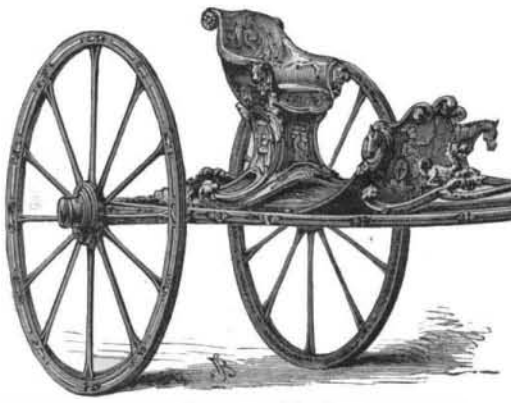
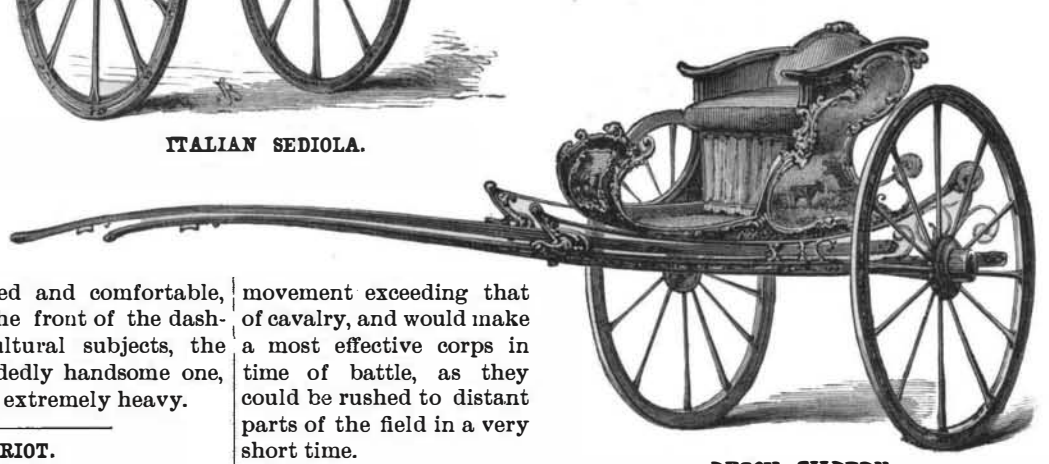
CARRIAGE MAKERS' WORK IN THE LAST CENTURY.

It was not until the latter part of the seventeenth and the commencement of the eighteenth century that the inventor and mechanician seem to have applied themselves to making carriages which could be used with sufficient comfort to attain any degree of popularity. The most of the specimens we have of the work of an earlier period must have been extremely clumsy and awkward for actual service, though some of them are richly carved and elaborately decorated. In the French museum of Cluny is a fine collection of eighteenth century carriages, two singular vehicles belonging to which are represented in the accompanying illustrations. It is said that a vehicle something like the sediola here shown is still used in some parts of Italy. It is fixed without any kind of suspension to the shafts, obtaining its spring from their great length, and is allied to the Norwegian carriole, the Neapolitan calesso, and the Cuban volante. The body is decorated with carvings of mythological subjects in bold relief, and the wheels are elaborately painted, animals and birds being profusely represented on the tire. The Dutch tilbury shown is built more after the style of our gigs at present, being suspended on straps which go over small wheels at the back, so they can be loosened or tightened at will. The seat is padded and comfortable, and the sides and back, with the front of the dashboard, are pictured with agricultural subjects, the vehicle being on the whole a decidedly handsome one, strongly built, but without being extremely heavy.



ITALIAN SEDIOLA.



DUTCH TILBURY.

A SCYTHIAN CHARIOT.

M. MEIOS, U. S. C. E.

I was much interested in the drawing published in a late number of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 528, describing an ancient Egyptian chariot wheel found in a recently opened tomb.

I send you a sketch of a chariot no less curious, which I find in my sketch book, and which I think had a somewhat similar origin. The vehicle represented in the sketch was taken from an Egyptian tomb of the date 1400 B.C.

It is said to be of Scythian origin, and probably formed part of the spoils of some Egyptian victory. Only a portion of the rawhide lashings with which all the joints were secured now remain. The hub is a composite affair, consisting of an inside tube made in two pieces, and afterward put together with wooden rings fitting over the ends of the tube.

The spokes, which are of wood with a natural crook, are made like the letter L, and are four in number, being fitted into a groove in the hub; the long arm of the L extending out to and into the felly, and the short arm bent at right angles and notched and fitted to the adjacent spoke. The whole was firmly bound together with rawhide.

The fellies, two in number, are scarfed together between the spokes and also lashed with rawhide. The section of the felly is oval or elliptical, and I could not discover that there was any provision made for protecting the wood with a tire of any sort. The floor of the chariot was of rawhide thongs, and must have made a very elastic footing indeed.

A light, elegantly curved yoke was attached to the pole of the vehicle by a pin and lashings, and was attached to the two horses by means of a forked piece of wood like an inverted Y, this piece being placed astride the neck in front of the withers and lashed to the yoke.

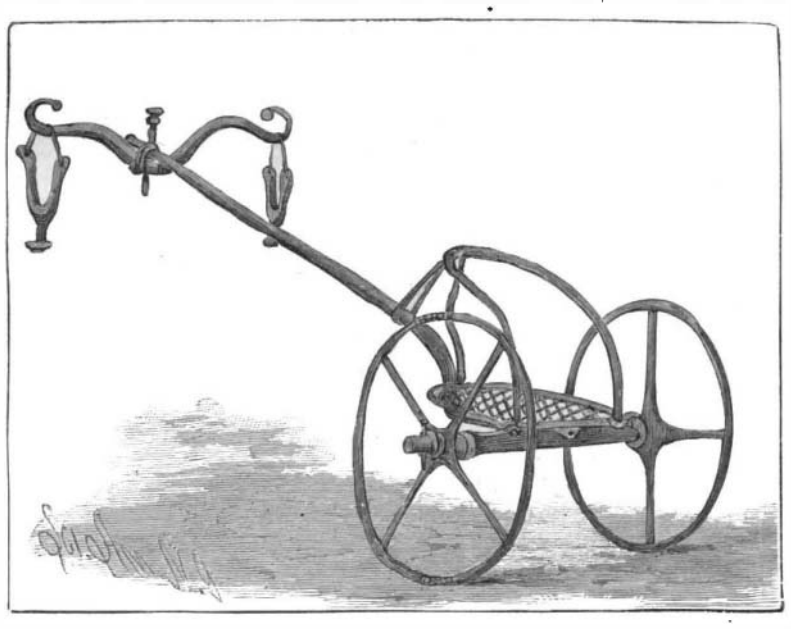
The weight of the whole vehicle, harness, yokes, etc., I estimated at not over 50 pounds, and the method of attaching to the horses must have left them with almost perfect liberty of motion.

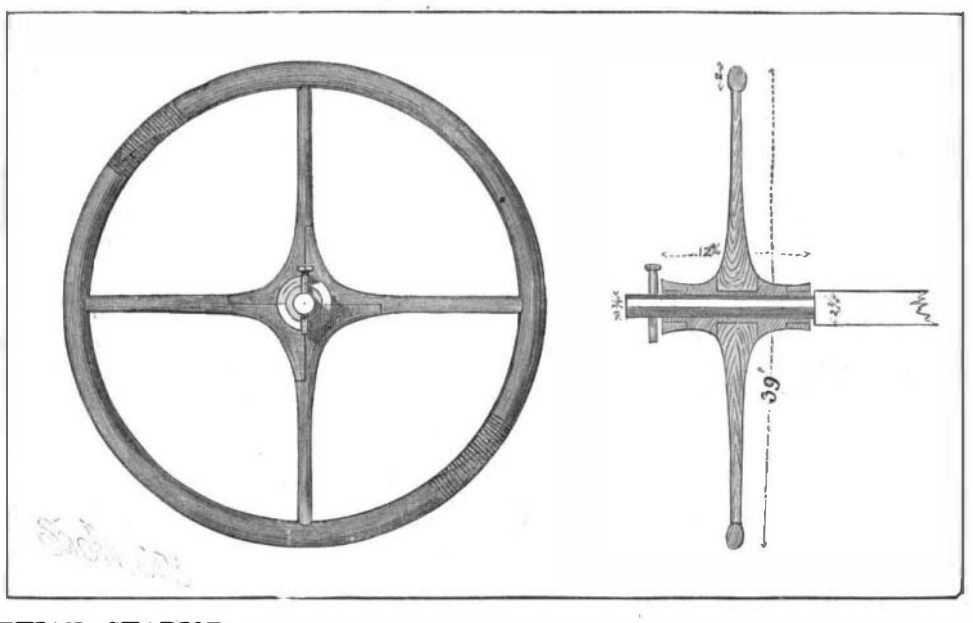
A squadron of such chariots, with two men (a driver and an archer) in each, must have been an exceedingly efficient sort of light artillery.

Perhaps we may witness in our own day, when cavalry has become only a sort of mounted infantry, a return to the methods of 3,000 years ago. There are great advantages in such a light cart as this chariot. It is too low to be upset, and can be taken over any sort of country. The harness and weight are reduced to a minimum. A regiment furnished with such chariots and with repeating rifles would have a rapidity of movement exceeding that of cavalry, and would make a most effective corps in time of battle, as they could be rushed to distant parts of the field in a very short time.

I append the following dimensions: Axle, 79 in. long; seat, 39 in. long, 20 in. deep; pole, 1½ in. diameter small end, 3 in. diameter large end; wheels, 39 in. diameter; hubs, 12¾ in. long; yoke, 35 in. long, outside to outside; neck fork or saddle, 10 in. long.

The chariot is now in the Etruscan Museum at Florence.





A SCYTHIAN CHARIOT.

Photography by a Lightning Flash.

BY PROF. EDWIN J. HOUSTON.

Mr. Albert S. Barker, of Philadelphia, has recently succeeded in taking two very fair photographic negatives of outside objects while illumined by no other light than that of a single lightning flash. These photographic views were taken at 7 P.M. on Thursday, October 29, 1885, near Philadelphia. The night was excessively dark, the wind strong, and the rain heavy. The camera was placed in an open window, with the slide drawn. The lightning flash came in less than one minute, when the slide was returned. The plate holder was then reversed and suitably placed for a second exposure. The plate was one of the highly sensitive gelatine films.

Mr. Barker developed the plates the same evening. From their behavior he rated the actinic effect of the light as equal to that obtained from an exposure of about $\frac{1}{800}$ part of a second in bright sunlight.

The popular impression as to the duration of the lightning flash is that it is practically instantaneous. From the experiments of Wheatstone and others with the rotating disk, the duration of the flashes measured would vary apparently from the $\frac{1}{1000}$ to the $\frac{1}{10000}$ of a second. Others estimate the duration of the flash as even shorter than these figures.

It is very doubtful if the average severe flash in this latitude does not endure or continue for a very much longer period. Despite the popular belief to the contrary, the author has frequently observed the motion of foliage when illumined by no other light than the lightning flash. This would not, of course, be the case if the flash were even approximately instantaneous.

It is a very significant fact that in the photographs of Mr. Barker the foliage shows unmistakable evidence of having perceptibly moved during the period of exposure; thus showing that it was by no means instantaneous.

It is to be hoped that Mr. Barker, or some other photographer, will repeat these exposures under the following conditions, viz.; to make the exposure while the camera is sharply focused on moving foliage or a rapidly rotating wheel, while illumined by a lightning flash, so as to determine more definitely the duration of the flash.

In the case of the lightning flash, the large percentage of blue rays would of course render the plate more sensitive to the extremely short exposure by practically prolonging the same, since the ordinary photographic chemicals now employed are especially sensitive to the blue portions of the spectrum.

It would appear from the facts developed by the photographs of Mr. Barker, that the method of measuring the duration of the lightning flash, as adopted by Wheatstone and others, which consists essentially in endeavoring to detect by the unassisted eye the change in position of a rapidly moving wheel or other object, while illumined by the flash, might be greatly improved by substituting for the eye the sensitive photographic plate, since the latter is apparently far more sensitive than the eye.

Should photographic pictures of a rapidly rotating wheel, whose rate of motion was known, be taken while illumined by a lightning flash, the displacement of the image on the negative would give far more reliable data for calculating the duration of the flash than the methods heretofore employed.

Mr. Barker's photographs, therefore, are not only interesting as showing how extremely sensitive the photographic plate may be made, but are also of interest as throwing some light on the possible duration of the lightning flash.—*Franklin Journal.*

Origin of Diastase.

Emile Laurent has investigated the question whether diastase is a product of bacterial action, or whether it can be formed without organic intervention. He placed seeds of lupin, maize, barley, and helianthus to germinate under a bell glass, over water which had been previously boiled, the seeds having been first freed from superficial micro-organisms by the ordinary processes of sterilization. When the sprout began to show, the seeds were introduced, with all necessary precautions, into tubes containing Koch's nutritive gelatine. The seeds continued to develop normally, without liquefying the gelatine, which constitutes, according to Koch, an infallible criterion of the absence of bacteria. Sprouted seeds, introduced into sterilized plum juice, continued to grow, without showing any bacteria in the liquid. Although these experiments can hardly be considered as decisive, they lend great probability to Laurent's opinion that bacterial intervention is not necessary.—*Bul. de l'Acad. Roy. de Belg.*, No. 7, 1885.

How to Intensify a Gelatine Negative for Line Work.

The *Brit. Jour. of Photo.* recommends the following: To prepare the negative for intensification, after thoroughly washing, soak it for five minutes in a bath composed of saturated solution of alum, to each pint of which an ounce of *aqua regia* has been added. Or, more conveniently, dissolve one ounce of common salt in four ounces of nitric acid by means of heat, and add to one pint of alum an ounce of the solution when cold.

In addition to clearing the film from stain, and preparing it for the silver intensifier, the above solution is useful in another way, namely, in clearing away any slight veil or fog. In this respect its action differs entirely from that of any other combination of alum and acid we have tried. If a veiled negative be treated with the alum solution above given, or, better still, with a very dilute solution of the acid alone, or of the mixture of nitric acid and salt, the image is gradually and completely converted into chloride. The action is quite different from that which occurs when hydrochloric acid is employed in a similar manner; the bleached image, instead of being a sickly, yellowish color, possesses a pearly whiteness, reminding one of the old alabastrian picture.

If, as soon as the solution is applied, a constant watch be kept on the *back* of the negative, the deepest shadows will gradually be noticed to assume the pearly tint spoken of; showing that the whole of the deposit constituting the fog or veil has been converted into chloride. A dip into clean hypo removes the chloride, leaving the shadows with a clearness and brilliancy scarcely obtainable by other means. In the case of half-tone negatives, experience alone can teach the proper moment to cease the action of the acid; but with black and white negatives the right time is instantly the veiled lines show white at the back of the plate.

The method of silver intensification is as follows: To a three grain solution of pyro a few drops are added of the following: silver nitrate, 60 grains; citric acid, 30 grains; nitric acid, 30 minims; water, 2 ounces. Dissolve the silver and citric acid separately, mix, and add the nitric. If a little sugar or glycerine be added, to help the intensifier to flow smoothly, the operation will be better performed by holding the plate on a pneumatic holder than in a dish, as the greater portion of the silver is, in the latter case, deposited on the dish. It will also economize silver.

After intensification and thorough washing, the plates are completed by a final dip in the acid-alum bath.

National Academy of Sciences.—Washington Meeting.

(CONTINUED FROM PAGE 272.)

Prof. T. Sterry Hunt, of Montreal, read a paper on the Cowles Electrical Furnace, recently invented by the Cowles Brothers, of Cleveland, O.

In this furnace the action is not electrical, though electricity is used as the means of generating heat, and with such success that the heat engendered far exceeds that by any previous process, and affords a powerful means of reducing refractory ores.

The furnace consists of a retort filled with charcoal in contact with the substance to be reduced. It is operated by passing an electric current through the mixture. It was found necessary to coat the particles of charcoal with lime in order to decrease their conducting power, and thus increase the intensity of the heat caused by the electric current. This coating was secured by wetting with lime water.

The intense heat melted the first furnace of fireclay, and a retort of carbon had to be substituted.

So great is the heat that a platinum wire is almost instantly melted; and an ordinary electric light carbon, plunged into the furnace for a moment, and then withdrawn, glows as the electric arc.

This furnace has been used to obtain the metal aluminum in a cheap form. For this purpose corundum is resorted to as the most practicable ore, common clay being too much mixed with sand or other impurities. It is believed that corundum may be obtained in large quantities at the cost of two or three cents a pound. Alumina in the form of corundum is immediately reduced to the metallic state aluminum.

In order to grasp the metal and retain it, copper is used to make an alloy, just as mercury does in the metallurgy of gold.

Quartz is melted in the furnace, becomes lighter, and a large part of the silicon is reduced.

Boracic acid gives fumes of boron, and the residual copper shows on analysis the presence of 3½ per cent of boron.

Manganese is also reduced, and an alloy containing 66 per cent of it was shown.

Alloys of aluminum with carbon, with silicon, and a peculiar alloy, believed to consist entirely of aluminum and nitrogen, were also shown.

Aluminum forms valuable alloys with iron. The addition of a small proportion of aluminum to iron reduces its melting point, without impairing its strength as carbon does. One-half of one per cent is sufficient for this purpose.

Titanium was reduced, but would not form an alloy with copper.

All easily reducible metals are conveniently obtained by this process, such metals as magnesium, potassium, and sodium being mentioned.

As yet, *pure* aluminum has only been produced in small lumps direct from the furnace, but it may be obtained by melting an alloy of aluminum and tin with lead, when the lead and the tin separate.

Another method of obtaining the aluminum pure is by subliming either an alloy of aluminum with carbon or one with copper, when the pure aluminum is carried over.

In aluminum bronze some silicon is always present, but that is no detriment. It is not yet determined whether or not the silicon can be separated.

The aluminum bronze, or the alloy with copper, is the most readily obtained, and hence the cheapest form of aluminum. The importance of these alloys is incalculable. Their economic value has long been understood, but their use has been limited by high price. Webster, of Birmingham, England, has for many years been the chief manufacturer, and has charged on the basis of 60 shillings (about $15) a pound for the aluminum contained in the mixture. The present process enables manufacturers to furnish it at $2.50 or in large quantities at $1.80 per pound in the form of 10 per cent alloy with copper, a pound of this mixture costing 30 cents.

The properties of aluminum bronze vary much with the proportion of copper and aluminum.

The maximum amount of aluminum which can be tolerated is 10 per cent, until we get near the other end of the scale, when mixtures of 70 or 80 per cent of aluminum, or more, give valuable workable alloys.

These bronzes have a general resemblance to those of copper with zinc.

Some large manufacturers have said that aluminum bronze could not be rolled, but it has been rolled successfully, and specimens were shown. It has also been drawn into wire, as shown, having a breaking strength of 109,000 pounds.

The addition of a small amount of aluminum to brass increases its strength remarkably; 2 or 3 per cent nearly doubles it.

It is strange that a metal which holds oxygen with such tenacity, when combined, should be so slow to enter into combination with it; yet, in fact, aluminum is almost untarnishable, and the alloys which contain 5 per cent or more seem to share this property. A specimen containing 2½ per cent, however, was shown to be tarnished by action of the atmosphere.

Specimens of aluminum silver were also shown. The addition of 4 per cent to German silver makes an alloy so tough that Cowles thinks razors might be made of it.

Silicon bronze is used for telegraph wires. The addition of one-half per cent of silicon greatly increases the strength, without materially reducing the conductivity of the wire. The Bennett-Mackay cable is made of this alloy.

In early experiments with the Cowles furnace, an engine of 30 dynamo power yielded a daily output of 50 pounds of 10 per cent alloy. Brush has now constructed an engine with 908 revolutions a minute, which for every 35 horse power reduces one pound of the alloy per hour. The expense of working is now covered by one-half cent an hour for one horse power; thus the cost of the alloy is 17 cents a pound.

Within a week, the gases given off by the furnace have been analyzed. In the early part of the process it is found that a large amount of nitrogen was given off, showing that air leaks into the furnace. After an hour and a half, the nitrogen is much diminished.

They at first used moist carbon for packing, but have now reformed that, thereby saving the waste of fuel in drying out the moisture.

In the ensuing discussion, Mr. Sellers, of Philadelphia, remarked that he had made a series of experiments at iron works in that city, in the use of aluminum with iron, which gave what is technically called "dead melting" in two or three minutes, instead of an hour, as required by previous method. The result was very fine castings, and absence of flaws, which so often vex the founder, in using the process generally employed.

The entire number of papers read was twenty-six, many being technical as usual.

Prof. Ogden N. Rood, of Columbia College, gave an account of a series of experiments on color contrast, whereby it appears that colors appearing on neutral ground to the eye, as a result of contrast with those seen, are not, as is generally supposed, complementary, except in the case of red; and in proportion as the violet end of the spectrum is approached do the contrasted colors differ more and more from the complementary ones. He found also that bluish colors affect the eye more than reddish ones. The reason of these physiological actions he was unable to explain.

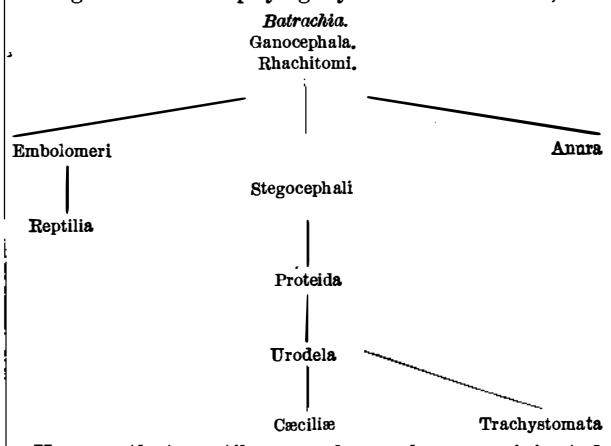
Prof. H. A. Rowland, of Johns Hopkins University, gave a valuable exposition of the absolute and relative wave lengths of lines of the solar spectrum, remarking that Angstrom's determinations were no longer sufficient, because of the superior accuracy of modern instruments. Rowland regards his own determinations as correct within one or two parts in half a million.

Prof. A. Graham Bell gave a further contribution to the study of heredity in relation to deaf-mutism, taking in hand, this time, the families of Martha's Vineyard. An important fact noted was that, notwithstanding the repeated intermarriages on the island, and the fact that the families investigated were scattered all over the island, all but two of the deaf mutes were found in the township of Chilmark, which contains the smaller part of the population, and in which town four per cent of the people are deaf mutes.

Doctors speak of the prevalence of typhoid fever in Chilmark, and even note a definite boundary within which it prevails, calling it the typhoid fever line, showing that the influence of environment is more potent than that of heredity.

A few of the papers proposed new or modified classification, which met with such thorough and unanimous approval that the schemes presented are subjoined, and are believed to mark the final results attained by science in the departments named.

Prof. E. D. Cope, of Philadelphia, now gives the following scheme as the phylogeny of the Batrachians, viz.:



He says that reptiles, as above shown, originated from a batrachian type.

Prof. Theodore Gill, of Washington, classifies fishes as follows, four classes:

1st. Leptocardians, or lancelets.
2d. Mydonts, or lampreys.
3d. Selachians, or sharks and rays.
4th. Teleostomes, or true fishes.

He remarks that these are entitled to be called classes rather than orders, being more widely separated from each other than the orders of either reptiles or birds.

The brain furnishes the best indication for classifying the major groups, and the osseous system for general grouping.

Almost all orders of fishes are of recent introduction. In the Devonian formation are seven or eight orders, all but one extinct; and no living order has there a representative, except dipnoi.

Prof. Charles D. Walcott, of Washington, proposes the following classification of the rocks above and below the Cambrian of North America:

PALÆOZOIC.	Carboniferous:	Permian, Coal measures, Lower carboniferous.
	Devonian:	Catskill, Chemung, Hamilton, Corniferous.
	Silurian:	Oriskany, Lower Helderberg, Niagara.
	Ordovician:	Cincinnati, Trenton, Chazy, Calciferous.
	Cambrian:	Potsdam, Georgia, St. John.
?	Keweenaw:	Keweenaw series, Grand Canon series, Llano series.
	Huronian:	Lake Superior, Minnesota, Newfoundland.

He would further classify the Cambrian rocks as follows:

Upper Cambrian:	Potsdam, Knox, Tonto.
Middle Cambrian:	Georgia, L'Anse au Loup, Prospect.
Lower Cambrian:	St. John, Braintree, Newfoundland, Wasatch, Tennessee.

Prof. Hunt commended this scheme as the best yet presented, especially approving the separation of the Ordovician. It was formerly supposed that the Potsdam contained the earliest forms of life, but Prof. Walcott has shown fossils from the lowest Cambrian, and has at least cast doubt upon the Keweenaw and Huronian.

The fall meeting of the Academy will be held at Boston, commencing Nov. 9, 1886. W. H. H.