The plantar reflex has lately been invested with considerable clinical importance through the investigations of Babinski. Under the name of Babinski phenomenon, or big toe phenomenon, the following variations of the plantar reflex have been described:

Upon stimulation of the sole of the foot, the big toe is dorsiflexed, and the other four toes are plantar-flexed. When this occurs slowly this is the typical Babinski phenomenon. It is believed to denote disease of the pyramidal tracts.

In children below two years of age, in whom the pyramidal tracts are not fully medullated, this variety of plantar reflex is normal.

While the typical *Babinski phenomenon*, as just described, is believed to be undisputed evidence of disease of the pyramidal tracts, with the mentioned exception in children, its absence does not prove that the pyramidal tracts are not diseased.

There are many combinations and changes of the Babinski phenomenon, and the significance of all of them is still under dispute.

At present it is best for clinical purposes to accept the following guide:

The Babinski phenomenon is positive, and the inference therefrom justified:

1. When upon stimulation of the sole of the foot there is dorsiflexion of the big toe and plantar flexion of the other toes.
2. When upon stimulation of the sole of the foot there is dorsiflexion of the big toe only.
3. When upon stimulation of the sole of the foot, there is dorsiflexion of all the toes.

The significance of the third variety is doubtful. All authorities do not agree that the Babinski phenomenon is always an indication of organic disease of the pyramidal tracts.

In examining for the plantar reflex, it is well to observe carefully the result of the first stimulation. After repeated stimulations, the patient's attention and conscious interference can never be fully excluded and a variety of cerebral reflexes occur which obscure considerably the interpretation of the result.

As a result and consequence of disturbed and changed reflex activity, a set of phenomena have received clinical study and attention. These phenomena are comprised under the name of associated movements and contractures. From among them the so-called Strümpell phenomenon is of clinical value, although limited.

The *Strümpell phenomenon* consists of the following:

When the patient is asked to flex the thigh upon the hip, and the leg upon the knee, there is an associated plantar flexion of the foot observed in cases of disease of the pyramidal tracts.

Under physiological conditions, or when there is no disease of the pyramidal tracts, the foot is dorsiflexed under the above-mentioned conditions. The so-called Kernig sign, which is believed to be pathognomonic of cerebro-spinal meningitis, also belongs to this group. The Kernig sign is an inability on the part of the patient to extend the leg when the thigh is flexed.

Contractures and muscular rigidity are frequent accompaniments of exaggeration of tendon reflexes; the exceptions to this rule are few.

The state of the reflexes has been of considerable value for diagnosis and correct anatomical interpretation of pathological motor phenomena.

The terms flaccid and spastic paralysis refer particularly to the state of the reflexes of the paralyzed muscles.

A flaccid paralysis is a more or less marked motor paralysis, with loss of reflex activity and diminution of the reflex tone.

A spastic paralysis is a more or less marked motor paralysis with increase of reflex activity, and increase of tonus.

Joseph Fraenkel.

LITERATURE.

Ch. Bouchard: Traité de pathologie générale, tome v., 1901.
Jendrassik, Sherrington, van Gehuchten: XIII. Congrès Internat. de Médecine, Paris, 1900, Section de Neurologie.
Munch-Peterson, H.: Die Hautreflexe und ihre Nervenbahnen. Deutsche Zeitschr. der Nervenheilkunde, Band 22, 3 u. 4 Heft.
Sternberg, Maximilian: Die Sehnenreflexe, 1893.
Jendrassik: Deutsches Archiv f. klin. Med., 1883, xxxiii., 177, 1894, liii., 569.
Fraenkel and Collins: Journ. Ment. and Nerv. Dis., 1900, xxvii., 375.
Luethye, Hugo: Münch. med. Wochenschr., August 12th, 1902.
Pfaundler, Meinhard: Münch. med. Wochenschr., July 22d, 1902.
von Bechterew, W.: Ueber den Lumbo-femoral Reflex. Neurol. Centralbl., 1902, No. 18.
Saenger, Alfred: Ueber myotonische Pupillaer-Bewegungen. Neurol. Centralbl., 1902, No. 18.
Fraenkel, Joseph: The State of the Reflexes in Supralumbar Lesion of the Cord. Medical Record, May 15th, 1897.
Erb: Archiv f. Psychiatrie, 1875, vol. 792.
Muskens, J.: Neurol. Centralbl., 1899, xviii., 1074. Brit. Med. Journ., 1900, ii., 829.
Fraenkel, Joseph: Weiterer Beitrag zum Verhalten der Reflexe bei hohen Querschnittsmyelitiden. Deutsche Zeitschr. f. Nervenheilk, Bd. xiii., 1898.

REFUSE DISPOSAL.—By this term is here meant the disposal of the waste matters of a city, town, village, or family, not including the sewage which is deposited in and escapes through the underground system of sewers. The items usually embraced in the term "refuse," as distinguished from "sewage," are the following:

Garbage or offal, consisting of the organic waste matter from kitchens; ashes; house dust; waste paper and rags; tin cans, crockery, bottles, and broken glass; street sweepings; night soil, or contents of vaults, cesspools, and pail systems.

Broadly speaking, the term refuse includes sewage, but since this form of waste product is usually disposed of by a distinct system of underground pipes managed by a board of sewer commissioners, the term refuse will here be limited to its usual significance, that of the material gathered periodically from houses, hotels, and streets, by a system of collection intended for this purpose. The municipal management necessary for conducting this class of work often constitutes a serious problem, in consequence of the liability of causing nuisance, either in

FIG. 3942.—Push-Cart Used for Collection of Street Sweepings. (From report of Street Department, Boston, 1900.)

the methods of storage, collection, and transportation, or in the final disposal of the material.

GARBAGE.—Garbage is usually defined as the waste products of food material. In addition to this, Chapin[1] enumerates, under the head of "refuse," such waste materials as glass, crockery, street sweepings, oyster and clam shells, sawdust, corkdust, old boots and shoes, dead

animals, lawn clippings, bottles, earthen, tin or iron ware, rubbish, tin cans, poisonous matter, excrement, urine, coal, and dirt. Dead animals and slaughterhouse refuse add value to garbage if it is to be made into fertilizers.

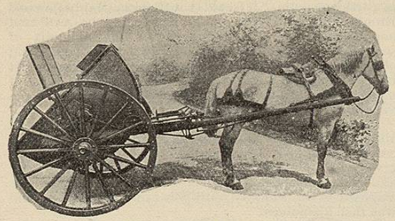

FIG. 3943.—Garbage Cart at an Angle for Washing or Easy Loading.

If the materials are sorted and such articles as tin cans, bones, and paper are selected out for utilization, then there is no objection to the deposit of such articles with garbage. But if the garbage is to be fed to hogs, or ploughed into the ground, tin cans are usually excluded. The rules and regulations in force at Lowell provide that "kitchen refuse, apple and potato parings, corn husks, cabbage leaves, shoes, rubbers, old bedding, soiled linen or cotton, and all refuse that can be burned shall be placed in the garbage vessels."

Household Storage.—In order that nuisance may be prevented, it is desirable that proper receptacles shall be provided by householders, hotel and restaurant keepers, and others for the storage of ashes, garbage, waste paper, etc., and that these be placed in convenient and accessible places for collection. Receptacles for ashes are best

FIG. 3944.—"Columbian" Dumping Cart showing Use of Dumping Lever.

made of metal. Those intended for garbage should be water-tight and provided with a well-fitting cover to exclude rain, prevent leakage, escape of odors, and access of dogs and other animals. In some cities separation of ashes, garbage, and paper is required by regulation; in others such separation is not so required.

Frequency of Removal.—Garbage is usually collected three times a week, but in some cities collection is made oftener, and in others not so often. In some cities definite hours are specified for such removal.

Vehicles of Removal.—The best form of vehicle for removal of garbage is made of metal, and so constructed as to admit of dumping instead of shovelling the contents. In some cities stout wooden barrels or iron casks are used, ten or more making a load.

In some large English cities where the pail system of collection for the removal of excremental waste is employed, the receptacle is removed from each house with the contents, and replaced with an empty or clean pail or tub. These receptacles are usually of metal painted and have a capacity of about a half-bushel. (Fig. 3943.)

The vehicles used for this purpose should always be provided with covers, either fixed or movable, for use when driving through the public streets.

Collection of Garbage.—In some cities garbage is collected by contract, and in others by some city authority. Municipal removal, however, as a general rule secures the most satisfactory service.

The following data present the cost and amount of collection of garbage in some of the largest American cities, the data referring either to 1898, 1899, or 1900. The following table relates to garbage only:

City.	Amount collected—tons.	Cost of collection.
Brooklyn	102,000	$120,000*
Baltimore	49,000	65,404
Boston	60,000	112,641
Buffalo	22,881	33,000*
Cleveland	22,375	69,400*
Milwaukee	28,716	61,883
New York (Borough of Manhattan)	152,000	101,840
Philadelphia	120,357	308,000*
Pittsburg	25,000	92,000*
St. Louis	69,634	99,673
New Orleans	67,500	97,200*

*Cost of collection and disposal.

The Separation of Refuse.—In very many cities it is the custom to separate the refuse into two or three or even more sorts; a very common method requiring the separation of the ashes, garbage, and paper or light combustible rubbish into three classes, the ashes being usually disposed of as a filling for waste lands, the garbage being fed to hogs, and the paper or light rubbish sold or burned. In addition to other classes, it is quite a common practice to separate the tin cans, bones, old iron and glassware, each of which has a certain market value. Such separation is often made a requirement by city regulations, and may be enforced by a penalty.

The English law relating to refuse is as follows (Section 42 of the Public Health Act, 1875): "Every local authority may, and when required by order of the Local Government Board, *shall* themselves undertake or contract for the removal of house refuse from premises; the cleansing of earth closets, privies, ashpits, and cesspools, either for the whole or for any part of their district."

By Section 43 of the same act, the local authority is made liable to a penalty of five shillings per day, payable to the occupant of a house, for failure to remove refuse after notice in writing from such occupant.

The street refuse of London is removed daily by boys with shovels and brush, and placed in iron dust bins, which are stationed at intervals along the edge of the pavement. In dry weather the streets are watered before being swept. The manure and dirt are removed by carts and taken to depots generally close to the river or to a railway station.

Each house has its dust bin or ashpit for the house refuse, from which the contents are collected periodically. The necessary depots for refuse are subject to the following general regulations:

1. The depots must be as distant as possible from inhabited places.
2. The refuse must not be put into pits, but above the ground level. If necessary, a special floor, three inches above the ground, must be made.
3. The ground should be drained and paved with impermeable material.
4. The depots should be sheltered from sun and rain, but the air should enter freely.
5. The ground leading to the depot should be well paved, so as to prevent pollution of the soil.

The custom of sorting refuse is vigorously opposed by some authorities. Mr. Goodrich[2] quotes Dr. Sedgwick Saunders as follows: "When the dust carts arrive at the wharf their contents are tipped into heaps at a place most

convenient to the people who are engaged as sorters. About seventy persons, chiefly women, were engaged in this degrading and loathsome work, most of whom are paid by piece work, but female sifters received seven shillings and a little coal and wood weekly. The appearance of the women is most deplorable, standing in the midst of fine dust piled up to their waists, with faces and upper extremities begrimed with black filth, and surrounded by, and breathing, a foul, moist, hot air, surcharged with the gaseous emanations of disintegrating organic compounds. I shall not forget visiting some of these poor creatures in a hospital, and witnessing the condition of their skins."

In Paris, previous to 1887, the refuse was put into the street in the evening. The ragpickers came and collected the rags, paper, bones, and glass. The refuse thus became scattered about the streets, rendering the collection difficult. The custom was forbidden by a decree of March 7th, 1887. The greater part of the refuse is taken to depots outside the city, where it is allowed to decay for five or six months, at the end of which time it becomes valuable as manure. Part is taken in boats to Corbeil, up the river, and to Pontoise, below the city. The removal of these heaps is done at much expense, the loss to the city averaging 2,000,000 francs ($400,000.)

In Brussels the refuse is collected at 7 A.M. from October 1st to March 1st, at 6:30 A.M. from March to September, and again at 6 P.M. from April 1st to September 1st. All refuse is conveyed in carts daily to the ash yard on the landing step of one of the canals, whence it is conveyed in boats directly to farmers, or to a depot at Evère outside the city.[3]

The Disposal of Garbage.—Briefly enumerated, the methods of final disposal of the garbage of cities are the following: Private or individual disposal, dumping at places designated for the purpose, ploughing into land, depositing in water, feeding to animals, economic reduction, and cremation or burning.

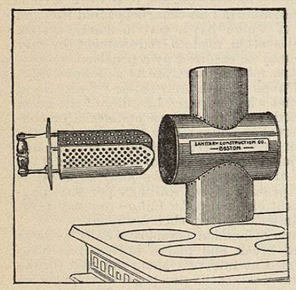

FIG. 3945.—Domestic Garbage Carbonizer as Applied to Kitchen Stove or Range.

The method which is practised in some households, of disposing of the garbage *by burning* it either in the kitchen range or stove, or in some appliance connected with the same, is both neat and cleanly, and avoids the foul odor which invariably attends the storage of such material in receptacles of any sort. Several appliances have been invented for the purpose of facilitating this method of disposal (see Fig. 3945).

The disposal of refuse *by dumping* at places designated for the purpose is the most objectionable, and unsanitary of all methods so far as organic or putrescible refuse is concerned, since it is sure to give rise to foul odors, and thus to become a source of complaint, even to persons living at a considerable distance. The habit of wild and domestic animals, of visiting such places and scattering the deposit, increases the nuisance. Frequent covering with earth in some degree obviates the trouble. Such disposal of ashes unmixed with organic matter, however, is not objectionable, nor is their use for the filling of waste lands to be condemned. This method, usually called "tipping" in England, is acknowledged, however, to be extremely unsatisfactory. Over eight hundred local authorities in England and Wales alone, each with a population exceeding two thousand, still either tip their refuse or dispose of it in some other equally primitive manner.[2]

With reference to the economy of using coal ashes for the purpose of filling waste land, the following quotation is worthy of note: "It is said that from the Manhattan and Bronx Boroughs, New York, there could be recovered one hundred and fifty thousand net tons annually of small coal, thrown away with ashes from domestic and other fires. What wasteful people the Americans must be if these figures are correct. Viewed in the light of modern practice in this country, such use for land development is quite astounding."[2]

Ploughing into the Land.—This method of disposal allows the garbage to be used as a fertilizer for growing crops, and is less objectionable than dumping. Chapin gives a list of eighteen cities where it is practised either as a whole or in part. In several other places it was once disposed of in this way until it became a nuisance, and was then abandoned.

Depositing in Water, either Salt or Fresh.—Several cities situated either upon the sea coast or near great rivers or lakes find it convenient to deposit garbage directly into the water, either directly from a wharf or by towing it to a distance in scows or other vessels designed especially for such work. Coal ashes and other heavy material thus treated sink to the bottom, but light material floats upon the surface, and while this method may be satisfactory to the city which adopts it, other places may find it a source of annoyance when favoring winds, tides, or currents deposit the floating matter upon their shores.

Feeding to Animals.—While this is perhaps the most economical mode of getting rid of the waste food products of a community, it is open to serious objections in consequence of the liability to cause a nuisance whereso-ever large numbers of swine are kept for this purpose, and because of its liability to produce disease in such animals. The feeding of city offal to milch cows is forbidden by law in some States, and should not be permitted except in such institutions as require the very careful selection and separation of bread and vegetables from the waste food immediately after it is received from the tables, and the use of the same before decomposition has begun. In the neighborhood of many large cities, piggeries exist having one thousand animals and more in each, to which the foul and offensive offal of cities is conveyed for feeding such animals. This process cannot be conducted without causing a nuisance to neighboring communities. So urgent has this matter become in the metropolitan district of Boston as to induce one large raiser of hogs to purchase a tract of unoccupied land in a neighboring State, where he proposes to feed ten thousand to fifteen thousand hogs, and to transport thither by rail the garbage of a large part of the district.

Pork raised in this manner, however, is much more liable to become infected with trichinæ than that which is produced by feeding good and wholesome food.

Cremation.—When the question of expense is not considered, burning by fire is undoubtedly the most satisfactory mode of refuse disposal. Great Britain is the principal country where this process is employed more than any other. Goodrich enumerates one hundred and twelve cities in which the refuse is treated by destruction by fire (all in England and Scotland). The material, however, which is sent to the crematory, differs essentially from that which is so treated in America, since in England the ashes (mostly of soft coal) are quite generally mixed with other refuse, and burned in the destructors. The product of such destruction is an ash or cinder, which may be used for making roads or walks, and to some extent for building construction. There is also added in some cities the material from the pail-closet system, where this plan of disposal still exists. This primitive system is rapidly diminishing in its extent, and giving way to the introduction of water-carried sewage in all large cities. In some places, as at Ealing, the sewage sludge from precipitation works is burned in the destructor. In Manchester, England, the dried excreta from the pail closets

sell for £3 per ton. At Liverpool the bulk of the refuse is sent to sea in steam barges, each carrying four hundred and fifty tons at a load. The deposit of this material causes complaint along the Welsh coast. It is rare to find in the reports of any of the English cities instances in which the destructors are of sufficient capacity to deal with the entire refuse of the city. The following list shows the disposal of the refuse of Birmingham for 1897:

	Tons.
Refuse sent to the tips, principally barged	34,703
Refuse dealt with by destructor	96,309
Mixed manure, ashpit manure, fish, sweepings sent to tips by boat, to fields by cart, or sent away by rail	74,855
Brickbats sent to tips	416
Material sold:—	
Oyster shells	15
Glass	19
Scrap tin	296
	206,613

In consequence of the location of English destructors in or near the populous parts of large cities much attention has been given to the subject of avoiding the nuisance arising from foul odors. This has been accomplished by the use of tall chimneys, high temperatures for combustion, and by the provision of secondary fires.

At present much attention is being given in England to the secondary use of refuse, that of steam raising for the purpose of generating electricity, sewage and water pumping, and other purposes.

The principal types of destructors employed in England are the Fryer, Horsfall, Warner, and Meldrum, while in America preference is given to the Engle, the Dixon, and the Smith.

The Engle consists of a brick furnace with chimney at one end, seventy-five to one hundred feet high. Several circular openings are made upon the top of the furnace, one being large enough to admit the carcass of a large animal. Driveways lead to the platform upon the top, the whole being enclosed in a covering house of brick or iron. On one side of the furnace there are doors for fuel, and another set of doors below them for removal of ashes. Between these two sets of doors are placed the grate bars upon which the refuse is dumped through the openings in the top. At each end of the furnace a fire box is placed. Below the garbage grates is a long combustion flue connecting with the base of the chimney, and controlled by a damper. A similar damper governs the admission of heat from above. (Fig. 3946.)

When the furnace is charged with a quantity of garbage, the flames from the firebox near the chimney (the upper damper being closed) pass over and through the refuse, driving the smoke and gases into and across the second fire where they are consumed. The flames of this second fire pass downward and underneath the grate, and are finally discharged through the chimney. By this second fire the liquids which drop through the grates from the garbage upon the hearth are also evaporated.

The general features of the Dixon furnace do not differ essentially from those of the Engle, but the Smith destructor is constructed on an entirely different plan from either. It consists of two sets of furnaces to which gas is supplied as fuel from a generating apparatus. Each furnace is a simple pot or tank lined with fire brick. There are no grates, the garbage resting upon the bottom. The gas is made to pass into the furnace, which is charged with refuse, the gases of combustion then pass on to the empty furnace of the pair, and thence to the flue leading to the chimney. This flue is filled with open brickwork, which being heated to a white heat burns the resulting gases, and deprives them of foul odor. When the charge is consumed, the process is reversed, the empty furnace being filled and the gases passed in the opposite direction, the same chimney being used in each instance.

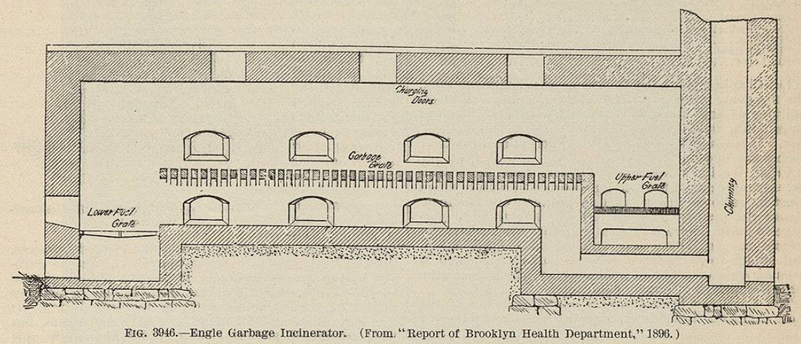

FIG. 3946.—Engle Garbage Incinerator. (From "Report of Brooklyn Health Department," 1896.)

Reduction.—The refuse of cities contains a considerable proportion of material which is utilizable. Hence various processes have been devised by which this material may be recovered and sold. The valuable portions are the fat or grease, the nitrogen, phosphate and potash, these latter ingredients being useful for conversion into fertilizers. Colonel Waring, under whose supervision the collection of refuse was efficiently carried on in New York, estimated the average composition of 3,000 tons of summer garbage as follows:

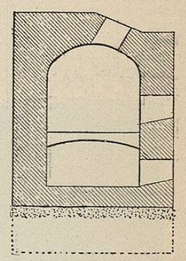

FIG. 3947.—Cross Section showing Location of Charging Door, Stoke and Ash-doors.

	Pounds.	Per cent.
Rubbish	140	7
Water	1,420	71
Grease	40	2
Tankage	400	20
	2,000	100

The tankage of one ton contained about 13 lbs. ammonia, 13 lbs. phosphoric acid, and 3 lbs. potash; if these

ingredients could be utilized, garbage would be worth according to Waring $2.47 per ton.

The following estimates are made of the amount, in pounds, of garbage collected per capita annually in large cities:

Boston	247
Buffalo	137
Milwaukee	205
New York	147
Paterson	80
Philadelphia	321
St. Louis	223

Dr. Chapin makes the following just comment upon the foregoing figures: "If the above average be correct, millions of tons must be collected annually from our large cities, worth double that number of millions of dollars. It is not to be wondered that energetic efforts have been made to save this waste."

From Waring's figures it appears that more than seventy per cent. of the garbage consists of water, which must be removed before salable products are obtained. Hence the practice in some cities of allowing the garbage to drain before it is treated, either by reduction or cremation. In Ealing near London, the garbage, ashes, and sludge from the town sewage works are stacked in pens for some time before treatment, by which means the mass is deprived of much of its water.

The following brief description relates to one of the more common methods employed for the reduction of

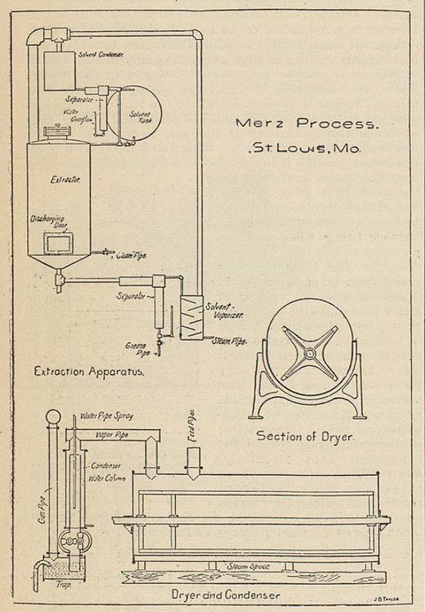

FIG. 3948.—Merz Reduction Apparatus. (From "Report of Brooklyn Health Department," 1896.)

garbage, the Merz process: When first received at the works, the garbage is put into a steel hopper and the superfluous water is allowed to drain into the sewer. The rags, bones, tin cans, etc., are then selected out and sold, and the garbage is put into the dryers, which consist of jacketed cylinders with revolving shafts and arms sto stir the garbage while drying. Each dryer holds about three tons. The dark-brown product is then put into the extractors, which consist of closed tanks with false bottoms. Naphtha percolates through the mass to extract the grease. The grease in solution is drawn off, the naphtha separated from it and the grease barrelled for sale. This grease is of a brownish color and of inferior quality. The dry residue after separation of the grease is ground, and sold to fertilizer manufacturers. The Simonin process, like the Merz process, extracts the grease from the garbage by the use of naphtha. It has this advantage over the Merz process, in that the garbage can be at once placed in the extractors without previous drying. It was carried on at Providence and at New Orleans, but was abandoned at both places. This method is now conducted at Cincinnati, but the advance in the price of naphtha has made it unprofitable.

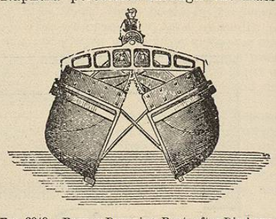

FIG. 3949.—Barney Dumping-Boat, after Discharging at Sea.

Chapin believes that this method can be successfully conducted with a moderate degree of profit, even without the payment of a bonus; but that this can be done only in a city where the garbage is very carefully separated.[1]

Another process, known as the Arnold process, is conducted at Boston, New York, and Philadelphia. It consists in rendering the garbage to recover the grease and drying the residue to be used as a fertilizer. Little attempt is made to prevent odors arising from the process. It is evidently considered by the operators to be cheaper, not to try to prevent nuisance, but to seek a location where the nuisance will affect only a few persons.

The cost of collection and disposal of garbage varies greatly in different cities, from a minimum of about 60 cents per ton to a maximum of $3.40 per ton, and from a minimum of 10 cents per capita to about 30 cents or more per capita.

Dry Refuse.—Dry refuse in many cities includes ashes and all the rubbish which accumulates in private homes and in stores, markets, etc. Manufacturing wastes are not usually removed by municipal collection. At the present day it is quite customary to require that three receptacles be provided, by the householder—one for ashes, one for garbage, and one for paper and other light refuse. The receptacles should be made of galvanized iron or other metal.

Usually dry refuse is disposed of by using it as a filling for lowlands, the owners of which are glad to have it disposed of in this manner.

In a few instances a small revenue of 10 to 15 cents per load has been received from the sale of ashes.

Experiments made in New York showed that the average ash of that city contains twenty per cent. of unburned coal, but probably some of this is finely divided and cannot be recovered with ordinary sifting processes. In some cities situated upon the seacoast and upon large rivers, the dry refuse is dumped into the water. In Boston the Barney dumping-boat is used, the material being dumped in the water at a distance of at least ten miles from the city on the ebb tide. On arriving at the point of disposal the two halves of the boat are separated by means of a hinge motion, very much like that of a clam shell. The towboat is started forward and the dumping boat is rapidly flushed out by the swiftly running water, and the two halves are brought together again. The boat is provided with water-tight compartments (see Fig. 3949).

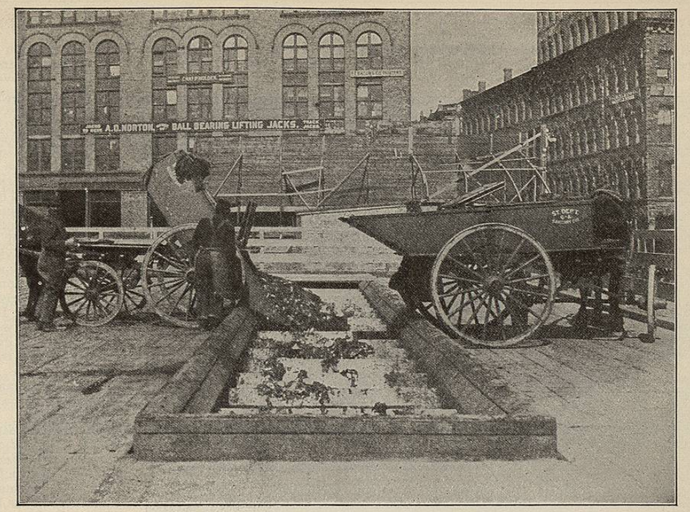

FIG. 3950.—Unloading Garbage into Scow at Wharf.

In Boston and New York attempts are made to utilize a portion of the material found in dry refuse. The plant for this purpose at Boston consists of a large room in which the wagons deposit their loads.

A long travelling apron, four feet wide, runs from the front of this room, through it into the furnace-room, where it discharges into the furnace. The power for moving the apron, for baling, and for furnishing light is obtained from the furnace. The persons who cull out the paper, rags, metal, glass, rubber, etc., and sort and prepare it for sale, stand at the sides of the moving apron. About eighty per cent. of this refuse is marketable, and the value of the daily collection is about $60.

The following are the prices obtained for the principal marketable portions of this dry refuse:[4]

Manilla paper	$0.50 per 100 pounds.
Newspapers	.35 " 100 "
Mixed paper	.25 " 100 "
Straw board paper	.25 " 100 "
Black rags	.30 " 100 "
White rags	1.50 " 100 "
Mixed rags	.90 " 100 "
Woollen rags	7.00 " 100 "
Soft-back carpets	.90 " 100 "
Hard-back carpets	.30 " 100 "
Linsey carpets	.65 " 100 "
Twine	.11 " 100 "
Old shoes, good	.12 " 100 "
Old shoes, poor	.11 " 100 "
Bagging	.40 " 100 "
Mixed bottles	.45 per barrel.
Old iron	9.00 per ton.
Copper	.11 per pound.
Brass	.10 " "
Lead	.04 " "
Zinc	.10 " "

In New York (Manhattan district) the amount of rubbish collected and disposed of in a similar manner in 1898 was 94,000 tons, and for this the sum of $63,500 was obtained.

Mixed Refuse.—In some cities the garbage and dry refuse are collected and disposed of together. This was for many years the plan adopted in New York, and is still in use in several quite large cities. When thus collected the garbage, ashes, and dry refuse are mixed together in the receptacles, which are usually of metal and are provided with covers, but quite often nothing better than ordinary barrels and boxes are employed. Regulations provide for the location of the full receptacles either on the sidewalk or upon the householder's premises. Provision is also made for regular hours and frequency of collection. Disposal is usually

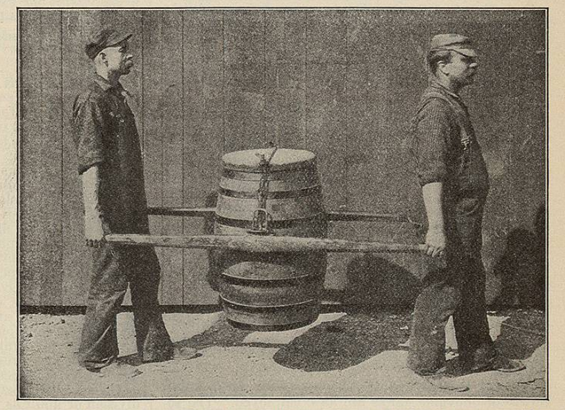

FIG. 3951.—Night-Soil Barrel, Used in Connection with Odorless Excavation Apparatus. (From Chapin's "Municipal Sanitation.")

made by dumping either upon lowlands or into water. The former usually creates more or less nuisance, but is tolerated because of its economy. In San Francisco the mixed refuse is cremated. In Troy a portion only (the most offensive part) is cremated, while in a few Southern cities parts of the garbage and dry refuse are burned in the open air at the dump.

Night Soil.—By this term is meant the liquid or semi-liquid contents of privy vaults and cesspools, derived from the household wastes of the water-closets, bath-tubs, and other fixtures, including that of the kitchen sink. The latter often proves troublesome in consequence of its greasy character and its liability to clog the traps and pipes through which it flows.

On account of the liability to cause nuisance in the performance of this work it is customary to require that the scavengers, or other persons who conduct it, shall be licensed and placed under careful supervision.

It is customary to require the use of tight receptacles for the removal of night soil, either barrels or tubs provided with handles and tight-fitting covers. (Fig. 3951.) Boxes or movable tanks are also employed. The so-called pneumatic odorless pumps are well adapted for this class of work. (Fig. 3952.) Tubs and barrels are conveniently handled, ten or twelve of such receptacles usually constituting a load.

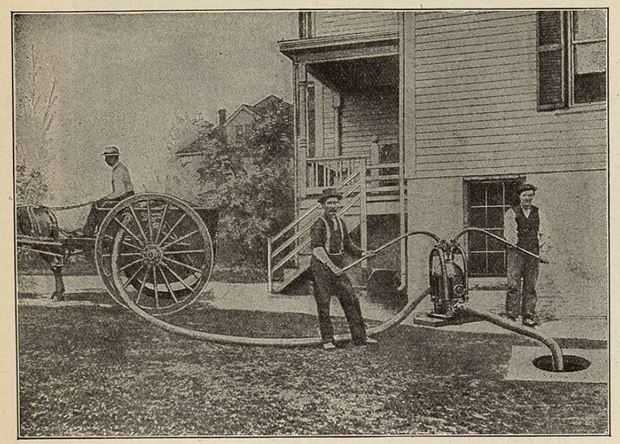

FIG. 3952.—Odorless Excavating Apparatus in Operation.

It was formerly customary to remove such material only at night, but this practice is gradually being substituted by removal in the daytime, when with improved apparatus it is practicable to do the work in a more cleanly manner.

Disposal.—In some cities the night soil is taken to suburban districts and there used upon farms as a fertilizer, a practice liable to cause nuisance to the neighborhood, if thus disposed of in the vicinity of dwellings. In some places it is dumped into water, either a large river, lake, or the ocean. In a few English cities where the pail system of excrement removal is still in use, the contents of the pails are taken to the crematory and burned together with other sorts of refuse.

The Refuse-disposal of Public Institutions and Other Establishments.—Special destructors are now made of smaller size than those in use by cities, for the destruction of the waste products of public institutions, hotels, department stores, factories, medical colleges, and other isolated establishments. Such forms of apparatus (Fig. 3953) are specially adapted to the destruction of infected bedding, clothing, rags, and other infected material which is not worth the trouble and expense of saving by any process of disinfection.

Samuel W. Abbott.

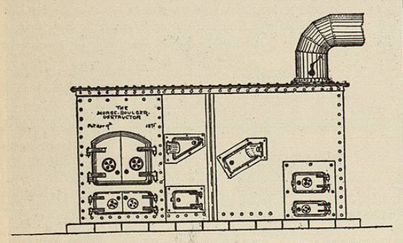

FIG. 3953.—Garbage Destructor for Use in Public Institutions, Factories, etc.

REFERENCES.

[1] Chapin: Municipal Sanitation in the United States, Providence, R. I., 1901.
[2] W. F. Goodrich, A.I.M.E.: The Economic Disposal of Town's Refuse, London, 1901.
[3] Palmberg: Public Health and its Applications, p. 242.
[4] Boston Post, January 21st, 1900.

REGENERATION.—Regeneration is the process which leads to the replacement of lost tissue. The term is applied equally to the reproduction of cells to take the place of those cast off under normal physiological conditions on the one hand, and to the repair of tissue destroyed by lesion on the other. In both cases the process is essentially the same. The new tissue is formed by the proliferation of cells in the immediate neighborhood of the area from which the cells have been cast off or destroyed. Moreover, the new tissue is derived from remaining tissue of like kind, connective tissue from connective tissue, epithelium from epithelium. Where reproduction of epithelial tissue does not take place, or where the reproduction is incomplete, the defect, it is true, is filled with connective tissue forming a scar; but this scar tissue is derived from the connective tissue around the defect, and not from the epithelium. Physiological regeneration goes on continuously to supply tissue waste; regeneration after lesion occurs in the healing of wounds, in the restoration of the mucosa after catarrh, and in similar processes.

There are two methods of multiplication of cells, direct division or amitosis, and indirect cell division or karyokinesis, mitosis or karyomitosis. In the former of these two methods the mother cell simply increases in size and

finally divides into two daughter cells after a division of the nucleus. In karyokinesis the process is more complicated, consisting as it does of a cycle of definite changes in the chromatin of the nucleus preceding the division. Direct division or amitosis is said by some authorities to take place only in cells which are no longer capable of forming new tissue, whereas mitosis occurs in active vigorous cells which form new tissue. Other authorities, on the contrary, regard the two processes as of equal significance.

The power of reproduction differs in different tissues. Surface epithelium and epithelium lining glands are capable of regeneration to a very large extent, as are also nerve fibres and many of the other tissues of the connective-tissue group generally. Of the latter, the periosteum is capable of the greatest degree of regeneration, whereas cartilage has only a limited power of regeneration. Ganglion cells once destroyed are probably never replaced by ganglion cells in the adult, and glandular epithelium is completely restored only where the defect is slight and where some of the original cells remain uninjured in the area of the lesion.

Regeneration of Epithelium.—In regeneration of epithelium the protoplasm of the cell divides in the later stages of karyokinesis, or after this is complete. In some cases the cell sends out processes of protoplasm, and the new nuclei wander out from the parent cell into these before the protoplasm is constricted off to form the new cell.

In a lesion of an epithelial surface, where the area destroyed is not too great in extent, the epithelial cells proliferating from all sides completely repair the defect; if it is more extensive, the defect is incompletely filled by connective tissue, thus forming a permanent scar. In the latter case, the connective tissue forming the scar results, as in all cases, from the proliferation of pre-existing connective tissue, not from proliferation of epithelium. Epithelium reproduces epithelium, never connective tissue, but it is also true that the character of epithelium reproduced is not always the same as that which is lost; for squamous epithelium may replace cylindrical epithelium, as is seen in atrophy of the mucosa of the bronchi and stomach in chronic inflammation of these surfaces.

Minor defects of epithelial surfaces, where underlying tissues are not destroyed, are quickly and completely restored by the proliferation of the surrounding epithelium. In recovery from acute Bright's disease, or in the healing of an ulcer of the stomach or intestines, the epithelium is often completely restored by the multiplication of the remaining mucous glands as well as by growth downward of the epithelium on the surface. Lesions of the liver are also completely restored by multiplication of the cells of the parenchyma and by the formation of new bile ducts.

Larger defects of epithelial tissue, particularly where the underlying structures are involved, result in a scar, with more or less incomplete reproduction of glands which are for the most part usually atypical.

Regeneration of Structures Consisting of Connective Tissue.—Defects of structures made up of connective tissue in any of its various forms may under favorable circumstances, as where the lesion is not too extensive, or in lesions of certain of the tissues of this group, even though they be extensive, be completely restored by the new formation of tissue identical in character with that originally present. Where the lesion is more extensive, particularly in one that occurs in certain of the connective-tissue structures, the defect is more or less filled up by connective tissue of a different type from that originally present. Connective-tissue structures such as the periosteum, bone marrow, blood and lymphadenoid tissue, are all readily restored completely after lesion. On the other hand, cartilage does not readily reform, and defects in this structure are replaced by ordinary scar tissue or by bone. New bone is formed not from pre-existing bone but from the remaining periosteum and from the bone marrow. Sometimes new bone is formed in other connective tissue, as in the intermuscular connective tissue and from the perichondrium. But muscle tissue is formed only from pre-existing muscle, never from connective tissue of any other kind. Ganglion cells are probably never restored after injury, defects in this tissue being replaced by scar tissue or by glia cells; but nerve trunks are readily restored, provided that the ganglion cells from which they spring are uninjured, for the regeneration is brought about by the growth of the axis-cylinder processes. The peripheral portion of a severed nerve always undergoes degeneration, it is never restored; all parts of it finally break down into granules and are dissolved away. The central portion of a severed nerve, on the contrary, undergoes degeneration for only a short distance from the end, back to the first or second Ranvier constriction from the end. In a few days after the occurrence of the lesion the axis cylinder in the central portion of the severed nerve begins active proliferation. At first the new axis cylinders are naked save for a layer of protoplasm rich in nuclei, but sooner or later the proper sheaths are reformed. If the degeneration of the peripheral segment of the severed nerve has not yet affected the Schwann's sheath, the new axis-cylinder processes may enter these and fill them out again. The regeneration of nerves takes weeks or months for completion.

In regeneration of connective tissue, as in reconstruction of other tissues, the proliferating cells are always much larger than the cells at rest. The proliferating cells, or formative cells as they are also called, not only possess a relatively large amount of protoplasm, but the nuclei are large and vesicular and contain nuclear bodies, many of them showing, by proper methods of hardening and staining, the various stages of karyokinesis. Frequently the formative cells contain more than one nucleus, sometimes even a large number of nuclei, forming giant cells (Fig. 3954, *i*). The tissue made up of these formative cells is appropriately called embryonic tissue, and the character of the permanent tissue arising from the development of the embryonic tissue is determined by the nature of the embryonic cells. If the formative cells are destined to form scar tissue they are called fibroblasts; if they are to form cartilage they are called chondroblasts; if bone, osteoblasts.

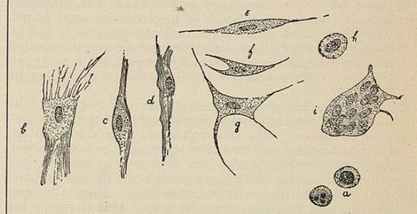

FIG. 3954.—Cells met with in New Formation of Connective Tissue. (After Ziegler.)

The formative cells are of many different shapes; some are large, round, or oval masses of protoplasm (Fig. 3954, *h*), others spindle-shaped (Fig. 3954, *e*), others roughly star-shaped (Fig. 3954, *g*), others irregular with long processes (Fig. 3954, *c*, *d*, *f*), or bundles of fibres at the ends as if the protoplasm were frayed out (Fig. 3954, *b*).

If fibrillated connective tissue develops from the embryonic tissue, fibres make their appearance between the formative cells, and by continuous increase they encroach more and more upon the latter till the formative cells finally lie compressed in fissures between the densely packed fibres.

Cartilage develops by the formation of a homogeneous intercellular substance instead of fibres, but the formative cells are encroached upon and compressed just as in the case of ordinary fibrillar connective tissue. The