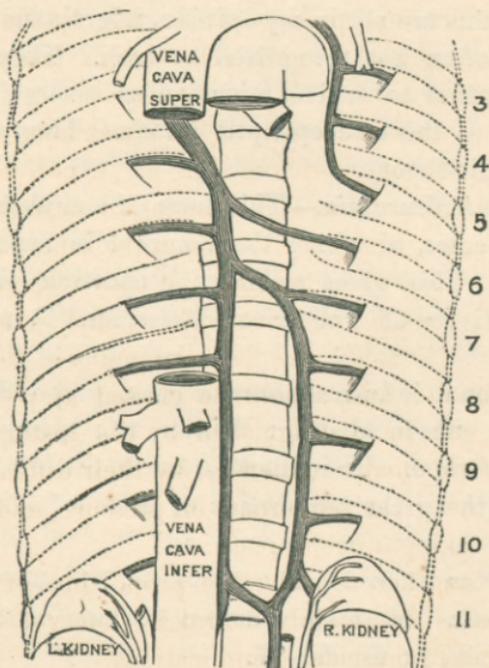
*Season.*—December, January, February, 16; June, July, August, 7; September, October, November, 9; March, April, May, 6.

*Causes.*—Cardiac disease, 1; neurasthenic and anæmic states, 12; ague, 6; tobacco-working, 1; exposure and muscular strain, 6; diabetes, 1; neuritis, 1; dyspepsia and anæmia, 2.

*Side.*—Right side, 6; left, 19; undetermined, 18.

*Pathology.*—This form of neuralgia occurs oftenest in neurasthenic, anæmic, and overworked women. Exposure and muscular strain are often noted.

Exciting causes are dyspepsia and constipation and uterine trouble. Mammary neuralgia is especially often attributed to some uterine trouble. But mammary neuralgia is rare compared with the so frequent complaint of “left-sided pain.”



This left side is oftener affected according to Luschka, because the arrangement of the azygos veins on that side

tends to allow a stasis of blood, those veins passing underneath the descending aorta and thoracic duct.

Others ascribe left-sided pain to a more frequent occurrence of pleuritic and pulmonary congestions on the left side, or to the reflex influence of the stomach.

Uterine disorders which produce a congestion of the pampiniform plexus in the broad ligaments are said to produce left-sided pain by reason of the fact that there are no (or few) valves in these veins, that they pass behind the sigmoid flexure (in which position they may be compressed), and that they empty into the renal vein at a right angle. The objection to this oft-quoted theory is that the veins in question are below the level of exit of the affected nerves, so that any pressure pain would be felt in the thigh or gluteal region unless it were reflected or transferred to higher branches.

More has been said than need have been about the reflex origin of intercostal neuralgia. In my experience only a small proportion are cases of transferred or reflex origin. Most intercostal neuralgias have much the same history and course as supra-orbital neuralgias, and they respond to anti-neuralgic treatment in the same way. I shall return to this subject later. Probably one half the pains in the side are myalgic in nature, and should be classed as pleurodynia. These pains can be distinguished by the history of their origin and of rheumatic influences, by their diffuseness and dullness, by the great tenderness on pressure, and the pain produced on taking a deep breath.

There is another considerable proportion of cases in which the pains are mainly neuralgic, but yet there are some evidences of muscular complications.

In the third class of cases there is the pure stabbing neuralgia, the pain paroxysmal and not increased, as a rule, by movement or pressure.

These distinctions between neuralgic, myalgic, and neuro-myalgic pains are important from a therapeutic point of view. In the purest types of intercostal neuralgia, antirheumatic remedies rarely do good, while the neurotic and anodyne drugs check it very rapidly.

A study of the various pains in the back and side leads me to this therapeutical aphorism—viz., plasters are for the back, blisters for the side. This means simply that most side-pains have a predominating neuralgic element, while most back-pains are myalgic, owing to the greater muscular mass at this point. Anodyne and stimulating plasters, as ordinarily made, have little influence over neuralgia.

The preponderance of pain on the left side seems to me probably due in part to the law that the left half of the body has less resisting power, so far as nervous phenomena are concerned, than the right, exhibiting at all levels a greater number of neuralgic, spasmodic, and other sensory and motor troubles of functional origin.

The so-called tender points in intercostal neuralgia are certainly much less frequently found than is supposed. There is tenderness over the seat of pain always; sometimes a second tender point is found in the back or anteriorly near the sternum, while only very rarely have I found the typical three tender points at the exits of the posterior, lateral, and anterior branches of the intercostal nerves. They may be felt in very chronic cases.

There is a form of intercostal neuralgia not generally recognized as such, because the pain is seated in the neighborhood of the anterior upper crest of the ilium, just at the distribution of the lateral cutaneous branch of the last dorsal nerve. The pain is quite sharply limited and there is tenderness on pressure.

*Cervico-occipital and Occipito-frontal Neuralgias.*—Total cases, 18.

*Sex.*—Male, 4; female, 14.

*Cause.*—Sequel to cerebro-spinal meningitis, 2; hysteria, neurasthenia, 6; anæmia and miscarriages, 1; neurasthenic and rheumatic, 3; syphilis, 2.

*Season.*—Autumn and spring, 8; winter and summer, 3.

*Age.*—Three fourths between the ages of 20 and 36; none below 20.

There are three types of neuralgic pains in the four upper cervico-occipital nerves.

I. One of these is the migrainous, and has been already described.

II. The second type is one of typical neuralgia with tender points, and a continuous course lasting for days or weeks. It is unilateral, and has the characters ordinarily described in the text-books. I have now a patient who has this true neuralgia with occasionally pseudo-migrainous attacks. The pains sometimes reach the character and intensity of true tics.

III. The third type is one found in hysteria and spinal irritation. In this disorder the pain is more bilateral or central, or perhaps shifting, and it is especially characterized by a sharp boring pain just below the occiput. With it there may be evidences of cerebral congestion or anæmia, with vertigo and faintness, but not vomiting. It is one of the hysterical neuralgias and indicates cervico-spinal irritation. The boring pain is almost pathognomonic.

It is a noticeable fact that the four upper cervical nerves supplying motion and sensation to the back and base of the skull are attacked by three painful neuroses just as with the fifth nerve, viz.: migrainous pains, ordinary neuralgic tics, hysterical neuralgias (clavus).

*Lumbar Neuralgias.*—While lumbar pains of muscular and reflex origin are as common as humanity, true dorso-

lumbar neuralgias are comparatively rare. I have notes of only eleven cases.

Dorso-lumbar neuralgias affect either the upper and short branches or the lower and longer branches of the lumbar plexus.

I. In the former case we have pains in the small of the back, the upper part of the buttocks, the neighborhood of the crest of the ilium, and, more rarely, in the hypogastrium, inguinal region, and scrotum or labia.

These pains form the upper lumbar or lumbo-abdominal neuralgias. They are affections of the branches of the first and second lumbar nerves.

Lumbo-abdominal neuralgias occur usually in women after the thirtieth year. They come on late in life like sciatica.

It is upon the upper half of the lumbar plexus also that the lumbo-abdominal pains are reflected which result from uterine displacements or from other irritations of the pelvic organs.

II. The neuralgias of the lower branches of the lumbar plexus produce pains in the outer, anterior, and inner part of the thigh, external cutaneous nerve, genito-crural and anterior crural nerves, the front of the knee, and inner part of the leg (crural nerve and obturator nerve). These form what are generally known as femoral or crural neuralgias. True neuralgias of these branches are very rare, according to both Anstie and Valleix; but here again reflex or transferred pains from the pelvic organs are not infrequently felt. Crural neuralgia is also sometimes felt in connection with sciatica.

*Painful Thigh.*—It appears to me that crural neuralgias of a certain type are not so very uncommon. Certainly I have met with several cases of what might be called, in a general way, "painful thigh." The patients in age and

history are like those suffering from sciatica. They complain of pain in the front of the knee and the anterior and outer parts of the thigh, but have no pain posteriorly, and none below the knee. The internal branches of the anterior crural nerve do not seem to be affected, while the middle and external cutaneous branches and the genito-crural nerve are involved. In one case I observed anæsthesia of the skin.

These cases do not correspond with classical descriptions of crural neuralgia, and they are sometimes regarded as irregular forms of sciatica, because of the diffused pain and stiffness of the thigh. They should be treated in the same way as sciaticas.

The upper lumbar neuralgias may be mistaken for lumbago or hip-joint disease. The lower lumbar neuralgias often present a general resemblance to irregular sciaticas. It should be remembered that neuralgic pains in the thigh alone are generally to be referred to a lumbar plexus.

*Sciatica.*—The total number of sciaticas available for statistical purposes is 73; 25 of these were in females, 48 in males, giving a proportion of 1 to 2. This gives a larger proportion to women than the German statistics of Erb and Eulenburg (65 to 17), while it gives a smaller proportion than the French statistics of Valleix, 72 to 52. The facts regarding age and season are summarized below, and show a rather larger number of cases in early life than is usually believed to occur, and also a decided preponderance of the disease in the autumn.

*Age.*—Fifteen to 25, 9; 25 to 35, 17; 35 to 45, 23; 45 to 55, 15; 55 to 65, 7; above 65, 2. As there are twice as many people living between 15 and 35 as between 35 and 65, and only 26 sciaticas to 47, sciatica is relatively nearly four times as frequent between the ages of 35 and 65. Winter, 21; spring, 9; summer, 8; autumn, 24.

As to the causes: Twelve gave a history of exposure and muscular strain. Ten gave a muscular rheumatic history. Only one had ever had acute rheumatism. Nine gave a distinctly neurotic history, having previously had other forms of neuralgia (3), epilepsy (2), or hysteria (1).

In 3 there was a phthisical taint, in 1 sexual irritation, in 1 probably malaria, in 2 syphilis, and in 1 constipation with piles and a very sedentary life.

Thus it appears that the age of forty and the male sex, and a tendency to muscular rheumatism or a neurotic, especially a lithæmic, constitution, prepare the way for sciatica, and that exposure and muscular strain or some nervous irritation precipitate it.

In many cases one gets every evidence of there being a neuritis—such as anæsthetic patches, coldness of the limbs, atrophy, and even slight partial degenerative reactions in the muscles.

THE ORIGIN OF "REFLEX" OR TRANSFERRED NEURALGIAS AND PAINS.—No point connected with the clinical history of neuralgias is of more interest than that of their so-called "reflex" origin. The production of migraine has been attributed, as we have seen, to the stomach and liver, to the eye, the tonsils, and the nose. Digital, plantar, cardiac, intercostal, and, in fact, all the neuralgias have been attributed to extrinsic causes. So much has appeared in literature regarding the effects of such remote irritation that the importance of this influence has perhaps become exaggerated. At the same time the subject is one deserving of further and persistent study until its present many obscurities are removed.

In this study it is to be remembered that the term reflex used here is not technically a correct one. An irritation in the stomach may cause a pain which is felt in the forehead. The impulse, starting in the stomach nerves, is conveyed to

the cortex of the brain, and this is felt as a sensation excited by the trigeminal nerve. It is a transferred sensation, not a reflex one, since the impulse is afferent only, and the outward reference of the pain is purely psychical.

Reflex pains are, therefore, really "transferred pains" as a rule. In some cases it may be, however, that irritations provoke reflex vaso-motor changes in remote parts, and the anæmia or congestion thus produced causes pain. There may be, therefore, "indirectly produced reflex pains." The term reflex pain is so widely used that I can not attempt to discard it. I use it, however, with the explanation here given.

From a study of many cases of my own for the several years in which my attention has been directed to this subject, from a study of the very meager literature bearing on it, and from personal inquiry among gentlemen who have had large experience in various special fields, I am able to collect the following facts regarding the various organs, the viscera, and their relation to transferred or reflex pains :

*With regard to the Eye.*—In the accurate determination of reflex pains the ophthalmologists have made much progress. I am greatly indebted to my friend, Dr. William O. Moore, for furnishing me, in an admirably succinct form, the results of his studies and experience in this direction. In general terms, the following statements may be accepted :

Reflex pains are produced by asthenopia, of which there are four types, as follows :

*Asthenopia.*—One, refractive ; 2, accommodative ; 3, muscular ; 4, neurasthenic.

The pain in No. 1 (refractive asthenopia) is usually of a dull, heavy character, and is felt in the forehead and along the supra-orbital branches after the eyes have been used for some time.

In No. 2 (accommodative) the pain is felt in the eye, and is one of fatigue. It is of a dull character. This pain, however, is not reflex.

In No. 3 (muscular) there is a sense of pain or, rather, of drawing, often referred to the back of the orbit, sometimes to the back of the head.

In No. 4 (neurasthenic) the sensations are much the same as in No. 3.

In addition, it appears to be established that refractive asthenopia in one eye may give rise to migraine.

The view that nearly all migraines are due to refractive errors, or to imperfection in the muscular apparatus of the eye, is certainly, in my experience, incorrect. It is well to remember that, while eye troubles may cause neuralgia, so, on the other hand, neuralgias of the fifth may cause eye troubles—such as blepharospasm, mydriasis, myosis, and asthenopia (Faucheron, "Rec. d'ophthal.," March, 1881). Occasionally eye irritation causes occipital or fronto-occipital pain, but this does not seem to be the rule. Iritis may cause pain felt over one half of the cranium, like a migraine.

Chronic diseases of the ear have been known to produce trigeminal neuralgias in very rare instances. It is more often that irritations of the maxillary branches of the fifth cause otalgia. My friend, Dr. Sexton, informs me that, as the result of examining the records in a large number of cases, he could not formulate any rule as to reflex pains of aural origin—*i. e.*, from chronic aural disease. Dr. E. Legal ("Deut. Arch. f. klin. Med.," xl, 2, p. 201) says that patients with pains in the occipital or temporal region should be examined for pharyngeal or middle-ear trouble. He reports ten cases in which, by using Politzer's method, or by catheterizing the tubes and treating the throat, the pains were relieved.

Dental caries may cause severe and intractable trigeminal neuralgia. The relation between the two was first studied by Neucourt ("Arch. gén. de méd.," June, 1849), who gave some striking examples. Lauder Brunton ("Lectures on Diseases of the Stomach") has also studied the matter in reference to localization, and believes that reflex pain from dental caries is usually felt in the temple, or, more specifically, a decayed molar in the lower jaw gives a temporal or occipital headache, a decayed molar in the upper jaw a temporal headache farther forward. Decayed canine or incisor teeth are likely to cause frontal or vertical headache. Such pains may be accompanied by sympathetic dilatation of the pupil.

The results of nasal and pharyngeal irritation have been fully discussed in late years.

It seems to be well established that there are sensitive areas in the nose, usually in the region of the inferior turbinated bone and its cavernous tissue, which may give rise to frontal headache, migraine, neuralgia of the larynx, and of the tongue (B. Robinson, "Med. Record," Jan. 30, 1886). Chronic pharyngitis and amygdalitis may cause migraine (Lorent, A. Jacobi, "Med. Record," Jan. 30, 1886), and the same trouble, according to Trautmann, is produced by chronic or subacute inflammation of the pharyngeal tonsil.

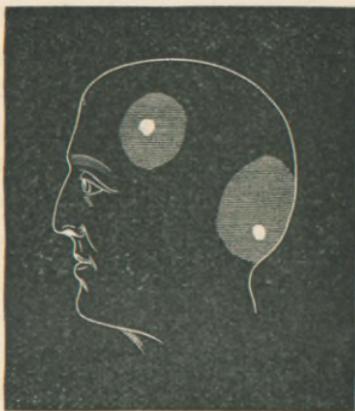


Diagram showing the seat of pain in migraine or occipital headache depending on decayed teeth or defects of the eyes. The shaded area shows the seat of the pain; the spot in each area indicates the seat of tenderness on pressure.—Brunton.

We have one authority (Hack) curing 240 cases of hemicrania by cauterizing the inferior turbinated bone; another, Trautmann, curing 85 out of 87 cases of the same disease by destroying the pharyngeal tonsil. Lauder Brunton attributes migraine in some cases to the reflex effect of dental caries ("Dis. of Digestion," p. 84).

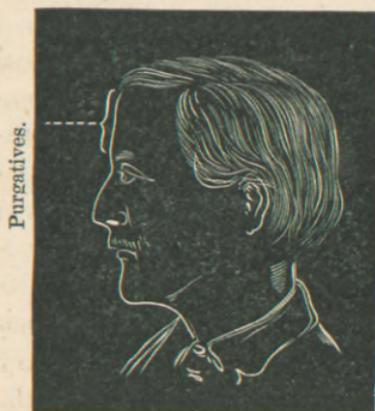
As others have reported almost equally extraordinary results from treating the eyes, it is plain that there are some errors here not alone of refraction, but also of observation or deduction. The inference is that almost any active surgical interference in the region of the head will cure 90 per cent. of migraines, or of so-called migraines. I am forced to the conclusion that the diagnosis in many of these cases was incorrectly made, and that in others the patients were not followed up for a very long time. We know that migrainous patients will sometimes go for months without any attack of pain.

According to Dr. C. C. Benson ("Medical World"), but on what authority I do not know, "when pain is located below the superciliary ridges, including upper eyelids, to the external angular processes on either side, the nasal passages and buccal cavity will be the seats of disturbance."

Irritations from the stomach cause reflexly a large variety of pains. It is not possible to decide always whether these pains are reflex or are due to vaso-motor disturbances, or the circulation of morbid products in the blood, as in cases of fermentative dyspepsia and of constipation associated with dyspepsia.

We all know that the simple ingestion of a glass of ice-water will cause a sharp frontal or temporal pain. Lauder Brunton finds that constipation and presumable intestinal irritation cause a diffuse frontal headache over the whole brow. When there is no constipation and the condition is

one of gastric irritation, the pain is either just above the eyes, or more rarely in the occiput (when it will be relieved by acids), or just at the roots of the hair (when it will be relieved by alkalies). (*Loc. cit.*)



Showing the position of the frontal headache which in cases of constipation is relieved by salines.—Brunton.



Showing the position of the frontal headaches relieved by acids and alkalies in the absence of constipation. The lower is relieved by acids, the upper by alkalies before meals. The lower one also indicates the occasional position of headache caused by straining the eyes.—Brunton.

Gastric irritation, according to Lange, more often causes thoracic pains and pains in the arms, but especially pains in the epigastrium and hypochondrium. Left-sided pains, resembling intercostal neuralgia, have been thought to be due sometimes to stomach disorder. Leoni, from his studies of cases, maintained that dyspepsia was sometimes a cause of intercostal neuralgia. (Axenfeld and Huchard, "Traité des névroses.") Revillout ("Gaz. des hôp.," 1873) makes the same statement. Desnos reports a case of intercostal neuralgia (Desnos, "Dict. de méd. et chirurg. prat.") caused

by ulcer of the stomach. Besides this, both functional and organic diseases of the stomach produce transferred pains referred to the cardiac plexus, producing symptoms resembling angina pectoris.

I have met with a number of cases of neurotic, anæmic young women who complained of attacks of heart-pain and respiratory oppression resembling angina; and the clinical picture is so distinct that I think we may speak of a "pseudo-angina pectoris of gastric origin." Dr. Long Fox ("Diseases of the Sympathetic") reports the case of the distinguished surgeon, Mr. Hilton, who was attacked three years before his death with severe angina pectoris. After suffering intensely from this for several months, the pain gradually wore away, and the symptoms of cancer of the stomach developed. Dr. Moxon (*loc. cit.*) speaks of a heartache of gastric origin, and its occurrence is no doubt familiar to all.

The scapular or shoulder pains in dyspepsia, and the pains felt between the scapulæ, due to the involvement of the posterior branches of the second to the sixth intercostal nerves, are common phenomena familiar to all.

Gastric irritations must have a certain severity to be felt as pain in the stomach or epigastrium, and in these cases there is doubtless, as a rule, some muscular spasm of the stomach-walls.

The milder irritations produced by gas, undigested food, excess of acid, etc., seem to be reflected most often upon the upper intercostal nerves or the cardiac nerves, vagal or sympathetic. The headaches in gastric irritation so often involve some toxic element that we can not speak of their origin with much positiveness.

The stomach and intestines are probably the most frequent cause of transferred pains; after this I would place the uterus and its appendages, and next the eye or heart. Lange considers that the heart ranks second.

In kidney disease neuralgic pains may be felt in the lumbar region, radiating forward to the lower abdomen and genitals—in other words, a lumbo-abdominal neuralgia is produced. In a case of renal colic I have observed the pain to be repeatedly centered about the anterior superior crest of the ilium.

Pains started up by the gall-bladder are felt in the right side of the thorax and right arm, while it is one of the aphorisms of medicine that disorders of the liver may cause pain in the right shoulder. Bilious headaches cured by a dose of calomel I have observed to be located sometimes in the vertex and occiput.

In abscess of the spleen there is a pain felt in the left shoulder (Grotonelli, Wardell).

I am unable to make any very definite statements as to what are the most frequent and characteristic neuralgias produced by pelvic disorders. In answer to letters of inquiry on the subject, my friends, Dr. A. J. C. Skene and Dr. H. T. Hanks, write that they are unable to formulate any rule. Vertical headaches, infra-mammary pains, and lumbo-abdominal pains, are all very frequent. Valleix thought that headaches were most frequently caused by uterine trouble. The vertex pain so often spoken and written of as a pelvic reflex is often, in my experience, an indication simply of anæmia. In this view I find I am corroborated by Dr. Lauder Brunton, in the work cited.

Lange says (*loc. cit.*) that in uterine troubles the reflex pains occur oftenest in the form of arthralgias. I have had a patient suffering with painful spasms of the bladder who had intense pain in the palms of the hands every time she had a bladder spasm ("Med. Record," July 25, 1885); another patient, while pregnant, suffered from digital neuralgia, and in a third case reported by myself, a patient of Dr. Nilsen's, suffering from ovarian prolapse, had

severe and continuous neuralgic pains in the wrist. Studies of the cause of reflex pains in the feet show that they may be referred in almost all cases to irritation of the genito-urinary tract, and occur more often in the male ("Med. Record," July 25, 1885). The

pains of uterine disorder, when reflected down, appear rarely to go below the knee; in other words, they affect the lower branches of the lumbar plexus, and not the sacral nerves.



Anæmic headache.—Brunton.

It has been stated that pain in the heels may be caused by ovarian abscess. In my experience, such pains are due to lithæmic and neurasthenic conditions, and will be relieved by remedies addressed to such states. It may

be said in general, then, that pelvic irritations are felt most frequently in the upper and short branches of the lumbar plexus, next perhaps in the intercostal nerves and upper cervical nerves, then in the trigeminus, and last in the hands and feet.

Lesions in the lung itself cause reflex pains in the form of intercostal neuralgia. Slight pulmonary congestions, such as occur at the very onset of phthisis, may cause intercostal neuralgia, and Anstie speaks of the value of these pains as warnings of the approach of phthisical disease. Apart from these neuralgias, the lung is very rarely an excitant of reflex pains, perhaps because its nerve-supply is small, aside from the sensory fibers of the vagus. Further study, however, may show that lung irritation may cause some of the painful affections of the larynx, tongue, or throat.

The question now arises whether, with these various facts before us, any general statements can be made with regard to the production of transferred pains. If we study them in connection with the anatomical arrangements of the cerebro-spinal and so-called sympathetic system, it is possible that the diffusion and transference of pain, though in a "mighty maze," will not appear entirely without a plan.

The cerebro-spinal nerves are sent out from their centers in divisions or companies of seven, and each company acts together and serves a common definite physiological purpose. These divisions are :

1. The ocular motor nerves, the trifacial, and the seventh—which supply motion and feeling to the face and anterior scalp. The remaining cranial nerves supply internal parts.

2. The four upper cervical nerves forming the cervical plexus. This leash of nerves supplies motion and sensation to the neck and occiput, and controls the movements of the cephalic extremity. It is in close connection with the trifacial, both at its origin and periphery, both directly and *via* the sympathetic. It is subjected to much the same disturbances, and may be looked upon as physiologically almost a part of the first set—*i. e.*, of the common sensori-motor cranial nerves.

3. The third leash of nerves is composed of the last four cervical and first dorsal. They form the brachial plexus, and furnish motion and sensation to the upper extremities.

4. The fourth set includes the dorsal nerves from the second to the sixth. This supplies the chest-wall, including the pleura, and with the sympathetic the lungs beneath.

5. The fifth set consists of the lower seventh to eleventh intercostals, which supply motion and sensation to the abdominal walls, to the lower dorsal muscles, and the skin over them.

6. The sixth set consists of the first four lumbar nerves with part of the twelfth dorsal, which is really a lumbar nerve. This supplies motion and sensation to, in general words, the hip-girdle—*i. e.*, the muscles (erector spinæ, etc.) of the loins, those of the anterior, inner, and outer portion of the thigh, and the skin over these regions, extending down to the upper half of the buttock and to the groin, scrotum, and labia. It is the lumbar plexus which furnishes most of this supply.

7. The seventh and last set consists of the sacral nerves, whose anterior branches (those of the first four, with the lumbo-sacral cord) form the sacral plexus. This supplies the external genitals of the male, the clitoris and part of the vagina, the perinæum and external sphincter and the lower buttocks, and the posterior part of the thigh and leg, except its inner side. In a general way we may state that the lower portion gives motion and sensation to the legs and posterior thigh (the sciatic); the upper portion to the genitals and the gluteal, perineal, and anal region (sup. gluteal, small sciatic, pudic).\*

Now each of these seven sets of nerves is in intimate connection by two branches with the sympathetic ganglia, and through these with the viscera of the different cavities.†

\* The sides of the body and both upper and lower extremities, except a portion of the legs, are supplied by lateral branches of the spinal nerves; the back, from occiput to iliac crest, by dorsal branches.

† Gaskill's recent studies of the visceral nerves show what I have taught for several years to my classes—*viz.*, that the sympathetic nervous system is in reality only an outflow from the cerebro-spinal. He also maintains that it is made up of fibers of a peculiarly small size which pass out through the roots to the viscera. The outflow of these visceral or sympathetic nerves takes place in the upper cervical region, *via* the glosso-pharyngeal and vagus; in the dorsal region, from the second dorsal to the second lumbar in the dog; in the sacral region, *via* the second and third sacral nerves. Gaskill's investigations so far cover only the subject of efferent nerves (probably vaso-motor) in dogs, and can not be yet applied to our present subject.

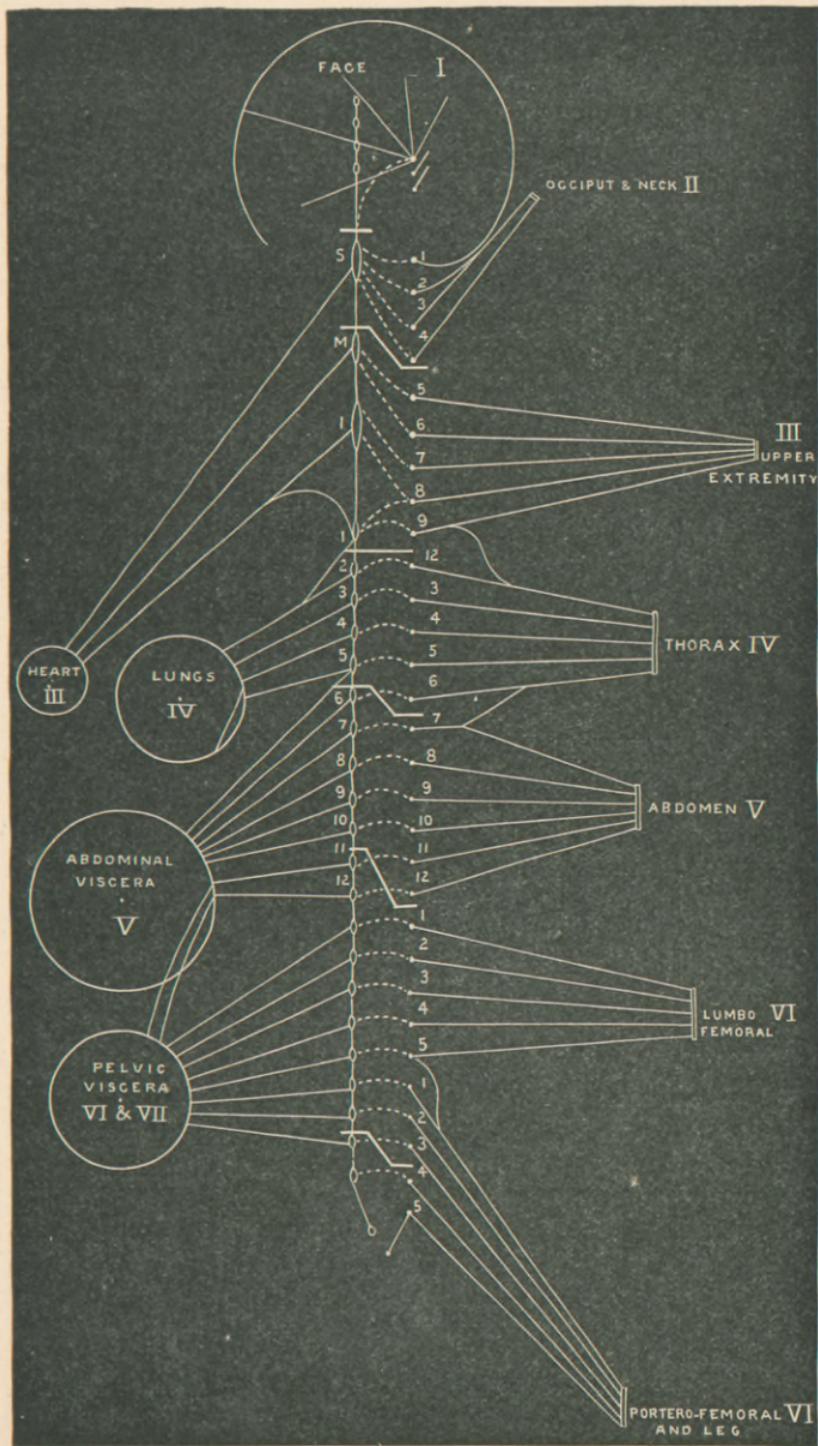


Chart showing the different levels of the cerebro-spinal and sympathetic nerve-supply. Cerebro-spinal nerves represented on the right side; sympathetic nerves on the left side.

The accompanying diagram shows better than any description what this relation is.

I. The first two leashes of nerves are connected most intimately with the four cerebral sympathetic ganglia (ophthalmic, otic, submaxillary, spheno-palatine) and with the upper cervical ganglion.

We can understand how irritations in the cranial cavity may be reflected almost indifferently upon the trigeminal or upper cervical nerves.

II. The third leash of nerves to the upper extremity is connected with the three cervical and first intercostal ganglia, all of which go to make up the cardiac nerves.

Hence irritations of the heart are reflected so often in the shoulder and down the arm.

III. *The first six* nerves of the thoracic wall are connected with the corresponding sympathetic ganglia which supply the lung tissue, and this anatomical fact may explain why in slight pulmonary congestions pain may be referred to the intercostal nerves.

IV. The fifth leash of nerves, fifth to the eleventh intercostal, is connected with the sympathetic ganglia, which supply nerves to the abdominal viscera *via* the splanchnic nerves. The great splanchnic supplies all the abdominal viscera, including the visceral serous membranes, except the kidneys. These are more largely supplied by the small splanchnic which arises from the eleventh and twelfth thoracic ganglia. The renal plexus in turn sends branches to the spermatic cord, testes, ovary, and fundus uteri, so that those parts of the pelvic organs are especially connected with the lower dorsal nerves; hence irritations of ovary, testes, cord, part of the uterus and kidneys, are often reflected as pains in the region of the kidneys and in the groins. It is, perhaps, over this arc that the low-down one-sided pains so often felt over the ninth to twelfth ribs originate.

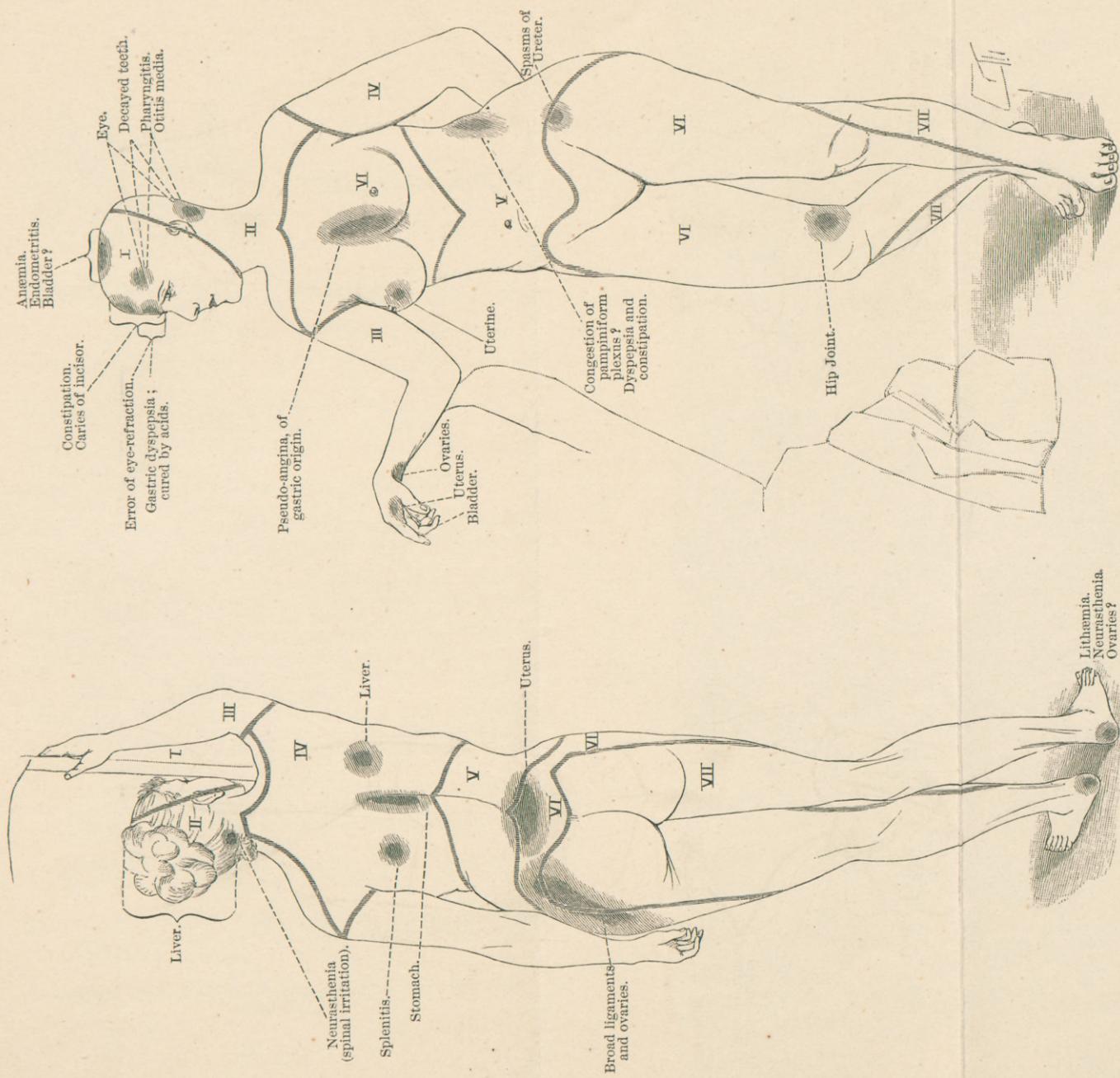
V. The lumbar strand of nerves is connected with the lumbar ganglia and *via* the aortic plexus with the descending colon, sigmoid flexure, and upper part of the rectum; through the hypogastric plexus with the pelvic organs, which it joins the sacral nerves and ganglia in supplying.

VI. The genital organs (vagina, cervix uteri, penis, prostate), except the testes and ovaries, are in close connection with the sacral strand of nerves (the seventh); the other pelvic viscera are more abundantly supplied by the lumbar and lower dorsal strands. Hence we find sciaticas and podalgia, and reflex pains throughout the lower extremity in urethral irritations, rarely in irritations of the testes, ovary, or higher parts of the pelvis. These latter cause more often lumbo-abdominal neuralgias.

In attempting to explain the reflex pains from the viscera, I am led to the belief that the pneumogastric nerve must be left out of account as a direct factor. The mass of the sympathetic nerves to the sensitive thoracic, abdominal, and pelvic viscera, are made up of white, medullated nerves that come directly from the cord. These nerves carry sensory fibers, and their excitation is painful (Ludwig, O. Nasse).

Whether it be the heart, stomach, or uterus, therefore, irritations that excite pain more probably pass up to the brain *via* the spinal nerves, their posterior roots, and the spinal cord. Having, however, to travel through two or three sets of ganglia, it is easy to understand how they may become diffused, and travel up paths belonging to another strand of nerves, and so be referred by the mind to a place remote from their origin.





Area	Strands of cerebro-spinal nerves.	Distribution.	Associated ganglia of sympathetic.	Main distribution.
Area I	Trigemimus, facial, etc.	Face and its orifices, anterior scalp.	4 cerebral.	Head. (slightly to heart).
Area II	Upper 4 cervical.	Occipital region, neck.	1st cervical.	Head.
Area III	Lower 4 cervical and 1st dorsal.	Upper extremities.	2d and 3d cervical, 1st dorsal.	
Area IV	Upper 6 dorsal.	Thoracic wall.	1st to 6th dorsal.	Lungs.
Area V	Lower 6 dorsal except last.	Abdominal wall, upper lumbar, upper lateral thigh surface.	5th to 12th dorsal.	Abdominal viscera, testes, ovary, fundus uteri <i>via</i> renal plexus.
Area VI	12th dorsal, 4 lumbar.	Lumbar region, upper gluteal, anterior and inner thigh and knee.	1st to 4th lumbar.	Pelvic organs.
Area VII	5th lumbar and 5 sacral.	Lower gluteal, posterior thigh, leg.	1st to 5th sacral.	To pelvic organs, the sympathetic supply being small.

Diagram showing the distribution of the seven cerebro-spinal strands of nerves, and the location of transferred pains and neuralgia.





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