

properties which separate it slightly from the powerful agent which enters into its composition.

Applied to the unbroken epidermis, the cyanide of potassium produces at first a sensation of coldness, followed by tingling and itching, and in a half-hour the skin is found to be somewhat reddened. Prolonged contact produces a phlyctenular or eczematous eruption.

Systemic effects are produced by the local and external use of the cyanide of potassium, viz., slowing of the pulse and respiration, muscular weakness, drowsiness, and coldness. Lethal effects may follow prolonged contact with the skin, even when the epidermis is unbroken. Applied to a wound or abraded surface, this salt causes a burning pain, excites a high degree of inflammation, and produces prompt lethal effects.

**THERAPY.**—Cyanide of potassium may be prescribed as a substitute for hydrocyanic acid in all of the maladies for which the latter is used. This salt has, however, some special applications which we owe to Trousseau. This eminent observer has shown that a solution of the cyanide applied to the seat of painful sensations gives great relief in various forms of *reflex headache*, gastric, cardiac, pulmonary, and menstrual. The headache which accompanies the pyretic state is, according to the same authority, cured or greatly alleviated by the cyanide solution, while at the same time a favorable influence is exerted over the temperature.  $\mathcal{R}$  Potassii cyanidi, gr. x— $\mathcal{D}$  j; aquæ lauro-cerasi,  $\mathcal{Z}$  iv. **M. Sig.:** *A compress, moistened with the solution, to be applied to the seat of pain.* From a quarter to a half hour of contact with the skin usually suffices.

A solution of the cyanide of potassium, of the strength given above, will remove the stains of nitrate of silver, and also the dissecting-room odor, from the hands.

Cyanide of potassium, in the form of ointment or solution, is an excellent remedy for allaying irritation in various cutaneous diseases. In *pruritus* and *urticaria*, the following formula (McCall Anderson) gives relief:  $\mathcal{R}$  Potassii cyanidi, gr. vj; pulv. cocci, gr. j; ungu. aq. rosæ,  $\mathcal{Z}$  j. **M. Sig.:** *Ointment.* In *eczema with pruritus*, the same authority recommends the following:  $\mathcal{R}$  Potassii cyanidi, gr. v; sulphuris, potassii bicarb.,  $\mathring{a}\mathring{a}$   $\mathcal{Z}$  ss; pulv. cocci, gr. vj; axungiæ,  $\mathcal{Z}$  j. **M. Sig.:** *Ointment.* A solution of the cyanide of potassium is one of the most effective applications for that very troublesome disorder, *pruritus pudendi*.  $\mathcal{R}$  Potassii cyanidi, gr. xv; aquæ lauro-cerasi,  $\mathcal{Z}$  viij. **M. Sig.:** *Lotion.* This formula is also serviceable in *lichen* and *prurigo* (Hardy).

Entomologists make use of the cyanide to destroy insects without injuring their structures. One part of the cyanide, two parts of plaster of Paris, and one and a half part of water, made into a paste and

poured into a wide-mouthed bottle, sets into a solid mass, which gives off the vapor of hydrocyanic acid (Squire).

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**Amyl Nitris.**—Nitrite of amyl. *Nitrite d'amyle*, Fr.; *Amylnitrit*, Ger.

**PROPERTIES.**—A yellowish or reddish-yellow liquid, rather oily in consistence, very volatile, and having a peculiar and very diffusive ethereal odor. It is insoluble in water, but soluble in all proportions in alcohol, ether, chloroform, benzol and benzin. It has a neutral or a slightly acid reaction. It may contain, as impurities, nitric acid, amyl-nitric ether, amylvalerianic ether, and hydrocyanic acid. The specific gravity is .877. Dose,  $\mathfrak{m}$  ij— $\mathfrak{m}$  v, by inhalation or subcutaneously.

**ANTAGONISTS.**—The actions of the nitrite of amyl are antagonized by all those agents which increase the functional activity of the spinal cord and sympathetic—as strychnine, brucine, picrotoxin, digitalis, ergot, belladonna, and, as McCullough has shown, it is an efficient remedy in chloral-poisoning. The opposing action of amyl nitrite and ergot has been demonstrated clinically by Dr. Fancourt Barnes, in cases of hour-glass contraction induced by ergot. This antagonism may not be available, owing to the difference in the rate at which they are diffused, to affect the system.

**SYNERGISTS.**—All of the motor depressants increase the effects of the nitrite of amyl.

**PHYSIOLOGICAL ACTIONS.**—The following are the symptoms produced by nitrite of amyl when inhaled: acceleration of the action of the heart; sudden flushing of the face; dilatation of the arterioles in consequence of paresis of the muscular layer of these vessels; a sense of extreme fullness of the brain, with vertigo; fall in the blood-pressure; lowering of the temperature; complete resolution of the muscular system of animal life. The vapor of nitrite of amyl applied directly to the tissues—muscular or nervous—suspends or completely arrests functional activity. Circulating in the blood, it undoubtedly affects most the vaso-motor nervous system and unstriped muscular fiber.

The marked acceleration of the heart (Pick) is in part consecutive, doubtless, to the sudden dilatation of the arterioles, permitting such an increased quantity of the blood to enter these vessels as to require renewed effort on the part of the heart to supply it; in part also to the parietic state which it induces in the inhibitory apparatus. The great fall in the blood-pressure noted by Brunton, Wood, and Amesz-Droz, is also due to dilatation of the arterioles, and consequent dimi-

nution of tension in the peripheral vascular system. Dilatation of the retinal vessels, when nitrite of amyl is inhaled, has been ascertained by ophthalmoscopic examination (Aldridge).

On the nervous system of animal life the nitrite of amyl acts as a depressant—impairing motility first, and, at the last, sensibility. It affects both the spinal cord and the nerves, lessening the sensibility to all forms of irritation, and diminishing the reflex functions. It also impairs the contractility of muscle. Death ensues from failure of respiration, and the cerebral functions are unaffected until carbonic-acid poisoning ensues.

Decided lowering of temperature is produced by the nitrite of amyl. This result is no doubt due to the action of this agent on the hæmoglobin, whereby the carrying capacity of the red blood-globules of oxygen is lessened (Gamgee), metamorphosis of tissue is interfered with, and the generation of animal heat is diminished. A peculiar change ensues in the color of the blood as a result of the lessened oxygenation: all the blood of the body assumes a modified venous hue.

A curious fact has been noted by Hoffmann, viz.: the hypodermatic injection of lethal doses of nitrite of amyl produces in rabbits a temporary glycosuria.

**THERAPY.**—The applications of the nitrite of amyl in the treatment of disease have been deduced from a study of its physiological actions. It is especially indicated when morbid symptoms result from vaso-motor spasm. It has been shown that *epileptic attacks* may be warded off by the inhalation of nitrite of amyl at the beginning of the movement of the *aura*. Patients who have a distinct warning of the seizures should be constantly provided with a small quantity of this remedy in order to practice the inhalation whenever an attack is impending. The mechanism of the action is very simple: the vaso-motor spasm of the cerebral vessels, which is the initial symptom of an epileptic convulsion, is relaxed, and the vessels dilated by the nitrite of amyl.

By the timely inhalation of the nitrite, the *cold stage of an ague* may be aborted, but the hot stage is not modified in any way (Price, Ziegler). This power may be most serviceable in cases of *pernicious intermittent*, the danger of which consists in the extreme depression of the cold stage. The cardiac failure caused by chloral, chloroform, and other heart-poison, and the condition of sudden weakness which may ensue from various causes, in cases of fatty heart, are often remarkably relieved by the inhalation or hypodermatic injection of amyl nitrite.

An attack of *migraine*, of that form characterized by vaso-motor spasm (pallor of the face), may be quickly relieved and sometimes aborted by the inhalation of two or three drops of amyl nitrite.

When there are redness of the face, injection of the conjunctivæ, and fullness of the cerebral vessels, this remedy is contraindicated. Cases of *neuralgia of the fifth nerve*, second division, have been cured by inhalation of amyl, repeated from time to time as the pain required its administration.

*Asthma*, when purely spasmodic, is usually quickly checked by this remedy. The paroxysms of difficult breathing which accompany emphysema and cardiac disease are not relieved in this way; indeed, the author has known the most serious distress to be produced by the inhalation under these circumstances.

*Exaltation of the reflex function of the spinal cord and muscular spasm* are morbid states in which good results may be expected from inhalation of the nitrite of amyl. It has been used with success in *tetanus*. It should also be fairly tried in *strychnine-poisoning* and in *hydrophobia*. Michael has administered it in *tinnitus aurium*, a most obstinate and distressing condition, with comparatively good effects: of a group of thirty-three cases, nineteen were distinctly benefited.

Most signal relief has been obtained from the inhalation of amyl nitrite in *angina pectoris*. We owe this important suggestion and practice to Brunton, who had ascertained that when the paroxysm of angina pectoris occurs, a great rise of arterial tension takes place. When the pain, præcordial distress, and anxiety are felt, there should be no delay in the use of the remedy. Some cautions are, however, needed. It may be unsafe when advanced degeneration of the cerebral vessels exists (Anstie). Fatty degeneration of the heart, which is so frequently a cause or an accompaniment of angina pectoris, may also render the use of so powerful a paralyzer of doubtful expediency.

Dr. Mary Putnam Jacobi has found the inhalation of nitrite of amyl very serviceable in *neuralgic dysmenorrhœa*. As an antagonist to ergot, it may prove in a high degree useful, when ill effects are caused by this remedy. Thus, in a case of hour-glass contraction produced by ergot, the inhalation of amyl nitrite procured immediate relief. On theoretical grounds this agent was proposed for the relief of *cholera asphyxia* (Brunton, Gamgee), but the trials thus far made with it have demonstrated its inutility. Owing to the fact, shown by Gamgee, that nitrite of amyl combines with hæmoglobin, Brunton proposes that this remedy, if given at all in cholera, must be administered by the stomach or by subcutaneous injection, and not by inhalation.

Repetition in the use of the nitrite of amyl diminishes its effects, and hence increasing doses are necessary when it is often employed in the same case.

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**Nitro-Glycerinum.**—Nitro-glycerin. (Not official.)

**PROPERTIES.**—Nitro-glycerin is an oily liquid, colorless, or pale yellow, and has the specific gravity 1.60 at 59° Fahr. It burns quietly in the open air, but heated in a close vessel, or subjected to percussion, it explodes violently. It decomposes if long kept. It is very slightly soluble in water, but dissolves freely in alcohol and in ether. The best preparation for administration is the alcoholic solution—one part of nitro-glycerin to one hundred parts of alcohol. The dose of this ranges from one minim to many minims. As the susceptibility to this agent varies greatly, the initial dose should be the smallest. One minim of the one-per-cent solution will give some persons violent headache, while others may take a minim of the undiluted drug without any decided effect.

It should not be forgotten that the alcoholic solution will explode if struck with a wet hammer.

*Sodii Nitris.*—Nitrite of soda.

*Potassii Nitris.*—Nitrite of potassium. These salts have been proposed and used as substitutes for amyl nitrite and nitro-glycerin. Dose, gr. iij—gr. viij.

*Ethyl nitrite* is the most important constituent of nitrous ether. Inhaled, it has effects similar to the other nitrites.

**ANTAGONISTS.**—All those agents which increase the reflex activity of the spinal cord and stimulate the vaso-motor system, as strychnine, ergot, digitalis, belladonna, etc., antagonize nitro-glycerin.

**SYNERGISTS.**—Amyl nitrite acts very similarly, and the motor depressants in general promote the actions of nitro-glycerin.

**PHYSIOLOGICAL ACTIONS.**—The taste of nitro-glycerin is at first sweetish, but this impression is followed by aromatic pungency. In a few minutes—from three to five—after a small medicinal dose, there are suddenly experienced a feeling of giddiness, tension of the head, with fullness, languor, nausea, and sometimes stomach-pain. Such effects are experienced from a small dose, if the individual taking it is susceptible. It follows, then, that the quantity of nitro-glycerin causing such symptoms must vary in different patients. Dr. Harley experienced these effects after taking fifteen drops. Dr. Fuller experienced some fullness of the head, perspiration, intermittent pulse, and some after-headache, from a dose equivalent to fifty minims of a one-

per-cent solution, or a half-drop of the nitro-glycerin itself (Murrell). In some persons a drop or two of the one-per-cent solution will cause dizziness, faintness, a rapid and very weak pulse, perspiration of a rather clammy character; or, indeed, the symptoms may proceed to unconsciousness. Dr. Murrell applied the moistened cork of the bottle containing the solution to his lips, and in a few minutes experienced a tremendous action of the heart and arterial system; his pulse rose to 100 and higher, and he had "a splitting headache" for some time. There is no change in the temperature. Women and the feeble in constitution suffer more decided effects than the robust. Drowsiness comes on, with a feeling of languor, in those on whom the smallest dose acts kindly. With the rapid pulse is a considerable degree of dirotism. The change in the character of the pulse begins in about six minutes after the dose is taken, and lasts on the whole about one hour. The sphygmographic tracings appended to Dr. Murrell's paper are remarkable for the extent of the excursions of the lever, the abrupt ascent, the sharpness of the summit, and the dirotic rebound, indicating an extremely low state of the arterial tension. When the heart of a frog is put into a .75-per-cent salt solution, and two drops of a ten-per-cent solution of nitro-glycerin are added, the heart acts more and more slowly, and presently stops. An alcoholic solution has no effect (Brunton). When injected into the jugular vein of a cat, the nitro-glycerin solution arrests the heart speedily. That the vagus is paralyzed, and the inhibition thus removed from the heart, is proved by the fact that galvanic excitation of the vagus has no effect in restraining the cardiac movements. Changes occur in the blood like those induced by amyl nitrite and the nitrites of soda and other nitrites; that is, the blood assumes a chocolate-color, and probably loses its power of absorbing and conveying oxygen; but its so-called ozonizing function may not be interfered with, since nitro-glycerin does not prevent the guaiac reaction, in which respect it agrees with the other nitrites. The change in the color of the blood is produced slowly when blood is shaken up with some nitro-glycerin outside of the body (Brunton).

In frogs nitro-glycerin causes weakness, tetanus, ending in paralysis; but, in warm-blooded animals, there are convulsive movements, as twitching of the muscles, hiccough, spasmodic breathing, etc. The tetanus in frogs, according to Brunton, is not due to a direct action of the poison on the spinal cord, thus opposing the assumption of Minor, who held that it acts on the medulla. The paralyzing effect of nitro-glycerin appears to be due to an action on the muscles, and also on the motor nerves. When it is applied directly to the muscles, they quickly lose their contractility. The reflex function of the cord is extinguished first in the parts external to the cranium, the cerebral nerves preserving their power to transmit impressions until later. Sen-

sation is destroyed by it as well as motility. Death is due to asphyxia—to paralysis of the muscles of respiration. Notwithstanding the activity of nitro-glycerin, the most serious symptoms are recovered from without detriment. Thus Dr. Murrell narrates several cases in which unconsciousness was produced without any ill results, except some temporary headache.

**THERAPY.**—Nitro-glycerin is adapted to the treatment of the maladies in which its congener, amyl nitrite, has proved so effective. It has the advantages over the latter of being more permanent, more readily administered, and more sustained in action. In *sea-sickness*, *reflex vomiting*, *gastralgia*, *hepatic colic*, and other painful and spasmodic affections of the digestive tube, it may afford very prompt relief. It was first employed in the treatment of *angina pectoris*, in which it gives as much relief as does amyl nitrite, but the latter should be preferred when the utmost promptitude of action is necessary. The form of the disease requiring this medicine is that characterized by high tension of the peripheral vessels, which is doubtless the condition in the genuine cases of *angina pectoris*. Very prompt relief may be given to attacks of *hiccough* by this medicine. Some cases of *spasmodic asthma* are much benefited by it. The less there is of structural alterations, the more certain the relief. As the secretions of the mucous membrane of the respiratory tract are increased by it, the cases with deficient secretion are those most certain to be benefited. It should be carefully tried in *whooping-cough* and in *laryngismus stridulus*. There is much to be expected from nitro-glycerin in diseases of the nervous system characterized by heightened reflexes. An attack of *epilepsy* may be aborted by its timely administration, and Hammond finds it as a remedy for this disease second only to the bromides. By preventing the spasm of the vessels and consequent sudden anæmia of the brain, the first and most important event in the series can not occur. It should be fairly tried in *tetanus* and *hydrophobia*. In *neuralgia* of the fifth nerve it has given immediate relief in numerous instances. It is the most appropriate remedy in that form of *migraine*, or sick-headache, in which the vessels are in a condition of spasm, but is not proper in those cases having a flushed face from dilated vessels.

The cold stage of an *intermittent* may be aborted by the timely administration of nitro-glycerin. It promises to be especially useful in the pernicious malarial diseases to prevent the dangerous depression of the cold stage. In these cases its administration should be so timed that the physiological effect of the remedy occur at the onset of the cold stage of the disease. The mechanism of its curative action is obvious. Remarkable results have lately been obtained from this remedy in *acute and chronic Bright's disease* (Robson)—results which the author is able, from personal observations, to confirm. It is well

known, of course, that high arterial tension is present; but whether as causative of the renal changes, or a consequence of them, is not known. The apparently constant association of degenerative changes in the renal ganglia with the lesions of Bright's disease, discovered by Da Costa and Longstreth, would indicate that the state of the vessels is a factor in developing the structural alterations. The manner in which nitro-glycerin affords relief, and possibly effects a cure, is thus fully explained. Indeed, all of the curative results obtained from nitro-glycerin must be referred to its action on the vascular apparatus.

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**Aconitum.**—The tuberous root of *Aconitum napellus* Linné (Nat. Ord. *Ranunculaceæ*). (U. S. P.) *Racine d'aconit*, Fr.; *Eisenhutknollen*, Ger.

The Indian aconite-root, or *bish*, is supposed to be more powerful than the root of *Aconitum napellus*, and is preferred for the manufacture of aconitine (Flückiger and Hanbury).

**Abstractum Aconiti.**—Abstract of aconite. Dose, gr. ss—gr. j.

**Extractum Aconiti Fluidum.**—Fluid extract of aconite. Dose, ℥ j—℥ v.

**Extractum Aconiti.**—Extract of aconite. Prepared from the leaves. Dose, gr.  $\frac{1}{2}$  to gr. ss.

**Tinctura Aconiti Radicis.**—Tincture of aconite-root. Dose, ℥ j—℥ v.

**COMPOSITION.**—The principal alkaloid is *aconitia* or *aconitine*, which exists in two forms, crystalline and amorphous, and forms with acids crystallizable salts. The crystalline form of aconitine is soluble in chloroform, ether, and alcohol. Aconite contains also another alkaloid which has received various designations—*pseudo-aconitine*, *napelline*, *nepalline*, etc., which is closely allied to aconitine, and is found in commerce under this name. It is but slightly soluble in chloroform, ether, and alcohol, and it exists also in two forms, crystalline and amorphous. Besides the foregoing, another base has been discovered, to which the name *napelline* has also been given (Hübshmann). This is an amorphous alkaloid, having strong basic properties, soluble in water, chloroform, and alcohol, but not soluble in ether.

These basic substances are united with a peculiar acid—*aconitic acid*.

**ANTAGONISTS AND INCOMPATIBLES.**—Alcohol, ether, ammonia, turpentine, digitalis, heat, etc., antagonize the actions of aconite. In cases