**On the course of the taste fibres / by A. Francis Dixon.**

With the Author's compliments

22

# ON THE COURSE OF THE TASTE FIBRES.

By A. FRANCIS DIXON, B.A., M.B.

*Reprinted from the* Edinburgh Medical Journal. *Edinburgh and London,* Young J. Pentland, *April* 1897.

# ON THE COURSE OF THE TASTE FIBRES.

By A. Francis Dixon, B.A., M.B., *Chief Demonstrator of Anatomy, Trinity College, Dublin.*

A recent paper in this Journal, by Dr. W. R. Gowers, raises again the important question of the course which the taste impulses take in passing towards the brain. Dr. Gowers considers that the interesting case which he describes supports the view which he has already so strongly advocated, namely, "that the path of taste from all parts in which this sense exists, reaches the brain by the root of the fifth nerve." This theory, which has many supporters, is based chiefly on observations made on a number of living persons in whom taste sensation was lost, and is also supposed to gain support from post-mortem observa-

tions in some cases. A very strong plea that the fifth nerve is the nerve of taste is made out by Dr. Gowers in his "Diseases of the Nervous System," vol. ii. p. 225, where, after examining the evidence, he concludes that, although cases occur in which there are symptoms of disease of the fifth nerve, without loss of taste, yet there is no recorded case of any loss of taste where disease has been limited to the nerve roots of the medulla.

The course which the taste impulses are supposed to take by such investigators, in travelling towards the brain, is a very complicated one, and we may be forgiven if we are sceptical regarding it, unless the fact is demonstrated in a very complete and conclusive manner. It is maintained that the nerve fibres which convey taste impulses from the anterior part of the tongue, and which run in the lingual nerve, leaving it by the chorda tympani to join the facial nerve, are to be found later on continued from the facial into the great superficial petrosal and Vidian nerves, by which means they reach Meckel's ganglion, and thence the brain by the second division of the trigeminal nerve. From the posterior part of the tongue taste sensations are believed by the supporters of the fifth nerve theory to travel first in the fibres of the glosso-pharyngeal nerve. Leaving this, however, by the tympanic branch or nerve of Jacobson, they reach the tympanic plexus, and are conveyed finally either into the third division of the fifth nerve, through the small superficial petrosal nerve and the otic ganglion, or possibly, as has been suggested by others, into the second division of the fifth, by the communication which exists between the tympanic plexus and the great superficial petrosal nerve.

Several other complicated courses for the taste fibres, both for the anterior and posterior parts of the tongue, have been suggested.[1]

The accompanying diagram (Fig. 1) illustrates in its simplest form the course assumed for the taste fibres, by those authorities who believe the fifth nerve to be the nerve of taste. We are asked to believe in this complicated course for these impulses, from observations made on cases in which the lesion was supposed to affect only the roots of the fifth nerve, yet in very many of them an opportunity did not present itself of verifying the diagnosis by a post-mortem examination. It must necessarily be extremely difficult to be certain that, in a case where the whole of the fifth nerve root is paralysed, we are justified in attributing all the symptoms present to disease of this nerve alone. Seeing that the distance between the fifth and seventh nerves at their attachments to the brain is only 10 mm., and the points where they pierce the dura mater are only the same distance apart, a lesion to affect all the fibres of one and permit all those of the other to escape must indeed be very sharply circumscribed.

[1] See, for instance, Schwalbe's "Lehrbuch der Neurologie," p. 856.

Again, although the facial nerve emerges at the upper end of the medulla oblongata, still at first it "commonly adheres for a short distance to the lower border of the pons, just where the latter is passing into the middle peduncle of the cerebellum, and immediately below the fifth nerve."[1] Further, although the direction of the seventh and fifth nerves are not parallel inside the cranial cavity, yet the seventh nerve, as it passes into the internal auditory meatus, lies as far forward as the point where the fifth nerve issues from the brain, and is separated from the root of the fifth by a distance of 3–4 mm. only. The fifth and seventh nerves are, therefore, very closely related in the intracranial parts of their

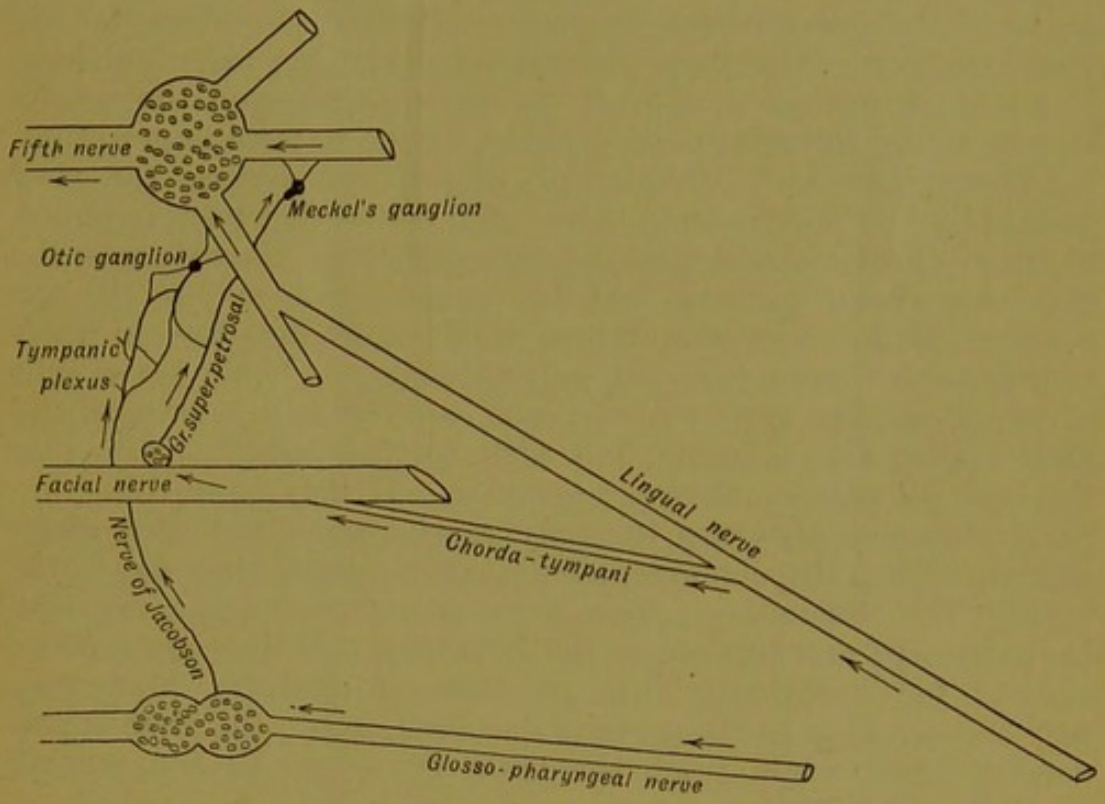



FIG. 1.—To illustrate the course assumed for the taste impulses by the believers in the fifth nerve theory.

course, and a lesion in the region of one, if extensive enough to affect all its fibres, must of necessity lie very near the other.

We must also remember that we are not forced to accept the complicated course for the taste fibres as the only possible anatomical one, seeing that both those nerves (seventh and ninth), which are denied the function of carrying taste impulses, are in part at least anatomically sensory nerves. The chorda tympani, admittedly a nerve of taste, is connected with the seventh nerve, and this nerve possesses a ganglion, namely, the geniculate ganglion, which is just as much the homologue of a spinal ganglion as the Gasserian ganglion of the fifth nerve. This is a well established fact. Further, by many anatomists, the pars intermedia

[1] Thane, "Quain's Anatomy," 10th ed., vol. iii. p. 251.

is considered to be continuous in part at least with the chorda tympani, and so would represent the continuation of the chorda tympani fibres through the ganglion cells to the brain. If the chorda tympani be not a sensory branch of the facial nerve, we have yet to discover the sensory branches of the geniculate ganglion corresponding to those fibres which pass brainwards from that ganglion in the pars intermedia. The well-known structure of the ninth nerve and its ganglia indicate also a sensory distribution. Further, the cells of the ganglia of the ninth nerve resemble those of the ganglion of a posterior nerve root; therefore, in all probability, as many fibres leave the ganglion as enter it. Are we then to assume that the fibres of the small nerve of Jacobson represent numerically all the fibres of the peripheral part of the glosso-pharyngeal which carry taste impulses? If we are, it makes it difficult for us to understand the sensitiveness of the posterior portion of the tongue to taste impressions.

There is another anatomical difficulty regarding the view upheld by Dr. Gowers and others. Supposing that taste impulses, passing in the facial and glosso-pharyngeal nerves, leave them by the great superficial petrosal and Jacobson's nerve, to join the trigeminal, as has been maintained, then these impulses in their course to the brain pass not only through ganglionic nerve cells of spinal ganglion type, twice in each case (namely, of seventh and fifth nerves, and of ninth and fifth nerves), but they also pass through the otic, or Meckel's ganglion. If they have this complicated course they are the only special sense impulses which pass through multipolar sympathetic nerve cells on their way to the brain. The difficulties appear very great in adopting the fifth nerve theory; and further, we shall see later that there are *a priori* reasons for considering that impulses, of whatever kind they may be, travelling in the nerve of Jacobson, and in the great superficial petrosal, would reach the brain by the ninth and seventh nerves respectively.

Examining the arguments put forward in favour of taste impulses reaching the brain by the fifth nerve roots in Dr. Gowers' "Diseases of the Nervous System," there are a few points I should like to draw attention to. For instance, p. 225, he states: "One unequivocal case has been recorded by Erb, in which the fifth nerve in the middle cranial fossa was involved in a mass of inflammatory connective tissue, and the nerves of the medulla were normal"; in this case the sense of taste was lost. I have to express my regret that I have not been able to see Erb's paper, but the case as stated by Dr. Gowers does not seem to be "unequivocal," because a mass of inflammatory tissue, involving the fifth nerve in the middle cranial fossa, would in all probability, unless it were sharply circumscribed, affect the geniculate ganglion of the facial, since it lies close to this fossa behind the hiatus Fallopii. Unless it were specially stated that this ganglion and

the pars intermedia were carefully microscopically examined, it seems hardly fair to assume that they were unaffected by the inflammatory process taking place so near them. If the geniculate ganglion were affected, taste would be lost, even if it travels in the seventh nerve.

The statement made in a note on the authority of Vulpian, that the chorda degenerated, after section of the fifth nerve in the skull, seems absolutely contrary to what one would expect when we consider its mode of development.

The complicated arrangement of the fibres of the facial nerve outside the cranium, and the extraordinary number of communications established among its filaments in the pes anserinus, before the muscles of the face are supplied, might explain why a lesion affecting, say, one side of the nerve in its intracranial part, might be difficult to detect in the living. It seems scarcely possible that a small lesion in the intracranial part of the facial should destroy all the nerve fibres for any one muscle. Yet, on the other hand, a small lesion, if it lay either in the geniculate ganglion or probably in the pars intermedia, might destroy all the central connections of the chorda tympani, if, as many believe, it can be proved to be a true sensory branch of the facial. A small lesion in the motor part of the seventh might escape notice during life, especially if it were accompanied by marked paralysis, say, of the sensory part of the fifth nerve, and if the sensation of taste were lost at the same time, it would naturally be assumed to be a part of the fifth nerve paralysis, although it might really represent an extension of the injury from the fifth to the sensory part of the seventh nerve.[1]

We pass now to certain facts which tend to show that the chorda tympani and the great superficial petrosal nerves are to be looked on as true afferent branches of the seventh nerve, and the nerve of Jacobson as a true branch of the ninth.

With regard to the development of sensory nerves, we know that the axis cylinder of each of the fibres is developed as a process of a nerve cell, in a ganglionic mass, whose cells are similar to those found in the developing spinal ganglia. Further, a process from the same cell, which gives rise to the axis cylinder of the fibre of the sensory nerve, grows backwards towards the brain or spinal cord, and is the future connection between the distal part of the sensory nerve fibre and the brain or spinal cord. Thus are formed from the cells of the ganglionic mass the peripheral sensory nerve and the sensory nerve root. In after life, sensory impulses are conveyed in each nerve towards the ganglion from which it

[1] In the case described in this Journal by Dr. Gowers, the sixth nerve was paralysed; and, further, the function of the facial muscles was somewhat impaired on the affected side. This latter symptom Dr. Gowers does not consider indicates involvement of the seventh nerve. Even if this is so, the lesion cannot be said to lie wholly in front of the nerve-roots of the medulla, and there is no evidence that the sensory fibres of the facial nerve have escaped.

grew out, and from this ganglion by the sensory root to the brain or spinal cord. This appears to be the universal experience.

A few years ago, while studying the development of the fifth nerve branches in man, I had an opportunity of paying special attention to the mode of development of those nerves which in the adult connect the fifth with other cranial nerves. Applying the developmental test to the chorda tympani, there is no doubt we have here to do with a true branch of the facial nerve. Indeed, it has been figured and described as such in 1888 by Professor His.[1] During my observations I had ample opportunity of verifying this, both in the human and rat embryos.[2] The nerve is found unconnected with the lingual at first, and lies in the region of the developing tongue, before the lingual is of any considerable size. Since the nerve is a sensory one, it seems fair to assume that it conveys impulses towards the ganglion of the facial, of which it is a branch. Similarly, the great superficial petrosal nerve is formed very early, and is developed as an outgrowth of the cells of the geniculate ganglion. It is connected at first with the seventh nerve, and only in a later stage acquires connections with the fifth nerve. We may assume, then, that the impulses which pass in the great superficial petrosal, of whatever kind they may be, reach the central nervous system by the roots of the seventh nerve. If this is not so, we have in the chorda tympani and great superficial petrosal nerves exceptions to what is found to be the case in all other nerves developed from ganglia of the spinal ganglion type.

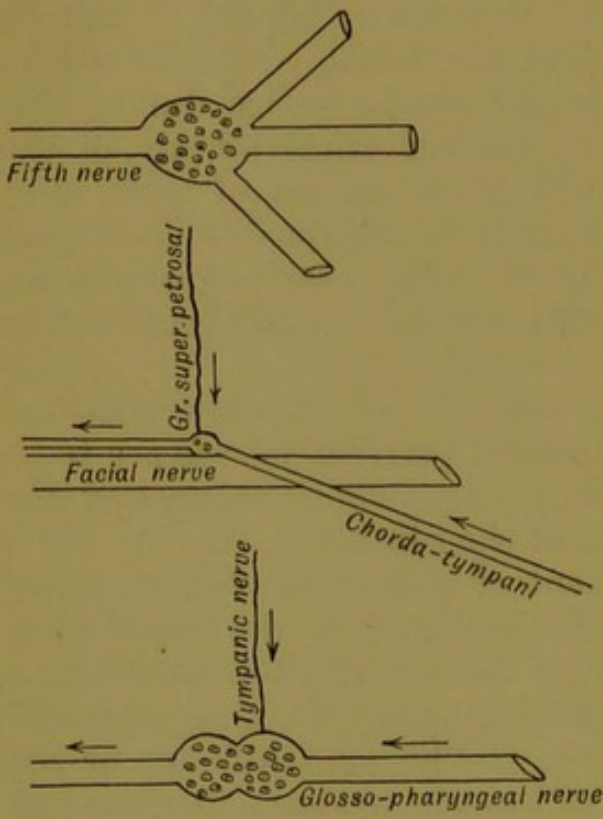



FIG. 2.—To illustrate the earliest connections of the chorda-tympani, great superficial petrosal, and tympanic (Jacobson's) nerves.

The same series of investigations proved that the nerve of Jacobson is an outgrowth of the ganglion of the glosso-pharyngeal nerve, and hence almost certainly carries impulses into the course of that nerve, and not into that of the trigeminal.

Figure 2 illustrates the directions in which the nerves are developed, and the arrows the course of the impulses which they carry, as inferred from their mode of development. This being so, can we resist the conclusion that

[1] *Abhandl. d. math.-phys. Cl. d. k. sächs. Gesellsch. d. Wissensch.*, Bd. iv.

[2] "On the Development of the Branches of the Fifth Cranial Nerve in Man," *Trans. Roy. Dub. Soc.*, Ser. 2, vol. iv.

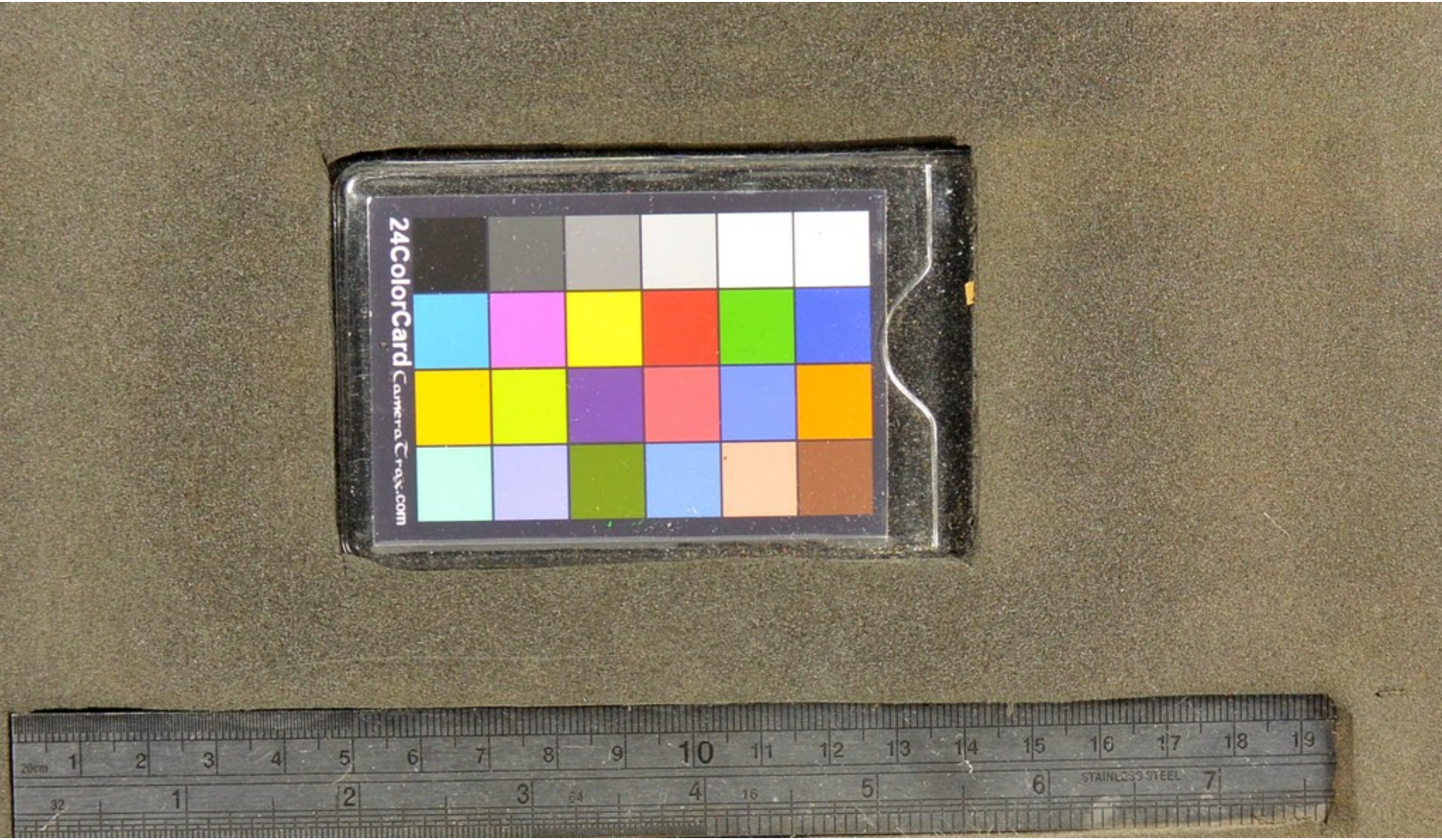
the taste impulses reach the brain by the seventh and ninth nerves?[1]

This extraordinarily difficult question, which has up to the present time not been capable of experimental elucidation, will doubtless soon receive much light, as the result of the much more frequent and complete operation on the fifth nerve.

A crucial test appears in the condition of a patient's taste sensations after the complete removal of the Gasserian ganglion, if it can be shown that the geniculate ganglion, together with its root and branches, have escaped injury during or subsequent to the operation.

In this paper I have avoided notices of the literature of the subject, and it must be remembered that an enormous number of papers have been written on the arrangement, communications, and structure of these nerves. Further, the idea that the ninth and seventh nerves are the nerves of taste, is probably the older of the two theories, and has, I believe, the most supporters.

[1] It is only right to state that if the observations of Penzo (*Anat. Anz.*, Jena, 1893) and others are correct, these connecting nerves must in the adult contain fibres besides those which are developed in the manner just described.


24ColorCard
CameraCrazy.com
20cm
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
32
1
2
3
64
4
16
5
6
STAINLESS STEEL
7