but by their irritating influence upon the bronchial sensory end-organs of the vagus.* The afferent impulses from the bronchi thus generated and transmitted to the vagal center, would evoke, if the latter were normal, just sufficiently energetic recurrent, *i.e.*, efferent-motor, impulses to insure the elimination of the poisonous wastes (by causing periodical contractions of the bronchi, increasing the secretion of mucus, promoting the activity of the ciliated epithelium, etc.); but being hypersensitive, the center projects excessively violent stimuli to the bronchial muscles and mucosa, and the resulting bronchostenosis, produced in the manner described, gives rise to asthma.*

Reflex asthma differs from true bronchial asthma only in that the sensory impulses which excite the hypersensitive vagal center, and through it evoke the asthma, are derived from irritated surfaces other than those of the lungs, *i.e.*, the nose, the ear, etc.*

In this process the functions of the bronchial mucous membrane are assimilated to that of the stomach,* when, as shown by Pawlow, the presence of food provokes the secretion of gastric juice and the gastric muscular movements by exciting the sensory vagal terminals. We have seen that such a conclusion is warranted. The recurrent motor impulses originate, of course, from the vagal center. Since all impulses of common sensibility reach the posterior pituitary, while all cöordinated involuntary motor impulses arise from this organ,* it becomes the normal source of this class of stimuli to the lungs as well.

That it is a general center which is hypersensitive—one capable of responding to impulses received from many sources—is shown by the multiplicity of conditions by which asthma may be provoked. The asthma caused reflexly by nasal and aural polypi, excitation of sensitive spots in the nasal cavities, ethmoiditis (Emerson,[24] Coggeshall[25] and others), abscess of the antrum (Richardson[26]), uterine disorders (Katz,[27] Strübing,[28] von Leyden and others), etc., illustrates this fact. With the general vagal center as the source of the asthmogenic impulses, the manner in which such lesions can produce reflex asthma becomes plain. Though unable to describe the paths followed, Schadewaldt[29] and others consider nasal asthma a trigeminal neurosis. If the pituitary's vagal center is made the terminal of sensory impulses from the nose, and the vagal efferent nerves the transmitter of motor impulses to the lungs, the reflex arc is complete.* Moreover, the actual participation of the pituitary body in such phenomena is well shown by the experiments of Cyon, who found that destruction of this organ completely annulled the reflex sensibility of the nasal mucosa.

That asthmatics suffer from hypocatabolism is well known; this is emphasized by the prominence given uric acid and the gouty diathesis

* *Author's conclusion.*
[24] Emerson: Boston Med. and Surg. Jour., May 30, 1901.
[25] Coggeshall: Medical Record, June 3, 1905.
[26] Richardson: Laryngoscope, Aug., 1899.
[27] Katz: Deut. med. Woch., Bd. xxii, S. 804, 1896.
[28] Strübing: Zeit. f. klin. Med., Bd. xxx, S. 1, 1896.
[29] Schadewaldt: Verhandl. Berl. med. Gesellschaft, Bd. xvii, S. 225, 1887.

as a cause of the disease by many authors. We have seen the all-importance of toxic wastes in the causation of epileptic fits. Taylor[30] and others have reported cases in which it replaced the fits. Sciatica, migraine, angina pectoris and other conditions due to toxic wastes are frequently observed in asthmatics. Again, the so-called "renal" asthma is obviously due to retention of excrementitious products in the blood. Indeed, MacIlwaine[31] has laid stress on the importance of albuminuria as a precursory symptom of this condition. Moncorgé,[32] F. Ehrlich,[33] Lemonnyer[34] and others have illustrated the influence of a rheumatic diathesis by a number of cases. All these instances are necessarily results of a debilitated condition of the organism. Aside, however, from the cases in which such a debilitated condition occurs without apparent cause, are others in which it is directly traceable to disease or habits which undermined the patient's health. As to the former, in a study of 40 cases of hay-fever, several of which were complicated with asthma, I[35] found that almost all had suffered from several of the diseases of childhood. Kissel[36] has observed the same fact in 4 cases of bronchial asthma in children, though the disease is rare in childhood. Crookshank[37] has described, under the term "asthma sexualis," cases of asthma which followed sexual excesses in both sexes. It may also, as shown by Fiessinger,[38] occur as a complication of true neurasthenia.

Closely related to the products of hypocatabolism as primary causes of bronchial asthma is the so-called "dyspepsia asthma" which Albu and others have ascribed to auto-intoxication. Landi[39] found that emetics and purgatives caused prompt relief in such cases. In 5 cases reported by Murdoch[40] the asthma occurred after meals and yielded readily to treatment of the stomach. In 31 cases observed by Einhorn[41] the attacks of asthma occurred either immediately after meals or two or three hours later—a suggestive coincidence with the period of assimilation.

Aside from these endogenous excitants, however, are many others of exogenous origin which are capable, as is well known, of provoking typical attacks of bronchial asthma: dust, emanations, pollen, smoke, etc. This affords self-evident proof that, however produced, asthma is primarily due to an excitant—whether applied to the sensory terminals of the bronchial mucosa or any other mucosa. As everyone is exposed more or less to the morbid effects of such irritants, asthmatics must be particularly susceptible to these irritants: a fact readily explained by the hyperexcitability of their general vagal center.

Treatment.—Remedies Which Arrest the Paroxysm.—This is, of course, the first indication. The bronchostenosis being mainly caused by contraction of the bronchial muscles, and thus, in turn, being due to stricto-dilation of the arterioles through which the capillaries of these muscles receive their blood, our aim should be to provoke contraction of the arte-

[30] Taylor: N. Y. Med. Jour., Oct. 21, 1899.
[31] MacIlwaine: Med. Press and Circular, Sept. 19, 1900.
[32] Moncorgé: Lyon médical, vol. lxxix, p. 175, 1895.
[33] F. Ehrlich: Archiv f. Verdauungskrankheiten, Bd. v, S. 126, 1899.
[34] Lemonnyer: Thèse de Paris, 1902.
[35] Sajous: "Lectures on the Diseases of the Nose and Throat," Phila., 1885.
[36] Kissel: Wratch, No. 16, 1894.
[37] Crookshank: Edinburgh Med. Jour., June, 1899.
[38] Fiessinger: Jour. de practiciens, Nov. 1, 1902.
[39] Landi: Clinica moderna, Ann. v, No. 24, 1899.
[40] Murdoch: N. Y. Med. Jour., Jan. 12, 1901.
[41] Einhorn: Jour. Amer. Med. Assoc., Feb. 1, 1902.

rioles. As these vessels are constricted by sympathetic fibers, agents which stimulate the sympathetic center are indicated. Prominent among these is *belladonna,* especially when its alkaloid, *atropine,* is employed hypodermically. The best results are obtained when $^1/_{120}$ to $^1/_{60}$ grain (0.0005 to 0.001 gm.)—according to the strength of the patient—is thus given, with morphine ⅛ to ¼ grain (0.008 to 0.016 gm.), which also promotes contraction of the arterioles and relieves thereby the bronchial hyperæmia. Relief is also afforded by burning paper previously dipped in a strong solution of *potassium nitrate* and an infusion of *stramonium* and dried, and inhaling the smoke. Cigarettes composed of *stramonium, hyoscyamus* and *cannabis Indica,* and others, such as Espic's, available in all drug-stores, are composed of agents which act like belladonna and promptly relieve the attack when smoked. In Germany, Neumeier's cigarettes, containing *lobelia, stramonium, sodium nitrate, potassium nitrate* and *potassium iodide,* are extensively used.

The coal-tar derivatives, *antipyrin, acetanilid, phenacetin,* which likewise stimulate the sympathetic center, are sometimes useful. *Paraldehyde* has been recommended in doses ranging from 45 to 60 grains (3 to 4 gms.). *Adrenalin* 10 drops of the 1:1000 solution, in 1 dram (4 gms.) of saline solution, hypodermically, acts promptly. (See also p. 761, vol. i.)

The use of atropine, introduced by Trousseau, has recently been revived and highly recommended by Von Noorden[42] and Riegel.[43] The former begins with $^1/_{120}$ grain (0.0005 gm.) and gradually increases the dose to $^1/_{10}$ grain (0.0065 gm.). I have been using it over twenty-five years, and prefer $^1/_{120}$ grain (0.0005 gm.) combined with ¼ grain (0.016 gm.) of morphine to produce an immediate effect, repeating the dose in two hours if necessary. F. P. Hearder[44] obtained rapid and complete relief in the majority of 30 cases in which he used paraldehyde in the doses mentioned. Whitaker[45] reported a case in which 45 grains (3 gms.) caused collapse which lasted two days.

Measures Which Tend to Remove the Cause.—The irritability of the vagal center (which may be influenced by afferent impulses from any portion of the body) may be perpetuated by any condition which causes it to receive a continuous flow of afferent impulses, differing from those normally received only in that they are more energetic.* Nasal polypi

* *Author's conclusion.*
[42] Von Noorden: Therap. Monats., Bd. xii, S. 539, 1898.
[43] Riegel: Deut. med. Woch., Bd. xxv, S. 669, 1899.
[44] F. P. Hearder: Brit. Med. Jour., Mar. 21, 1896.
[45] Whitaker: N. Y. Med. Jour., May 2, 1896.

or exostoses, by pressing on the nasal terminals of the fifth nerve, may thus transmit a stream of stimuli to the pituitary body and keep its centers turgescent and hypersensitive.* Hence, all organs within reach, the nose, the ears, the uterus, etc., should be examined to ascertain whether the predisposing cause of the asthma be not located therein. The peripheral organs are merely hyperæsthetic in some cases, and the contact of irritating substance—dust, smoke, etc., in the case of the upper respiratory tract—suffices to provoke asthma. The source of the primary central irritability may also be a localized chronic congestion, *i.e.,* hypertrophic rhinitis, gastritis, bronchitis, cystitis, etc., and slight additional irritation of these structures by substances inhaled or ingested may bring on a paroxysm by further exciting the already hyperæsthetic center. The liability to attacks of asthma cannot be removed unless any such cause of central irritation be eradicated.

In some of these cases paroxysmal sneezing, to which the patient attaches but little importance, points to the source of the central irritation. By passing a probe over the Schneiderian membrane sensitive areas are frequently found which provoke sneezing, cough and even dyspnœa when touched. Chromic or glacial acetic acid applied to these areas suffices in some instances to prevent further accesses. In such cases the local application of a 10 per cent. solution of cocaine in the midst of an attack of asthma will arrest it. Pawinski[46] observed a case in which the retention of urine was the cause of the paroxysms, these passing off as soon as the patient was catheterized. Boas[47] has reported several cases in which mild dyspeptic symptoms were followed by severe asthma and diffuse perspiration which lasted until the gastric disorder had disappeared or had been relieved by emesis. In asthmatic children whose breath is foul, the tongue furred, Landi[48] obtained immediate relief from emetics or purgatives. These few examples illustrate the fact that asthma is a neurosis which may be caused by a multitude of conditions, and that it is only by a diligent search that the physician can discern the primary cause of the disease.

When the cause of the disease cannot be traced to any localized disorder, the central hyperexcitability is the result of repeated irritation by the toxins or endotoxins of several diseases acquired in rapid succession—the diseases of childhood, for instance—or it is due to the constant irritation to which toxic products of hypocatabolism submit the central neurons.* In either case the asthmogenic agents are the same: an excess of these toxic wastes in the blood.* As their presence therein is

* *Author's conclusion.*
[46] Pawinski: Revue de méd., vol. xix, p. 219, 1899.
[47] Boas: Berl. klin. Woch., Bd. xxxiii, S. 882, 1896.
[48] Landi: *Loc. cit.*

due to imperfect metabolism, the aim should be to enhance this process. *Potassium iodide* is recognized as the most beneficial agent we possess when given in doses of from 5 to 10 grains (0.3 to 0.6 gm.), three or more times a day, according to the severity of the case. This agent produces its effects by actively stimulating the adrenal center, thus causing a marked increase of auto-antitoxin in the blood.* The products of metabolism being adequately catabolized and converted into benign eliminable products, the vagus center and the bronchial mucosa are no longer irritated and the paroxysms of asthma finally cease. *Thyroid gland,* in ½ to 1 grain (0.03 to 0.06 gm.) doses, acts in the same way, and is especially useful in children (in correspondingly smaller doses) and as a substitute for potassium iodide when this agent is not well borne.* *Adrenal gland,* in 2-grain (0.13 gm.) doses may be combined with it advantageously.

The disease is readily controlled by giving potassium iodide, 5 grains (0.3 gm.), and the tincture of belladonna, 5 minims (0.3 gm.), together in a mixture every three hours at first, then the iodine alone in 10-grain (0.6 gm.) doses in a tumblerful of water during each meal. If there remains some tendency to dyspnœa, 1 grain (0.065 gm.) of thyroid gland after each meal will serve to dissipate it. In uncomplicated cases this plan is very effectual. The iodide may be increased to 20 grains (1.3 gms.) three times daily if needed. As stated by Hare,[49] asthmatics bear large doses of this agent without causing iodism.

An interesting feature in connection with effects I ascribe to the iodides and thyroid, *i.e.*, an increase of auto-antitoxin in the blood, is the observation of Revilliod[50] that diphtheria antitoxin—which is similar to the endogenous antitoxin as regards constituents—had proved very beneficial in severe cases. Suggestive also is the beneficial though ephemeral influence of adrenal extract and adrenalin, noted by S. Solis-Cohen,[51] Bullowa and Kaplan[52] and others. As emphasized by S. Solis-Cohen, however,[53] it is powerless to relieve an acute paroxysm, but tends, when given during the intervals, to diminish the tendency to recurrence. The iodides and thyroid produce the effects of diphtheria antitoxin and adrenalin, but far more efficaciously by stimulating persistently the adrenal center.

An important feature of the treatment of asthma is the *diet*. The attacks occur at night in the majority of cases, because during sleep all vital processes are somewhat depressed. Catabolism being correspondingly less active, toxic wastes accumulate in the blood and finally provoke the attack. A light evening meal, without meat, is, therefore, indicated. In severe

* *Author's conclusion.*
[49] Hare: College and Clinical Record, Dec., 1894.
[50] Revilliod: Rev. med. de la Suisse Romande, vol. xvii, p. 689, 1897.
[51] S. Solis-Cohen: Jour. Amer. Med. Assoc., May 12, 1900.
[52] Bullowa and Kaplan: Medical News, Oct. 24, 1903.
[53] S. Solis-Cohen: Phila. Med. Jour., Oct. 15, 1898.

cases, especially when the dyspnœa is continuous, a *milk diet* of three or four weeks' duration, followed by a frugal mixed diet of milk and vegetables, in which meat is partaken of but once daily, and at the midday meal, is almost curative, the milk diet being resumed when the asthma tends to recur.

Alcohol is contraindicated, since it deoxidizes the blood; pure water, on the other hand, when drunk freely, facilitates the work of the kidneys by lowering the specific gravity of the fluids passed through them. The bowels should move freely, mild saline laxatives being used when necessary.

The plain dietetic measures embodied in the first paragraph, recommended by Huchard,[54] will be found very effective. Thorowgood[55] refers to cases in which reduction of the diet alone gave rise to remarkable relief. Many instances of this kind have been recorded.

HYPERÆSTHETIC RHINITIS (HAY-FEVER, ROSE COLD, ETC.).

SYNONYMS.—*Hay Asthma; June Cold; Catarrhus Æstivus; Idiosyncratic Coryza; Peach Cold; Pollen Catarrh; Ragweed Fever; Summer Catarrh; etc.*

To eliminate the array of absurd names which have been given this disease, some of which appear in the above list, I suggested in 1885 the term "Hyperæsthetic Rhinitis" as best typifying its salient phenomenon: extreme sensitiveness of the upper respiratory tract. As I will show in the following pages, this term, which has been adopted by several authorities, is fully justified. Hence its appearance at the head of this article.

Definition.—Hyperæsthetic rhinitis, a periodical acute coryza often accompanied by asthma, is due to excessive irritability of the trigeminal center, a condition sustained by toxic wastes which are present at all times in the blood of these cases, owing to functional torpor of the adrenal system. The periodicity of the disease is due to the presence in the air, at fixed seasons, of certain pollens, which, coming into contact with the hyperæsthetic terminals of the trigeminus in the nasal mucosa, provoke the attack.*

Symptoms.—The affection presents itself at periodic yearly intervals, either in August and early September, or else in the months of May or June. In some individuals two attacks occur in the year. The subject is often able to state the day and even

* *Author's definition.*
[54] Huchard: Jour des praticiens, Feb. 22, 1896.
[55] Thorowgood: Med. Press and Circular, Dec. 16, 1896.

the hour at which the onset is to occur. The summer variety of the affection is in general less severe and of shorter duration than the autumnal variety.

In some cases, mainly those of long standing, premonitory symptoms appear several days or even two weeks before the true onset. They may include general malaise, frontal headache, itching at the roof of the mouth and eyes, sensations of chilliness, and slight fits of sneezing. The symptoms of the actual attack may last only a few days, and resemble those of an ordinary cold in the head, or may be of more violent form, and are sometimes accompanied by asthma.

A sensation of violent itching in the nose generally marks the onset of the affection, and causes prolonged sneezing. With this may be associated pricking and stinging at and near the inner canthi, followed by profuse lachrymation. An abundant, watery, and alkaline discharge from the nose soon appears, which causes more or less irritation of the nostrils and upper lip. Respiration through the nose becomes much impeded through swelling of the nasal mucous membrane. Pain is present over the bridge of the nose; there is often also frontal headache, and pains in the eyeball or back of the head. Itching at the roof of the mouth and on the face is often complained of. Other possible manifestations comprise chilly sensations, loss of smell and taste, tinnitus aurium, partial deafness, involvement of the air-sinuses, pharyngitis, hyperæsthesia of the scalp; as well as general symptoms, such as moderate pyrexia, disordered stomach and flatulence, urticaria, with inability to perform mental work.

As the affection progresses, the nasal discharge becomes thicker in character, and may be muco-purulent. Photophobia and chemosis are prone to develop, and, occasionally, pseudo-membrane is formed in the nasal cavities. The attack may last from several days to as long as a few weeks, and when left untreated does not tend to disappear until the constituent of the atmosphere that causes the irritation is removed. Usually both onset and decline of the symptoms are sudden, but in some cases they may be more gradual.

Asthma not infrequently occurs as a complication of hay-fever. In most cases it begins a few days after the primary

nasal symptoms have appeared and as soon as these become marked. There comes a feeling of soreness in the pharynx, which is soon followed by hoarseness, slight cough, and a sense of tightness about the chest. These symptoms gradually increase in intensity and are generally worse at night. Sometimes they cease with the nasal symptoms, but in many other cases last for weeks or even months after the catarrhal attack.

Etiology and Pathogenesis.—The predisposing cause of hay-fever is an excessive irritability of the trigeminal center in the pituitary body, due to the presence in the blood of toxic waste-products.* The presence of these toxic wastes is in turn the result of hypoactivity of the adrenal system, a condition which may be either inherited or brought on by diseases of an adynamic type, especially those of childhood.* The proportion of adrenoxidase formed being inadequate, catabolism is carried on imperfectly and the intermediate wastes that are constantly present in the blood sustain the hypersensitiveness of the trigeminal center.*

As a result of this trigeminal oversensitiveness,* the mucous membranes, particularly those nearest the pituitary body,* *i.e.*, the nose (when the seat of local lesions, hypertrophies, polypi, exostoses, etc., especially), the eyes, pharynx, ear, and in some cases the entire respiratory tract, are hyperæsthetic. Some patients show evidence of this condition by fits of paroxysmal sneezing throughout the year, under the influence of certain irritants, emanations, etc., others only at fixed periods, when certain pollens are present in the air breathed. The patients of the latter category constitute the cases of "rose-cold" that occur in May or June, and those of "hay-fever" that occur, as a rule, in August.

That hay-fever is a neurosis was first shown by George W. Beard, of New York, in 1876, while the rôle of pollen as the most frequent exciting factor was demonstrated the following year by Elias Marsh, of New Jersey. That lesions, growths, polypi, etc., play an important part in the pathogenesis of some cases, was demonstrated by W. H. Daly, of Pittsburg, in 1882, and in 1884 by Harrison Allen. All these features of the problem have been sustained by a large number of investigators.

The identity of the underlying cause of the disease, a general adynamia, was demonstrated by myself in 1885[56] after a study of 40 cases. Of these, nineteen showed a clear history of inherited predisposition to hay-fever, asthma, etc., while the rest had been rendered

* *Author's conclusion.*

[56] Sajous: "Lectures on the Diseases of the Nose and Throat," p. 170, 1885.

vulnerable by a large number of diseases of childhood: 55 per cent. having had six of these diseases, and 85 per cent. four of them. This view was independently sustained by Joal,[57] Cartaz[58] and others. Fink[59] holds that "the patient is always neurasthenic."

The ubiquitous result of such adynamia, *i.e.*, defective metabolism, as manifested by the "arthritisme" of French authors or our "gouty diathesis," has been noted by many observers since Guéneau and Mussy (1868) suggested it. Leflaive[60] having found that the uric acid ratio of the urine before and after attacks corresponded with that of gout, also ascribed the disease to the "gouty diathesis." Bishop, of Chicago, also urged this view in 1893. Grube[61] emphasized the fact that "most cases are among patients having gout or of gouty tendency, or with a history of gout in the family."

The next factor, the hyperæsthesia of the nasal and other mucous membranes, was first urged by John O. Roe, of Rochester, in 1883, and in 1884 by J. N. Mackenzie, of Baltimore, and others, the last-named observer concluding that there was also "a hyperæsthetic state of (probably) the vasomotor centers." The presence of "sensitive areas" in the nose may in fact be readily discerned with the aid of a probe, and has formed the basis of remedial measures.

The pathogenesis I submit in the general text coincides, therefore, with all the strongest doctrines that have been advanced, and—a suggestive fact—harmonizes them all. As to the rôle of the pituitary body—which contains, according to my views, the chief trigeminal center in the process—Cyon, we have seen, found that the nasal mucous membrane at once lost its usual sensitiveness (which, on irritation, provokes sneezing, lachrymation, etc.) after the pituitary was removed, and that even the most active stimulants, ammonia, for example, failed to elicit the least response."

Treatment.—Prophylactic Measures.—The constitutional factor of the disease is obviously of major importance in this connection, the object being to diminish, by a judicious diet, the toxic wastes which sustain the hypersensitiveness of the trigeminal center.* The nearer the indications for gouty subjects are followed, the better the patient fares. The reader is referred to the treatment of gout[62] for the prophylactic measures indicated.

Of equal importance is a thorough examination of the nasal cavities and the correction of any deformity which, when the mucous membrane is slightly engorged and swollen, causes opposite surfaces to meet. Polypi are not infrequently found in hay-fever cases; their removal alone affords marked relief; this applies likewise to sharp exostoses. On the whole, any disorder of the nasal cavities tends to aggravate the hyperæsthesia,

* *Author's conclusion.*

[57] Joal: Revue de laryn., otol., et rhin., vol. xv, pp. 273, 325, 1895.
[58] Cartaz: Thèse de Paris, 1895.
[59] Fink: Therap. Monats., Bd. xviii, S. 175, 1904.
[60] Leflaive: Gaz. des hôpitaux, vol. lxi, p. 329, 1888.
[61] Grube: Lancet, July 7, 1900.
[62] *Cf.* this volume, p. 1514.

and should be removed. If the probe passed gently over the nasal mucous membrane indicates the presence of areas that are exquisitely sensitive, their cauterization by the electric cautery or acids tends greatly to prevent the attack, especially if done within two or three weeks before the periodical onset.

As to preventive remedies, those which provoke destruction of all toxic wastes are the most beneficial, since they rid the blood of the cause of the trigeminal irritant.* The best of these is *thyroid gland,* 2 grains (0.13 gm.), three times a day (during meals) in adults, reduced after the fourth day to 1 grain (0.06 gm.), thrice daily.* This should be begun about four weeks before the onset of the periodical paroxysm.* *Strychnine,* in doses of $^1/_{40}$ to $^1/_{20}$ grain (0.0016 to 0.003 gm.), is also beneficial in some cases when the arterial pressure is low. *Digitaline,* in doses of from $^1/_{20}$ to $^1/_{10}$ grain (0.003 to 0.0065 gm.), during breakfast and supper, is indicated when there is simple cardiac dilation owing to general adynamia.* *Atropine,* in $^1/_{100}$ grain (0.00065 gm.) granules, night and morning, by enhancing the propulsive activity of the arterioles, increases the nutrition of the nerve-centers, including those of the pituitary body,* but its action on the pupil renders it an objectionable remedy. *Quinine hydrochlorate,* 3 grains (0.2 gm.), after meals, fulfills the same object by causing a rise of the blood-pressure.* The effects of these two remedies are ephemeral, however, and the first three are much to be preferred.

An important feature of the paroxysmal period as well as of the paroxysm itself, is to counteract acidosis, or what might be termed "ammoniosis," an excess of ammonia—an intermediate waste in this connection. This is readily accomplished by the use of *Vichy water* as a beverage, a quart being taken during the twenty-four hours.* The osmotic properties of the body fluids are thus preserved, and the elimination of wastes by the urine, intestine and sweat is facilitated. The same end is attained by drinking daily a quart of spring water containing one teaspoonful of *sodium chloride* and a similar quantity of *sodium bicarbonate.**

Strychnine, atropine and quinine have been used and recommended by others; I do not find evidence to the effect that thyroid extract or

* *Author's conclusion.*

digitalin have been used so far, except by myself. In suitable cases and when the dietetic measures recommended were carried out faithfully by the patient, they gave the best results.

The importance of acidity or excessive alkalinity of the nasal secretions in the pathogenesis of the disease, was first shown by D. Braden Kyle, of Philadelphia,[63] who writes in this connection: "That the chemistry of the secretions has to do with the causal factor, I have illustrated in a number of cases by rapidly changing the reaction of the secretion either from acid to alkaline or alkaline to acid, or rendering it neutral, and in many instances I have been able either partially or wholly to cure the attack." The author holds, moreover, that in a certain proportion of cases, the ammoniacal salts eliminated by the nasal mucous membrane act as irritants—sufficiently so in fact to bring on an attack. There is doubtless considerable truth in this view, since, as I have shown in the preceding articles, bronchitis and bronchial asthma are caused by a vicarious elimination of toxic wastes through the bronchial mucosa. That these ammoniacal salts are wastes is evident. Allantoin, which results from the oxidation of uric acid by potassium permanganate, for example, is an ammonia derivative; we not only have the uric acid in the blood-plasma of these cases, but also the counterpart of potassium permanganate as a powerful oxidizing agent, viz.: adrenoxidase.

Agents Indicated During the Attack.—The paroxysm being brought on reflexly by irritants in contact with the mucosa of the upper respiratory tract, the morbid process is as follows: Sensory impulses are transmitted to the trigeminal center of the posterior pituitary; this center being hypersensitive, the stricto-dilator impulses it transmits to the vasa vasorum of the arterioles of the mucous membranes are so energetic that these vessels are held widely dilated, thus causing intense congestion of the sinuses of the nasal mucosa and of the capillaries of the neighboring organs—the exciting cause of the distressing symptoms.*

The physiological indication, therefore, is to provoke constriction of the arterioles by means of agents which excite the sympathetic center sufficiently to enforce it.* This may be done by means of *opium, acetanilid, antipyrin* or any of the analgesics, in fact, since it is by causing constriction of the arterioles that they relieve pain.* *Codeine* is the safest of the opiates, and may be given in doses of $^1/_4$ grain (0.016 gm.), four times in the twenty-four hours. Acetanilid, in 5-grain (0.3 gm.) doses, may be given three times daily, ceasing if there is any tendency to cyanosis.

The best effects are obtained by using simultaneously vaso-

* *Author's conclusion.*
[63] D. Braden Kyle: Laryngoscope, Sept., 1903.

motor depressants and sympathetic stimulants.* The first of these, by relaxing all arteries, deplete the peripheral capillaries —including the sinuses of the nasal mucosa—and thus facilitate constriction of the arterioles by the second class of agents.* The coal-tar products become dangerous under these conditions; but *codeine* and *atropine,* which constrict the arterioles when they are dilated, are not, given as stated above; to depress the vasomotor, *sodium bromide* and *chloral hydrate,* 10 grains (0.6 gm.) each on retiring, or, if the patient is rendered sleepy in the day time, *veratrum viride,* 10 drops (1905 U. S. P.) of Norwood's tincture, may be used instead.

Whatever remedy is used during the paroxysm, general metabolism should be sustained, avoiding drugs such as strychnine and digitalis, which increase the vascular tension. *Thyroid extract,* 2 grains (0.13 gm.) twice daily, is the best agent at our disposal.* *Adrenal substance,* 5 grains (0.3 gm.) every three hours, has been recommended by several observers.

The adrenal substance was found useful by S. Solis-Cohen,[64] Beaman Douglass[65] and others. Interpreted from my standpoint, however, the action of this agent can only be ephemeral, and it is better to sustain the production of the adrenal secretion itself by means of thyroid.

Local Treatment.—The main feature is to promote contraction of the nasal sinuses and capillaries. *Cocaine,* if used at all, should be applied by the physician only, a spray of a 10-per-cent. solution being very efficacious. A better and safer agent is *adrenalin chloride,* but only when a weak solution, 1 in 10,000, is used, stronger solutions causing such violent constriction of the arterioles that they become exhausted and markedly relaxed* when the reaction occurs, aggravating the trouble. The *adrenalin ointment* 1:1000 does not present this drawback, and promptly reduces the swelling of the mucosa.

To protect the nasal surface against the irritation of pollens, dust, smoke, etc., a solution of *menthol* in fluid albolene, 10 grains (0.6 gm.) to the ounce, may be sprayed over the mucosa after using the adrenalin solution. It tends also to perpetuate the effect of the latter.

Dunbar's "pollantin" cannot be taken up in this connection, since I have no data upon which its physiological action can be based. The

* *Author's conclusion.*
[64] S. Solis-Cohen: Phila. Med. Jour., Aug. 13, 1898.
[65] Beaman Douglass: N. Y. Med. Jour., May 12, 1900.

results have been excellent according to some, and practically *nil* in the hands of others. Prausnitz[66] states that Dunbar's work has proven beyond doubt that hay-fever is due to the pollen of graminaceæ, which float in the air in enormous quantities during the hay-fever season. The toxin is probably of proteid character. It is likely, according to Prausnitz, that the antitoxin of Dunbar acts by causing an actual diminution of the toxins.

Hurry and excitement tend to enhance the trouble by causing an accumulation of toxic wastes in the blood. Another factor which tends to aggravate the central hypersensitiveness is bright light; hence the comfort afforded by dark glasses.

PERTUSSIS.

SYNONYM.—*Whooping-cough.*

Definition.—Pertussis is an infectious disease characterized by a violent reflex cough, due to irritation of the vagal sensory terminals in the mucous membrane of the respiratory tract by a specific germ of unknown identity.*

Symptoms.—After a period of incubation of from four days to two weeks, a coryza and cough appears which soon assumes a paroxysmal character. The cough is dry, short and forcible—the face becoming highly congested and cyanotic, the eyes suffused, the eyelids puffed up, etc.—and lasts until the chest is practically depleted of air. This is followed by the characteristic symptom of the disease, the "whoop," due to unusually vigorous inspiration. A clear, viscid mucus is then brought up, often accompanied by emesis of the contents of the stomach, and by involuntary micturition and defecation. Several of such attacks may follow in rapid succession, the child becoming livid and falling exhausted, and the pulse being extremely feeble and rapid. Such attacks occur from six to fifty times a day and most frequently at night. After a couple of weeks, the severity of the attacks lessens and they occur less frequently.

In most cases the general condition of the child remains relatively good; in others, the attacks are so severe that hæmorrhages occur in the conjunctiva, eyelids, brain, etc. Among other complications witnessed are broncho-pneumonia, emphysema and nephritis, various forms of paralysis, and convulsions.

* *Author's definition.*

[66] Prausnitz: Berl. klin. Woch., Bd. xlii, S. 227, 1905.

Etiology and Pathogenesis.—Pertussis is due to the presence upon the mucous membrane of the respiratory tract of an organism of unidentified nature (though probably Bordet and Gengou's recently discovered organism) which, owing to the irritating character of its toxin or endotoxin, causes violent local irritation and reflex cough.* As all coughs are due to impulses transmitted by the vagal center in the posterior pituitary,* it is this center upon which the brunt of the disease falls.*

The complications are not due to the pathogenic element itself, but to the violence of the muscular phenomena, skeletal and vascular: the emphysema is due to the centripetal pressure of the air, the paralysis to cerebral thrombi, the cardiac dilation to the intense blood-pressure,* etc.

There is a certain amount of absorption of the toxin since there occurs a protective reaction, as shown by the rise of temperature (100° to 101° F.—37.7° to 38.3° C.) and the marked leucocytosis—both of which indicate that the adrenal system is hyperactive.*

The association of pertussis with irritation of various parts of the respiratory tract has been suggested by a number of observers. Ritter,[67] for instance, ascribed it to what he termed the "diplococcus tussis convulsivæ;" Arnheim[68] to a bacillus resembling that of influenza, first described by Czaplewski, found in patches throughout the respiratory tract—the identical areas which Nothnagel and Kohts had described as "cough areas." In common with all other investigators, Burman considers these hyperæsthetic areas as the sensory terminals of the vagi. The minute bacterium recently discovered by Bordet and Gengou,[69] which differs from those of Afanassieff, Czaplewski, Manicatide, Vincenzi and others, proved extremely irritating when applied locally. Injected into the eye of a dog, it caused the cornea to become white and opaque, showing, according to Bordet and Gengou, that the organism probably excreted necrotizing toxins.

That the adrenal system is overactive during the disease is not only shown, as stated, by the febrile reaction, but also by the leucocytosis which, as stated by Churchill,[70] is present in almost all cases. Grulee and Phemister[71] found that it ranged from 12,500 to 48,500 in a series of fifteen cases studied by them.

Treatment.—TO INCREASE THE BACTERICIDAL ACTIVITY OF THE SECRETIONS of the respiratory tract is of first indication. *Quinine*, in large doses, 15 to 20 grains (1 to 1.3 gm.) daily, doubtless owes its value to the fact that by stimulating the

* *Author's conclusion.*

[67] Ritter: *Ibid.*, Bd. xxxiii, S. 1040, 1069, 1896.

[68] Arnheim: Virchow's Archiv, Bd. clxxiv, S. 530, 1903.

[69] Bordet and Gengou: Le scalpel, Sept. 2, 1906.

[70] Churchill: Jour. Amer. Med. Assoc., May 19, 1906.

[71] Grulee and Phemister: Archives of Pediatrics, Aug., 1905.

adrenal system and the sympathetic center, it increases the propulsive activity of the arterioles and thus augments the proportion of blood rich in auto-antitoxin into all capillaries, including those of the mucosa of the respiratory tract and its secretions.* *Belladonna* is likewise a favorite remedy, $^1/_6$ to $^1/_2$ grain (0.01 to 0.03 gm.), according to the age of the child, being given three times daily. Its action is similar to that of quinine, as to the arterioles.* *Creosote carbonate* in 3- to 10-grain (0.2 to 0.6 gm.) doses thrice daily, is an efficient remedy which also augments the auto-antitoxin in the blood, and dilates the arterioles, thus admitting also a larger proportion of blood into the mucosa and its secreting elements.* Creosote has been found useful when inhaled, and may be advantageously employed in this manner while the carbonate is given internally.

All these remedies, excepting the creosote carbonate, are familiar to all clinicians in this connection, and are only mentioned to indicate their physiological action according to my views. Kerley,[72] in a comparative study of 752 cases, found quinine in large doses the most effective agent among those mentioned above. Tyrrell[73] also regards it as our best remedy; he uses the hydrochlorate.

DRUGS WHICH REDUCE THE SENSITIVENESS OF THE MUCOUS MEMBRANES are useful to reduce the number of paroxysms. *Antipyrin,* which has been found useful, insures this effect by causing constriction of the arterioles;* it is given in 1-grain (0.065 gm.) doses for each year of the child's age (the maximum being 4 grains [0.25 gm.]), three times daily. *Acetanilid* is preferable in that it does not tend to cause cyanosis as readily. The *sodium* or *potassium bromide* accomplishes the same object in a different way, viz., by depressing the vasomotor center and causing the blood to recede from the peripheral capillaries.* *Chloral hydrate* produces a similar effect* and is useful at night to prevent the nocturnal paroxysms.

These remedies give the pathogenic germ free sway, however.* Their pullulation should be antagonized, therefore, by antiseptic sprays or steam, using a 5 to 1000 solution of carbolic acid, 10 to 1000 solution of resorcin, a 1 to 5000 of corrosive sublimate, or better, the creosote inhalations previously referred to.

* *Author's conclusion.*
[72] Kerley: Pediatrics, May 1, 1900.
[73] Tyrrell: Medical Record, July 22, 1905.

A very efficient measure as a derivative is the application of hot poultices to the back of the lungs, and the use of a wide belt to constrict the abdomen and sustain it during the paroxysms.

The hot poultices recommended by J. Madison Taylor have been found of considerable value by McKee[74] and others. The poultice is made large enough to cover the posterior surface of the lungs, and on this the child is permitted to lie for one hour without change. Relief is almost immediate. An excellent belt is that devised by Kilmer[75] and sold by Jungmann of New York.

Fresh air and out-of-door life are as beneficial in cases of pertussis as they are in tuberculosis. Dust, smoke, tobacco smoke, etc., greatly aggravate the irritation of the respiratory surfaces and increase the paroxysms. The child should be dressed warmly, and should, as much as possible, not be allowed to become excited.

To shorten the accesses, Taylor's combination of three parts of *chloroform,* five parts of *ether,* and one-half to one part of *amyl nitrite,* is very effective. A few drops of the mixture are applied on a handkerchief and held under the nose. The last-named remedy is the main factor in the effect produced, acting as it does by relaxing the excessive vascular tension.

[74] McKee: Phila. Polyclinic, Sept. 14, 1895.
[75] Kilmer: Archives of Pediatrics, Feb., 1907.