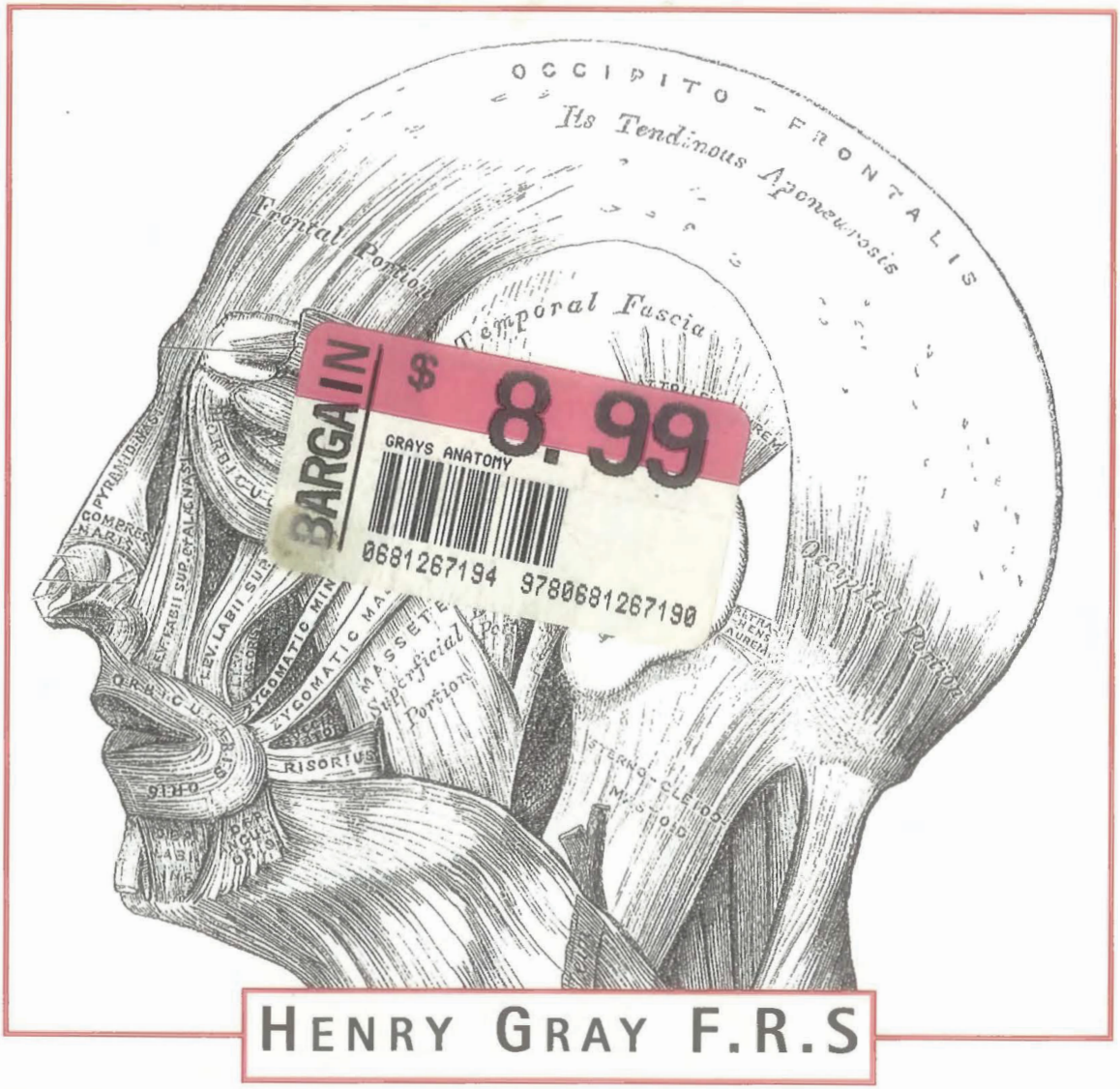
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HENRY GRAY F.R.S.

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THE FIRST EDITION OF THIS WORK

WAS DEDICATED TO

SIR BENJAMIN COLLINS BRODIE, BART.

F.R.S., D.C.L.

IN ADMIRATION OF

HIS GREAT TALENTS

AND IN REMEMBRANCE OF

MANY ACTS OF KINDNESS SHOWN TO THE ORIGINAL AUTHOR OF THE BOOK

FROM AN

EARLY PERIOD OF HIS PROFESSIONAL CAREER

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ERRATA

In the inscription to figure 566, page 798, for 17. *Eminentia acustici* read 17. *Eminentia acustica*. On lines 18 and 25, page 799, for *area acustici* read *area acustica*; and on line 20 for *striæ acustici* read *striæ acusticæ*

sometimes joined by a filament from the cavernous plexus of the sympathetic, or from the superior division of the third nerve.

The *long ciliary nerves*, two or three in number, are given off from the nasal as it crosses the optic nerve. They join the short ciliary nerves from the ciliary ganglion, pierce the posterior part of the sclerotic, and running forwards between it and the choroid, are distributed to the Ciliary muscle, iris, and cornea.

The *infratrochlear branch* is given off just before the nasal nerve enters the anterior ethmoidal foramen. It runs forwards along the upper border of the Internal rectus, and is joined, near the pulley of the Superior oblique, by a filament from the supratrochlear nerve. It then passes to the inner angle of the eye, and supplies the integument of the eyelids and side of the nose, the conjunctiva, lachrymal sac, and caruncula lachrymalis.

Ophthalmic Ganglion (figs. 604, 605)

Associated with the three divisions of the fifth nerve are four small ganglia. The *ophthalmic ganglion* is connected with the first division ; the *spheno-palatine* or *Meckel's ganglion* with the second ; and the *otic* and *submaxillary ganglia* with the third. All the four receive sensory filaments from the fifth, and motor and sympathetic filaments from various sources ; these filaments are called the *roots of the ganglia.*

The **Ophthalmic, Lenticular,** or **Ciliary ganglion** is a small, quadrangular, flattened ganglion, of a reddish-grey colour, and about the size of a pin's head, situated at the back part of the orbit between the optic nerve and the External rectus muscle, lying generally on the outer side of the ophthalmic artery. It is enclosed in a quantity of loose fat, which makes its dissection somewhat difficult.

Its *branches of communication*, or *roots*, are three, all of which enter its posterior border. One, the long or sensory root, is derived from the nasal branch of the ophthalmic, and joins its postero-superior angle. The second, the short or motor root, is a short, thick nerve, occasionally divided into two parts, which is derived from the branch of the third nerve to the Inferior oblique muscle, and is connected with the postero-inferior angle of the ganglion. The third, the sympathetic root, is a slender filament from the cavernous plexus of the sympathetic. This is frequently blended with the long root, though it sometimes passes to the ganglion separately. According to Tiedemann, this ganglion receives a filament of communication from the spheno-palatine ganglion.

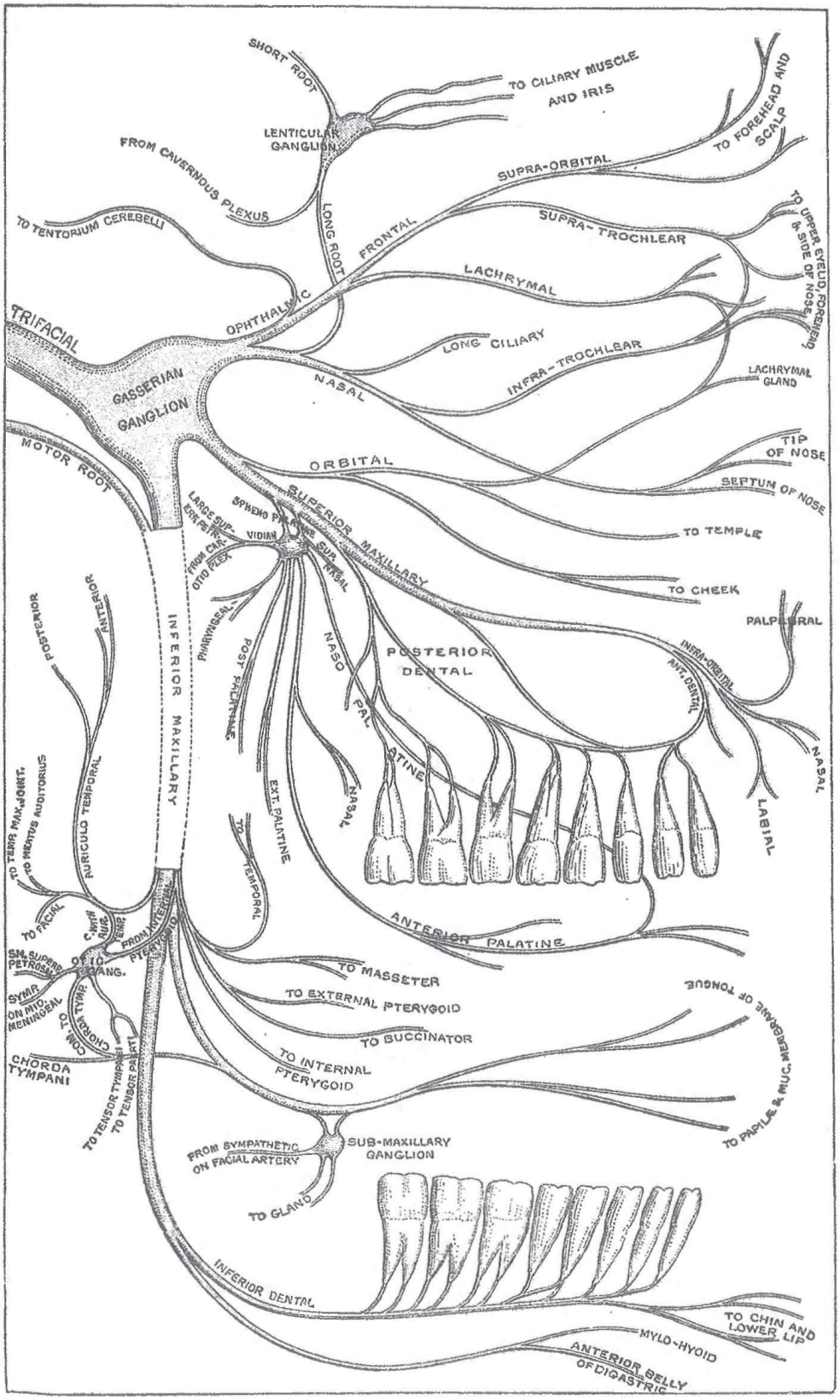
Its *branches of distribution* are the short ciliary nerves. These are delicate filaments, from six to ten in number, which arise from the fore part of the ganglion in two bundles, connected with its superior and inferior angles ; the lower bundle is the larger. They run forwards with the ciliary arteries in a wavy course, one set above and the other below the optic nerve, and are accompanied by the long ciliary nerves from the nasal. They pierce the sclerotic at the back part of the globe, pass forwards in delicate grooves on its inner surface, and are distributed to the Ciliary muscle, iris, and cornea. Tiedemann has described one small branch as penetrating the optic nerve with the arteria centralis retinæ.

Superior Maxillary Nerve (fig. 606)

The **Superior maxillary** (*n. maxillaris*), or second division of the fifth, is a sensory nerve. It is intermediate, both in position and size, between the ophthalmic and inferior maxillary. It commences at the middle of the Gasserian ganglion as a flattened plexiform band, and passing horizontally forwards, it leaves the skull through the foramen rotundum, where it becomes more cylindrical in form, and firmer in texture. It then crosses the spheno-maxillary fossa, and inclines outwards on the back of the superior maxilla ; it then enters the orbit through the spheno-maxillary fissure, traverses the infra-orbital canal in the floor of the orbit, and appears upon the face at the infra-orbital foramen.* At its termination, the nerve lies beneath the Levator labii superioris muscle,

* After it enters the infra-orbital canal, the nerve is frequently called the *infra-orbital.*

FIG. 605.—Plan of the fifth cranial nerve. (After Flower.)



and divides into a leash of branches, which spread out upon the side of the nose, the lower eyelid, and upper lip, joining with filaments of the facial nerve.

Branches of distribution.—The branches of this nerve may be divided into four groups, according as they are given off in the cranium, in the spheno-maxillary fossa, in the infra-orbital canal, or on the face.

In the cranium . . .	Meningeal.
In the spheno-maxillary fossa	Orbital or temporo-malar. Spheno-palatine. Posterior superior dental.
In the infra-orbital canal .	Middle superior dental. Anterior superior dental.
On the face . . .	Palpebral. Nasal. Labial.

The **meningeal branch** is given off from the nerve directly after its origin from the Gasserian ganglion; it accompanies the middle meningeal artery and supplies the dura mater.

The **orbital** or **temporo-malar branch** arises in the spheno-maxillary fossa, enters the orbit by the spheno-maxillary fissure, and divides at the back of that cavity into two branches, temporal and malar.

The *temporal branch* runs along the outer wall of the orbit in a groove in the malar bone, receives a branch of communication from the lachrymal, and, passing through a foramen in the malar bone, enters the temporal fossa. It ascends between the bone and substance of the Temporal muscle, pierces the temporal fascia about an inch above the zygoma, and is distributed to the integument covering the temple and side of the forehead, communicating with the facial and auriculo-temporal branch of the inferior maxillary nerve. As it pierces the temporal fascia, it gives off a slender twig, which runs between the two layers of the fascia to the outer angle of the orbit.

The *malar branch* passes along the external inferior angle of the orbit, emerges upon the face through a foramen in the malar bone, and, perforating the Orbicularis palpebrarum muscle, supplies the skin on the prominence of the cheek, and is named *subcutaneus malæ*. It joins with the facial nerve and with the palpebral branches of the superior maxillary.

The **spheno-palatine branches,** two in number, descend to the spheno-palatine ganglion.

The **posterior superior dental branches** arise from the trunk of the nerve just as it is about to enter the infra-orbital canal; they are generally two in number, but sometimes arise by a single trunk, and immediately divide and pass downwards on the tuberosity of the superior maxillary bone. They give off several twigs to the gums and neighbouring parts of the mucous membrane of the cheek (*superior gingival branches*). They then enter the posterior dental canals on the zygomatic surface of the superior maxillary bone, and, passing from behind forwards in the substance of the bone, communicate with the middle dental nerve, and give off branches to the lining membrane of the antrum and three twigs to each of the molar teeth. These twigs enter the foramina at the apices of the fangs, and supply the pulp.

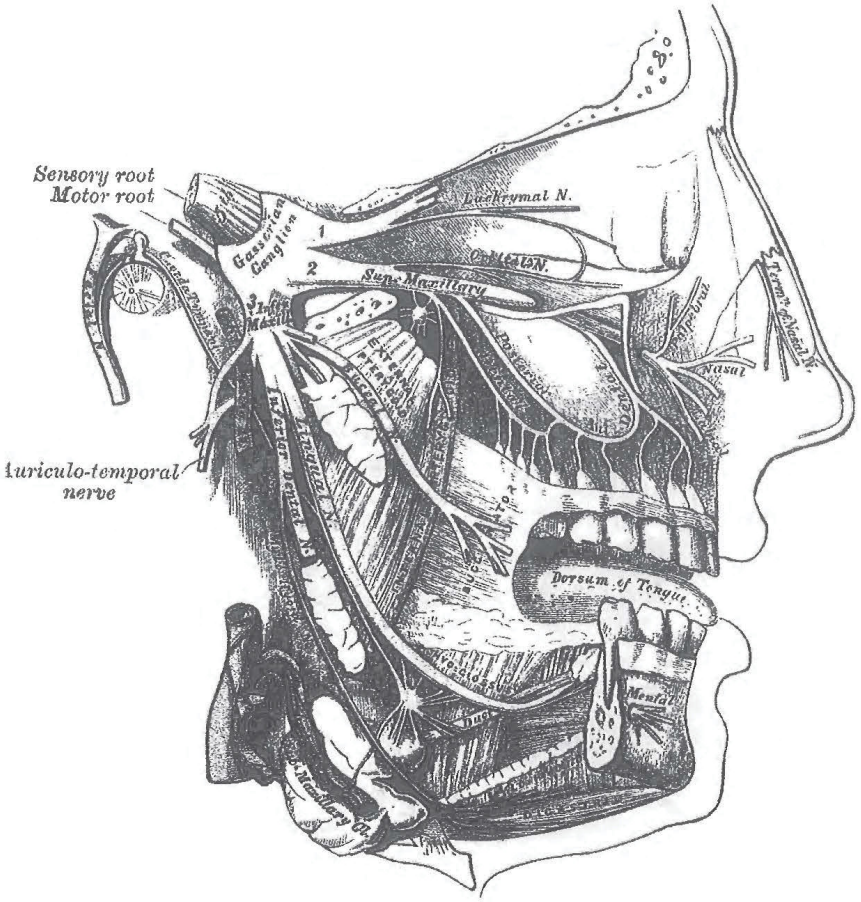
The **middle superior dental branch** is given off from the superior maxillary nerve in the back part of the infra-orbital canal, and runs downwards and forwards in a special canal in the outer wall of the antrum to supply the two bicuspid teeth. It communicates with the posterior and anterior dental branches. At its point of communication with the posterior branch is a slight thickening which has received the name of the *ganglion of Valentin*; and at its point of communication with the anterior branch is a second enlargement, which is called the *ganglion of Bochdalek*. It is probable that neither of these is a true ganglion.

The **anterior superior dental branch,** of considerable size, is given off from the superior maxillary nerve just before its exit from the infra-orbital foramen; it enters a special canal in the anterior wall of the antrum, and divides into a series of branches which supply the incisor and canine teeth. It communicates with the middle dental nerve, and gives off a *nasal branch*, which passes through a minute canal into the nasal fossa, and supplies the mucous membrane of the

fore part of the inferior meatus and the floor of this cavity, communicating with the nasal branches from Meckel's ganglion.

The **palpebral branches** pass upwards beneath the Orbicularis palpebrarum. They supply the integument and conjunctiva of the lower eyelid, joining at the outer angle of the orbit with the facial nerve and malar branch of the orbital.

FIG. 606.—Distribution of the second and third divisions of the fifth nerve and submaxillary ganglion.



The **nasal branches** pass inwards; they supply the integument of the side of the nose, and join with the nasal branch of the ophthalmic.

The **labial branches**, the largest and most numerous, descend beneath the Levator labii superioris, and are distributed to the integument of the upper lip, the mucous membrane of the mouth, and labial glands.

All these branches are joined, immediately beneath the orbit, by filaments from the facial nerve, forming an intricate plexus, the *infra-orbital*.

SPHENO-PALATINE GANGLION (fig. 607)

The **spheno-palatine ganglion** (*Meckel's*), the largest of the cranial ganglia, is deeply placed in the spheno-maxillary fossa, close to the spheno-palatine foramen. It is triangular or heart-shaped, of a reddish-grey colour, and is situated just below the superior maxillary nerve as it crosses the fossa.

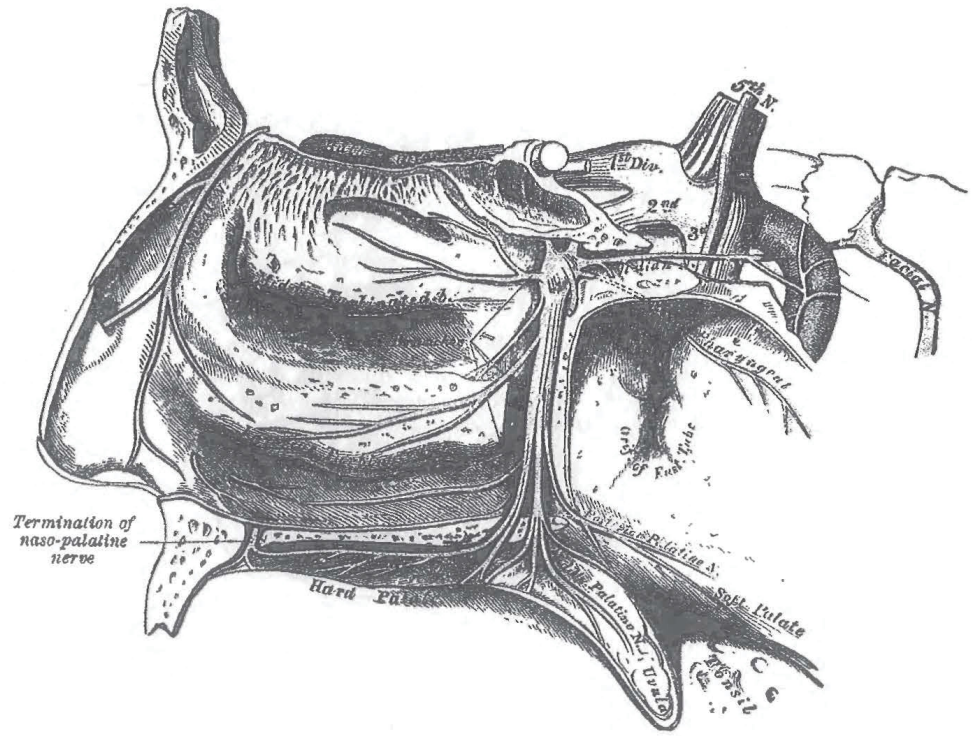
Branches of communication.—Like the other ganglia of the fifth nerve, the spheno-palatine possesses a motor, a sensory, and a sympathetic root. Its *sensory root* is derived from the superior maxillary nerve through its two spheno-palatine branches. These branches of the nerve, given off in the spheno-maxillary fossa, descend to the ganglion. Their fibres, for the most part, pass in front of the ganglion, as they proceed to their destination, in the palate and nasal fossa, and

are not incorporated in the ganglionic mass; some few of the fibres, however, enter the ganglion, constituting its sensory root. Its *motor root* is probably derived from the facial nerve through the large superficial petrosal nerve, but this nerve consists chiefly of sensory fibres; and its *sympathetic root*, from the carotid plexus, through the large deep petrosal nerve. These two nerves join together to form a single nerve, the *Vidian*, before their entrance into the ganglion.

The *large superficial petrosal branch* (*nervus petrosus superficialis major*) is given off from the geniculate ganglion of the facial nerve in the aqueductus Fallopii; it passes through the hiatus Fallopii; enters the cranial cavity, and runs forwards contained in a groove on the anterior surface of the petrous portion of the temporal bone, lying beneath the dura mater. It then enters the cartilaginous substance which fills in the foramen lacerum medium, and joining with the large deep petrosal branch forms the Vidian nerve.

The *large deep petrosal branch* (*nervus petrosus profundus*) is given off from the carotid plexus, and runs through the carotid canal on the outer side of the

FIG. 607.—The spheno-palatine ganglion and its branches.



internal carotid artery. It then enters the cartilaginous substance which fills in the foramen lacerum medium, and joins with the large superficial petrosal nerve to form the Vidian.

The *Vidian nerve*, formed in the cartilaginous substance which fills in the middle lacerated foramen by the junction of the two preceding nerves, passes forwards, through the Vidian canal, with the artery of the same name, and is joined by a small ascending branch, the *sphenoidal branch*, from the otic ganglion. Finally, it enters the spheno-maxillary fossa, and joins the posterior angle of Meckel's ganglion.

Branches of distribution.—These are divisible into four groups, viz.: *ascending* branches, which pass to the orbit; *descending*, to the palate; *internal*, to the nose; and *posterior*, to the pharynx and nasal fossæ.

The *ascending branches* are two or three delicate filaments, which enter the orbit by the spheno-maxillary fissure, and supply the periosteum. According to Luschka, some filaments pass through foramina in the suture between the os planum of the ethmoid and frontal bones to supply the mucous membrane of the posterior ethmoidal and sphenoidal sinuses.

The *descending* or *palatine branches* are distributed to the roof of the mouth, the soft palate, tonsil, and lining membrane of the nose. They are almost a direct continuation of the spheno-palatine branches of the superior maxillary nerve, and are three in number: anterior, middle, and posterior.

The *anterior* or *large palatine nerve* descends through the posterior palatine canal, emerges upon the hard palate at the posterior palatine foramen, and passes forwards in a groove in the hard palate, nearly as far as the incisor teeth. It supplies the gums, the mucous membrane and glands of the hard palate, and communicates in front with the termination of the naso-palatine nerve. While in the posterior palatine canal, it gives off *inferior nasal branches*, which enter the nose through openings in the palate bone, and ramify over the inferior turbinated bone and middle and inferior meatuses; and, at its exit from the canal, a palatine branch is distributed to both surfaces of the soft palate.

The *middle* or *external palatine nerve* descends, through one of the accessory palatine canals, distributing branches to the uvula, tonsil, and soft palate. It is occasionally wanting.

The *posterior* or *small palatine nerve* descends with a minute artery through the small posterior palatine canal, emerging by a separate opening behind the posterior palatine foramen. It supplies the soft palate, tonsil, and uvula, and was formerly believed to supply the Levator palati and Azygos uvulæ muscles, but these are probably supplied by the spinal accessory through the pharyngeal plexus. The middle and posterior palatine join with the tonsillar branches of the glosso-pharyngeal to form a plexus around the tonsil (*circulus tonsillaris*).

The *internal branches* are distributed to the septum and outer wall of the nasal fossæ. They are the superior nasal and the naso-palatine.

The *superior nasal branches*, four or five in number, enter the back part of the nasal fossa by the spheno-palatine foramen. They supply the mucous membrane covering the superior and middle spongy bones, and the lining of the posterior ethmoidal cells, a few being prolonged to the upper and back part of the septum.

The *naso-palatine nerve* (*Cotunnius*) also enters the nasal fossa through the spheno-palatine foramen, and passes inwards across the roof of the nose, below the orifice of the sphenoidal sinus, to reach the septum; it then runs obliquely downwards and forwards along the lower part of the septum, to the anterior palatine foramen, lying between the periosteum and mucous membrane. It descends to the roof of the mouth through the anterior palatine canal. The two nerves are here contained in separate and distinct canals, situated in the inter-maxillary suture, and termed the *foramina of Scarpa*, the left nerve being anterior to the right one. In the mouth, they become united, supply the mucous membrane behind the incisor teeth, and join with the anterior palatine nerves. The naso-palatine nerve furnishes a few small filaments to the mucous membrane of the septum.

Posterior branch.—The *pharyngeal nerve* is a small branch arising from the back part of the ganglion. It passes through the pterygo-palatine canal with the pterygo-palatine artery, and is distributed to the mucous membrane of the upper part of the pharynx, behind the Eustachian tube.

Inferior Maxillary Nerve (fig. 606)

The **Inferior maxillary nerve** (*n. mandibularis*) distributes branches to the teeth and gums of the lower jaw, the integument of the temple and external ear, the lower part of the face and lower lip, and the muscles of mastication; it also supplies a large branch to the tongue. It is the largest of the three divisions of the fifth, and is made up of two roots: a large or sensory root proceeding from the inferior angle of the Gasserian ganglion; and a small or motor root, which passes beneath the ganglion, and unites with the sensory root, just after its exit from the skull through the foramen ovale. Immediately beneath the base of the skull, this nerve divides into two trunks, anterior and posterior. Previous to its division, the primary trunk gives off from its inner side a recurrent (meningeal) branch, and the nerve to the Internal pterygoid muscle.

The **recurrent branch** is given off directly after its exit from the foramen ovale. It passes backwards into the skull through the foramen spinosum with the middle meningeal artery. It divides into two branches, anterior and posterior, which accompany the main divisions of the artery and supply the dura mater.