

Donders, F. C.: The Anomalies of Accommodation and Refraction of the Eye, London, 1864.  
Dyer, E.: Asthenopia not Connected with Hypermetropia. Transactions of the American Ophthalmological Society, 1865, p. 28.  
Harlan, G. C.: Congenital Paralysis of both Abducens and both Facial Nerves. Transactions of the American Ophthalmological Society, 1881, p. 216, and 1885, p. 45.  
Landolt: Refraction and Accommodation of the Eye. Translated by C. M. Culver, Edinburgh, 1886.  
Noyes, H. D.: A Treatise on Diseases of the Eye, New York, 1881.—On the Tests for Muscular Asthenopia, and on Insufficiency of the External Recti Muscles. Transactions of the Eighth International Medical Congress, held at Copenhagen, 1884.  
Prince, A. E.: Operation for the Advancement of the Rectus with the Capsule. Ophthalmic Review, 1887, p. 249.  
Schweigger: Handbook of Ophthalmology. Translated by Porter Farley, Philadelphia, 1878.—Clinical Investigations on Squint, edited by G. Hartridge, London, 1887.  
Stevens, G. T.: Terms for the Designation of So-called Muscular Insufficiencies. New York Medical Journal, December 8th, 1886.  
Theobald, S.: The Amblyopia of Squinting Eyes, with Discussion. Transactions of the American Ophthalmological Society, 1886, p. 273.

**STRAMONIUM LEAVES AND SEED.**—(*Stramonii Folia*, U. S. S., Br.; *Folia Stramonii*, P. G.; *Stramonii Semen*, U. S. P.; *Stramonii Semina*, Br.; *Stramoine* or



FIG. 4560.—Flowering Branch of *Datura Stramonium*, with Fruit. (Baillon.)

*Pomme épineuse*, Cod. Med.; *Jamestown Weed*, *Thorn-apple*, *Apple of Peru*, *Stinkweed*, etc.). The two drugs are defined respectively as the dried leaves and the dried seeds of *Datura Stramonium* L. (fam. *Solanaceae*). The stramonium plant is probably a native of Southern Asia, but it has become abundantly naturalized in nearly all subtropical and temperate regions. It is very common in rich soil of waste places in the Eastern United States. It is a coarse, smooth annual, from one to six feet high, with an upright tri- and dichotomously branched, smooth, green, more or less hollow stem, branching at, say, a foot from the ground, and forming a spreading crown. The habit of the flowering and fruiting branches, and the structure of the large, white, fragrant flowers, and of the fruit, are shown in the accompanying illustrations.

**DESCRIPTION.**—*The Leaves.*—A much-wrinkled, deep or somewhat grayish-green, rarely very slightly brownish mass, consisting of petioled leaves, the blades from 12 to 25 cm. (5-10 in.) long, and about two-thirds as broad, inequilaterally ovate, very oblique at the base, acuminate and

acute at the apex, very coarsely dentate or sublobed, the large teeth few, acute, with rounded sinuses, thin, smooth; the principal veins few and coarse; odor slight, narcotic when bruised; taste bitter and disagreeable.

*The Seeds.*—About 3.5 mm. ( $\frac{1}{8}$  in.) long and two-thirds as broad, flattened reniform, the hilum at one side of the concavity; testa dull black or blackish, hard, coarsely and shallowly reticulate-wrinkled, and very finely pitted; perisperm whitish, oily, concealing a cylindrical, curved embryo; odor unpleasant when bruised; taste sweetish and bitter, then somewhat acrid.

**CONSTITUENTS.**—The relations to one another of the mydriatic alkaloids of the *Solanaceae* are only now becoming known, and our ideas of those of stramonium must still be regarded as merely tentative. The alkaloidal content, at first described as distinct, under the name "Daturine," is now regarded, doubtless correctly, as being largely one of the *hyoscyamines* (see *Scopolia*), but which one, and in what proportions, and how far, and under what conditions mixed with atropine, are matters largely of conjecture. Even the percentage of total alkaloid is not well known. It is generally considered that the seeds contain about one-fourth of one per cent., the leaves not more than one-third as much. Besides these, the leaves contain a large amount of ash (fourteen and one-half per cent.), nitre, asparagin, a trace of volatile oil, and other unimportant substances, and the seeds about twenty-five per cent. of fixed oil.

**ACTION AND USE.**—From the above analysis it will be seen that stramonium can exhibit but little difference in action from hyoscyamus, and but little from belladonna. It is indeed capable of being used for exactly the same purposes, only it is more quieting and hypnotic than the latter, which may indicate the presence in it of some hyoscine or other alkaloid distinct from atropine or hyoscyamine. Custom, perhaps, as much as anything, has directed the leaves of this species, instead of those of the others named, to be used in the local antispasmodic treatment of asthma, for which purpose it is almost entirely prescribed. The common method is to administer it by smoking. The leaves may be burnt in a pipe or on the cover of a hot stove, or they may be made more inflammable by being soaked in a strong solution of

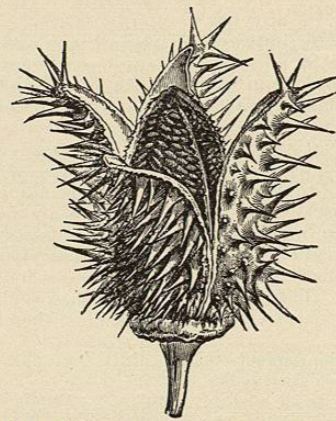


FIG. 4562.—*Datura Stramonium*; Ripe Fruit. (Baillon.)

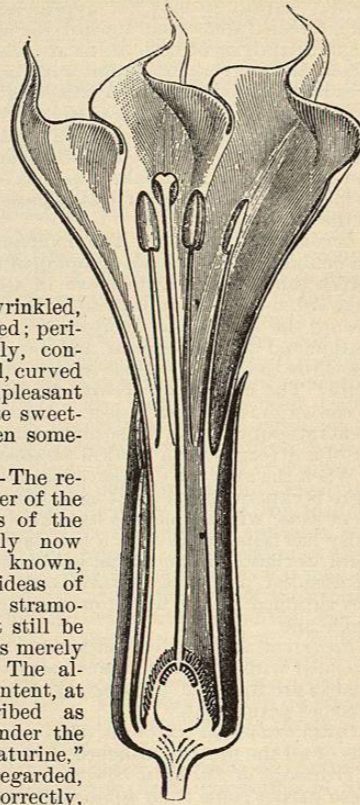


FIG. 4561.—Longitudinal Section of Flower of *Datura Stramonium*. (Baillon.)

saltpetre and dried, after which they will burn steadily, without flame and without requiring any apparatus; prepared in this way and flavored with aromatics and balsams, they are the foundation of most of the "asthma cigarettes" and "pastils," which are often better products than extemporaneous preparations are apt to be. The French Codex gives directions for making cigarettes of stramonium, containing 1 gm. each of leaves, without any admixture. For internal administration stramonium may be considered as about the equivalent of hyoscyamus. The following preparations are official,

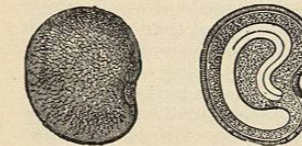


FIG. 4563.—Seed, Entire and in Section, of *Datura Stramonium*.

all made from the seed, the leaves being only used for smoking (1 or 2 gm.): Extract (*Extractum Stramonii*), strength about  $\frac{1}{4}$ ; Fluid Extract (*Extractum Stramonii Fluidum*), strength,  $\frac{1}{2}$ ; Tincture (*Tinctura Stramonii*), strength  $\frac{1}{10}$ ; and the Ointment (*Unguentum Stramonii*), strength (of the extract),  $\frac{1}{10}$  in benzoinated lard. All these have similar properties and uses to the corresponding preparations of hyoscyamus and belladonna, but are more hypnotic than the latter. Dose of fluid extract about 0.2 c.c.; of the other preparations, according to their relative strength.

**ALLIED PLANTS.**—*Datura*, of which the present plant is a characteristic species, consists of a dozen, mostly large, rank herbs, most of which have similar medical properties to the above. *D. Tatula*, with purple stems and flowers, scarcely distinct from *D. Stramonium*, and *D. alba*, of India, are used for the same purposes.

Henry H. Rusby.

**STRANGULATION AND HANGING, EVIDENCES OF DEATH FROM.**—Suffocation is the name applied to both the act and the result of deprivation of atmospheric air. When this deprivation is due to mechanical interference the term *mechanical suffocation* is used.

Mechanical interference may occur through pressure on or obstruction within some portion of the respiratory tract. Suffocation by pressure on the neck is called *hanging* when the constricting force is the weight of the body itself, and *strangulation* in all other cases. The term *suffocation* is also used in a more special sense where breathing is prevented by pressure on the mouth, nose, chest, or abdomen; or by obstruction within the respiratory tract; or by pressure on the tract from the œsophagus; or through inhaling irrespirable gases.

Strangulation may therefore be defined to include all cases of suffocation by *pressure on the neck* whether by cords or the hand, but excluding hanging. The Germans distinguish strangulation by the hand as *Erwürgung*, and by ropes, cords, etc., as *Erdrosselung*. The words garroting and throttling are often used in place of strangulation. In this article the word *ligature* will be used to include the very varied forms of constricting materials. Hard substances are sometimes placed in the ligature to increase the pressure.

Strangulation is almost always homicidal, hanging almost always suicidal, and the other forms of suffocation usually accidental, but often also homicidal. Both suicides and murderers are usually more violent than is really necessary to destroy life; murderers more so than suicides.

Death from strangulation as well as all other forms of suffocation, including hanging, is mainly by asphyxia; to some extent by coma or syncope or both. The post-mortem appearances will vary somewhat, depending on whether the deprivation of air is sudden or gradual, partial or complete, and whether there is coincident pressure on the great arteries, veins, and nerves. According to Hofmann, a pressure of 2 kgm. on the neck stops the flow of blood in the jugular veins; one of 5 kgm., in the carotid arteries; one of 15 kgm. stops the movement of air in the air passages, and one of 30 kgm. the flow of blood in the vertebrals.

The evidences of death from strangulation are *external* and *internal*. The principal external evidence is the mark of the cord or hand on the neck. Tidy says that nothing short of distinct external marks would justify a medical jurist in pronouncing death to be due to strangulation, while on the other hand Taylor considers the condition of the lungs (see *infra*) as characteristic. Liman does not think there are any internal appearances which can distinguish suffocation, strangulation, and hanging from each other. This statement is made the more probable in view of the fact that death in each case is generally by asphyxia.

All marks on the body should be carefully noted; the cavities of the skull, thorax, and abdomen carefully examined; the possibility of death having occurred from other causes, even in strangulation, must be considered. In all cases the cord or strangulating ligature should be carefully examined for marks of blood, for adherent hair or other substances. The precise manner in which the cord has been tied should be noted. Putrefaction may cause external marks to disappear. In some fatal cases there are either no marks at all or they are but slight; this is more likely to be the case in suicide than in homicide, and is usually due to the ligature being soft and yielding. The victim of a homicide may, however, first be stunned and afterward strangled. A person while intoxicated or in an epileptic or hysterical paroxysm may grasp his neck in gasping for air and thus leave finger marks. Marks are said to be plainer after the body has become cold and when subjects have recovered from attempts at suicide.

The mark of the ligature in strangulation usually encircles the neck more completely and is more horizontal than in hanging. These conditions may, however, be reversed, because a body may be dragged by the neck after strangulation, and there have been suicides by hanging in whom the mark of the cord was horizontal. As a rule, however, a horizontal mark with the knot on the same level as the cord, especially if below the larynx, suggests strangulation rather than hanging; and if there are several marks the probability is even greater. In compression with the fingers the marks are not in a horizontal but in an oblique line. The mark of the ligature is usually circular, well defined, and corresponds closely to the breadth of the ligature; rather depressed and usually below the larynx. As a rule this depression is not deep; the skin at the bottom of the groove is usually very pale, while the adjacent parts are red or livid. Sometimes the bottom of the groove shows ecchymoses. Neyding says that suggillations in the groove made by the ligature on the neck are rare, but are oftener found in strangulation than in hanging, because the conditions favoring their formation are oftener found in strangulation. In most cases the skin and connective tissue of the groove and of the parts in the vicinity show, microscopically, hyperæmia and hemorrhages. Liman states that when we find suggillation in the groove or its vicinity we may know that some other form of violence has been applied at the same time as that of the ligature or hand. He had not seen suggillation in the furrow either in strangulation or in hanging, except when the injured persons had lived some time. The absence of suggillation and ecchymosis was due, he thought, to pressure on the capillaries. Bremme says that there is no hemorrhage in the subcutaneous tissues of the mark of the ligature, either in strangulation or in hanging, if death occurs at once and the cord is removed soon after death; but if the cord remains for some time after death there may be hemorrhages, or if death does not occur at once, whether the ligature is removed or not. It is impossible to distinguish ante-mortem from post-mortem hemorrhage. Different constricting agents may make quite similar marks. Taylor mentions a case in which a soft silk handkerchief was used and the appearance was the same as that of a narrow cord, due to the tightness with which it was tied. Marks may be made on the neck within a limited time after death similar to those made during life. Tidy's experiments led him to fix this limit at

three hours for ecchymosis and six hours for non-ecchymosed marks. Taylor, however, doubts if such marks can be made one hour after death. He says that the period cannot be positively stated, and probably varies according to the rapidity with which the body cools.

A cord may be found near a body or even around its neck; there may even be a mark around the neck. These may be attempts at deception. Marks much like those of violence may be made by tight collars and handkerchiefs remaining till the body is cold. Cases are reported of bodies having been strangled and then burnt or hung, to cover the crime; and of partial suffocation by gags followed by or coincident with strangulation. Where a hard substance like a piece of coal or stone is inserted into the ligature (usually a soft cloth) and presses against some part of the neck, there is usually a corresponding bruise. Marks of pressure by the thumb and fingers are usually on the front of the neck, and either just above or just below the larynx. In many cases these marks are only those of the finger tips with some scratches, and show definitely the probable size of the assaulting hand and whether right or left. Marks of strangulation may disappear rapidly after removal of the ligature. Assaultants usually constrict the neck much more violently than is sufficient to cause death. Marks of violence on the neck are therefore greater in strangulation than in hanging. A great variety of external injuries other than those on the neck have been found in the different cases reported, where other forms of violence were also used. With few exceptions such additional injuries indicate homicide.

Since the evidences of death in hanging are so similar to those in strangulation, and since "hanging" is not considered elsewhere in this HANDBOOK, these evidences will be pretty freely treated here.

The external appearances in hanging are those due to the action of the ligature on the neck and to other violence, if any has been done, and those due to asphyxia or syncope. If the suspension is very brief and the ligature soft and supple and the body instantly cut down after death, there may be no mark. Allison questions the value of the mark, contending that it is post mortem, and reports cases; he says it is present only if the drop is considerable or the suspension continues after death. Tidy says that the mark is in a measure independent of the ligature and duration of suspension and does not usually acquire its color for some hours after death; sometimes, however, it has occurred in a much shorter time. It may be slight because the ligature has been placed over the clothing. The longer a body hangs after death the plainer is the mark. It can be produced on the cadaver. Harvey says that the characteristic mark was found in 8 non-fatal cases in nearly 1,500 cases of hanging. Coutagne, in 24 necropsies on subjects hung, found 17 in which the lesions of the neck were plain.

The direction of the mark in hanging is usually oblique, following the line of the lower jaw upward and backward behind the mastoid process; it may, however, be horizontal. If the ligature encircles the neck more than once, one mark may be circular, the other oblique. If a running noose is used, the mark may be circular and be seen all the way round the neck, looking like the mark of strangulation. Taylor states that if the noose should be in front, the mark may be circular, the jaw preventing the ligature from rising upward in front as much as it would behind. If it encircles the neck but once, its continuity is apt to be broken by the prominence of the hyoid bone, thyroid cartilage, sterno-mastoid muscles, etc. In 117 out of 143 cases Tardieu found the mark between the chin and the larynx; in nearly all the remainder, over the larynx; in a very few, below the larynx; the last position was due to the protection of the neck by a handkerchief or beard, or there was some anatomical or pathological peculiarity which prevented the ligature going higher. Hofmann saw 2 cases of tumor of the neck; one in a woman where the cord was below the larynx, and the other in a man where it was over the larynx. Remer found the cord above the larynx

in 38, over the larynx in 7, below in 2. Devergie found it above the larynx in 20, over it in 7, below in 1. Casper found it above the larynx in 59, over it in 9. Roth in 49 cases found the ligature above the hyoid bone in 5, between the bone and larynx in 31, over the larynx in 8, below it in 1. Hackel found the ligature, in 40 per cent. of cases, between the hyoid bone and larynx; in 60 per cent., lower down. The ligature always appears lower after the body is laid down than it was in suspension. Maschka found the furrow above the larynx 147 times in 153 cases.

The character of the mark in hanging will vary according to the kind of ligature used, its mode of application, the vitality of the tissues, and the period that has elapsed since death. The result is different according as the knot or loop is single or double, a running or slip knot. The mark may differ in character in one part of the neck from what it is in another. The same furrow may be soft in one part and dry in another. The width of the mark does not necessarily correspond to the diameter of the ligature. A double mark usually means that the ligature has been twice passed around the neck, although the marks may not be continuous or parallel. Tardieu states that a large single leather thong pressing on the neck only by the borders may make a double mark. The mark is usually depressed. The depth of the depression, groove, or furrow, as it is called, is greater the narrower and firmer the ligature, the longer the suspension, and the greater the weight of the body. The mark may be merely a slight depression, without color, or only a red blush if the subject is young, tissues are healthy, and suspension is brief. Roth in 49 cases found that the furrow of the ligature was brown in 40, red brown in 6, and 3 times bluish. In about two-thirds of the cases of hanging, as generally observed, the bottom of the furrow, the place of greatest pressure, is white, especially so where the knot is tied; while the edges of the furrow are usually slightly raised and red or livid. If the subject is very fat there may be only a slight depression. Harvey says that this hard, white, shining, translucent band from compression of the connective tissue is the first stage of the parchment or vellum skin, and is chiefly noticed in fresh bodies. The borders are swollen and oedematous, called by Lacasagne *bourrelet de sillon*. The skin below the furrow is usually violet. Authors differ as to whether this is due to congestion or to hemorrhage. Roth in 49 cases found swelling below the furrow 27 times. Hackel found ecchymoses above the mark in 35 per cent. of the cases of hanging. Hofmann thinks that the lividity of the upper border of the furrow is due to the stopping of the venous blood descending from the head.

The dry, hard, yellowish-brown, or reddish-brown parchment furrow described by writers on hanging is said to be common. Ogston found it in one-third of his cases. It is found only when the body has remained suspended for several hours after death; indeed, it may be produced by applying the ligature to the cadaver; is not at all, therefore, a proof of suspension during life. Liman states that constriction by a ligature even for some time does not necessarily cause a mummified or excoriated furrow. He saw cases in which the mark was soft, flat, scarcely colored, but little interrupted, and not parchmenty. Its appearance can be prevented or delayed by examining a body soon after death or by re-hanging it; and after it has appeared it will disappear on the application of some liquid. Taylor compares this parchment mark to the cutis from which the cuticle has been removed for two or three days. The parchment skin is seldom seen in strangulation, though Liman has seen it. Neyding says that it depends mainly on the amount of excoriation of the skin, and that this is greater in hanging. Tardieu explains this frequency as being due to the fact that the constriction in hanging lasts longer.

The violence used in hanging may cause ecchymoses and abrasions of the skin of the neck adjacent to the mark of the ligature. Slight abrasions and ecchymoses are sometimes found in the furrow. Ecchymoses alone do not indicate whether suspension has been before or

after death; but abrasion with hemorrhage strongly suggests suspension during life. Devergie regards ecchymoses of the neck as strongly suggestive of homicide. Neyding says that suggillation in the groove is oftener found in strangulation than in hanging, and Bremme that there is no hemorrhage in the subcutaneous tissue of the mark if death occurs at once and the cord is removed at once after death; but if the cord remains for some time after death there may be hemorrhage, or if death does not occur at once, whether the ligature is removed or not. Roth found ecchymoses or small bladders at the lower margin of the furrow 9 times in 49 cases. Riechke found only once in 30 cases a hemorrhage beneath and on both sides of the mark. Chevers did not find ecchymoses of the skin of the mark in cases of hanging. Coutagne found hemorrhage into the connective tissue or muscle. Casper found no ecchymoses in 50 out of 71 cases. Maschka saw 2 cases where burns on the neck resembled the mark of a ligature.

The furrow when once distinct remains constant for a long time after death even in putrefaction. Marks from soft substances, however, disappear sooner than those from strong and uniform compression. The value of the presence or absence of marks on the neck and the character of the marks have been questioned. Orfila, Casper, and Vrolik have shown by experiment that if a body is hanged within one or two hours after death the furrow, parchment skin, lividity, and the density of the connective tissue will appear just as is seen when suspension has occurred during life; but ecchymoses and infiltration, clotted blood in the skin and connective tissue and muscles of the neck, suggest suspension during life.

The marks of topical medical applications, as plasters, sinapisms, etc., must not be confounded with marks of violence. In apoplectics with short, full necks we may find at the borders of the folds of the skin in the neck one or more red or livid depressions that bear some resemblance to the marks of a ligature; but on section there are no ecchymoses.

The neck nearly always appears stretched in hanging. According to Roth, the mobility of the head is increased by this stretching. The head also is always inclined to the side opposite to that of the knot. In suicides the head is usually bent forward on the chest.

Usually in strangulation there is hemorrhage into the loose connective tissue under the mark and in the subjacent muscles; in most cases isolated and circumscribed, but sometimes extending beyond the line of the mark. Hemorrhage from compression by the fingers is more marked than that from ligature. Sometimes there is only fulness of the subcutaneous veins.

In hanging, the connective tissue under the mark is usually white and condensed, the more so if the body has been long suspended. This dryness or condensation was found by Hackel in 52 per cent. of hangings. Deeper-seated parts are injured only when the hanging has been violently done. The muscles, especially the sterno-mastoid, are sometimes ruptured; Hofmann reports several cases. In 50 hangings Lesser saw 11 ruptures of muscle. Maschka never saw the rupture in suicides. Hackel in 67 cases failed to find the muscle ruptured. Hofmann believes that the rupture of the muscle is sometimes post mortem. Coutagne found the sterno-mastoid ruptured once in 24 cases.

The neck occasionally suffers extreme injury, and owing to the violence used (Tidy) this occurs oftener in strangulation than in hanging. Occasionally the neck is broken. The hyoid bone may be broken; Maschka saw it once in 18 of *Erdrosselung* and in 5 of *Erhängung*. The bone is rarely dislocated in hanging. Orfila mentions a case of fracture. Barker usually found the bone fractured in judicial cases. Pellier reports 2 cases. Hofmann says the hyoid cornua are often fractured, especially when the ligature is between the hyoid bone and thyroid cartilage. Coutagne found fracture of the bone 8 times in 24 cases; he attributes the fracture to the pressure against the spine. Pellier speaks of fracture of the styloid process.

In strangulation the carotid arteries may suffer rupture of their inner and middle coats, especially in atheromatous subjects and when compression has been great. Friedberg states that the injury of the carotid is a proof that the strangulation occurred during life, and probably from pressure of the fingers on the neck without any regard to any disease of the artery. He reports two cases. The examiner should be careful not to injure the artery with the forceps. The vessels may contain clots. In hanging also the carotid arteries may be injured; usually the inner and middle coats are torn; and hemorrhage may occur into the wall of the vessel. The common carotids are those usually affected and just below the bifurcation, but the external carotid is also occasionally injured. The injury is said to be due to the stretching and squeezing of the artery, stretching being the most effective, since the rupture often occurs at a distance from the mark of the ligature. Such injury of the artery does not prove that hanging took place during life, because it has been produced on the cadaver; but hemorrhage into the wall of the vessel, or wound or rupture after death, is very improbable. Maschka says the lesion is very rare. Tardieu says it is rare and therefore unimportant. Pellier reports 4 cases of rupture of the carotid in a total of 23. Levy records the experiments of Hofmann of Vienna and Brouardel and himself of Paris, 5 in number, and concludes that compression of the carotids, if it produces obliteration, can cause rapid loss of consciousness and death; and explains why in incomplete suicide the subject is unable to help himself. Coutagne found rupture of carotids 10 times in 24 cases, and insists on the importance of the lesion.

In all forms of asphyxiation the hands are usually clinched, and may have articles in their grasp which under the circumstances have a medico-legal value. In hanging, the hands are often clinched so tightly that the nails are driven into the palms; this occurs more especially when the hanging has been done with violence. When the feet touch the ground, as often occurs in suicides, the hands may be stretched out. Roth found the hands and feet flexed in 44 of 49 cases. Taylor says that we may expect to find the hands clinched when constriction of the neck is sudden and violent. The legs are usually livid.

In asphyxia the tongue is often swollen, dark, protruding, and sometimes bitten. Maschka states that if the ligature lies above the hyoid bone the tongue will be drawn backward; if over or below the bone, the tip of the tongue may appear more or less between the jaws. In hanging the tongue is usually livid and swollen, especially at the base. According to Tidy, Dr. Guy looks on this as showing that suspension took place very probably during life. In about one-third of the cases the tongue is protruded and compressed between the teeth; sometimes bitten. Some observers found it protruded only as a result of putrefaction. The protrusion is not believed to depend on the position of the ligature. Hackel in 67 cases found the tongue lying forward in all cases in which the cord was between the larynx and hyoid; in 55 per cent. in front of the teeth, in 18 per cent. between the teeth; where the ligature was lower down the tongue was behind the teeth. He found by experiment that in the spasmodic expiratory effort the tongue was thrust forward; in the inspiratory movement drawn backward; and he concluded that the forward movement was the result of reflex action. Maschka found the tongue between the teeth 58 times in 149 cases. Roth in 49 cases found the tongue projecting and bitten in 22, the teeth shut in 15 others; in 15 the mouth was open; the tongue was retracted in 30.

In asphyxia the face usually shows pain and suffering, although sometimes the features are calm. In the latter case there may have been syncope. The face varies in color from violet to black, and may be swollen. Casper says that the face has the same appearance as in any other corpse. Liman found the face livid in only 1 of 14 cases of strangulation. Hofmann says that the cyanosis appears during the agony, because of the paralysis of the