L, *albumenuria.* In eight observations

$NH_3=0{\cdot}0521$ gr. per 1000 grs.

M, *phthisis.* In five observations

$NH_3=0{\cdot}072$ gr. per 1000 grs. $=1{\cdot}89$ gr. per diem.

N, *nervous diseases.* In five observations

$NH_3=0{\cdot}0546$ gr. per 1000 gr. $=1{\cdot}4332$ gr. per diem.

O, *chronic nodular arthritis* (rheumatic gout). In 4 observations

$NH_3=0{\cdot}15$ gr. per 1000 grs. $=3{\cdot}9375$ grs. per diem,

or nearly double that of health.

P, *gout.* The ammonium seems to be increased in this disease.

Q, In nine cases of *complicated disease,* with extreme physical prostration,

$NH_3=0{\cdot}0069$ gr. per 1000 grs. $=0{\cdot}1835$ gr. per diem.

R, the cases taken *just before death* are very remarkable, showing a vast decrease in the amount of ammonia. Eight cases gave an average of

$NH_3=0{\cdot}0304$ gr. per 1000.

In two cases it was entirely absent, the only cases of entire absence known to the authors.

The authors refrain from any generalization. The total number of cases upon which observations were made exceeded 200.

II. "Examination of the Gases occluded in Meteoric Iron from Augusta Co., Virginia." By J. W. Mallet, Ph.D., M.D., Professor of Analytical and Applied Chemistry, University of Virginia. Communicated by R. Mallet, C.E. Received April 23, 1872.

The investigation by Graham of the gases given off by meteoric iron from Lenarto, in Hungary, when heated in a vacuum produced by a Sprengel pump, excited much interest at the time of publication*, but does not seem to have been followed up by any similar examination of other meteorites. I have made use of pieces of the iron found about three years ago in Augusta Co., Virginia, the description and analysis of which were published by me in the 'American Journal of Science' for July 1871, in order to repeat the experiment of Graham, and ascertain whether similar results to his would be obtained. A large part of the work of the extraction and analysis of the gaseous contents of this iron has been done by two of the students in my laboratory, Mr. F. P. Dunnington, of Baltimore, and Mr. J. B. Adger, of South Carolina, to whom I am much indebted for their assistance.

Two preliminary experiments were made,—the first with some shavings from the cutting of the iron upon a planing-machine; the second with a solid piece of the metal planed to smooth, clean surfaces, and quite free

* Proc. Roy. Soc. xv. p. 502.

from any crust or scale. The shavings were subjected to the purification practised by Graham, namely, washing with a hot solution of potassic hydrate, followed by washing with distilled water and thorough drying. The solid strip of iron was not so treated, care having been taken to use no oil upon the tool employed in cutting it. Both specimens gave off gas readily when heated in the Sprengel vacuum, the amount in each case being larger in proportion to the bulk of the iron than in the experiment of Graham; and analysis showed that the same gases were present as those found by him, with the addition of carbonic anhydride in not inconsiderable amount.

The final experiment was made as follows, with great care, and with all precautions which could be thought of to avoid error.

A parallelopiped of iron was cut upon a planing-machine from the largest of the three masses found (that spoken of as No. 1* in the paper above referred to), the work being done with special care, to avoid the least trace of grease being derived from the machine.

Not only was the cutting-tool itself made red-hot in the blacksmith's fire, hardened in clean water, and tempered and ground without contact with any thing greasy, but every part of the machine-bed, set-screws, and frame, from which any risk was to be feared, was carefully cleansed, and paper used to cover the whole of the iron, except where actually borne upon by the tool. The piece of iron measured about 75 millims. long, 16 millims. wide, and 12 millims. thick. It was cut from as solid a portion of the mass as could be found, and was quite bright upon the surface and free from crust, though traces of a very minute crack or fissure were barely perceptible at one end. The piece weighed 124·589 grammes; and as the specific gravity of the iron had been found to be 7·853, the volume was 15·87 cub. centims. A new and perfectly clean porcelain tube, with sound glaze, was used, heated by a small upright fire-clay furnace with good draught, through holes in the opposite sides of which the tube was passed. The fuel was charcoal, in pieces a little larger than a walnut. The Sprengl pump had a fall-tube of about 1·34 metre long; its connexions were made with great care, and were protected by outer casings of india-

* The results of ordinary analysis were:—

Iron	88·706
Nickel	10·163
Cobalt	·396
Copper	·003
Tin	·002
Manganese	trace.
Phosphorus	·341
Sulphur	·019
Chlorine	·003
Carbon	·172
Silica	·067
	99·872

rubber tube, with the annular space between the tubes filled with glycerine. A plate of glass floating on the mercury in the funnel at top served to prevent the risk of air being carried down, as the metal was gently poured on through another and smaller funnel with narrow aperture.

A good vacuum having been obtained in the cold, lighted charcoal was placed in the furnace, and gas very soon began to come off.

It was determined to analyze separately that collected at the beginning, middle, and end of the process, in order to see whether the different constituent gases were given off at the same or at different rates. The total amount obtained was 36·33 cub. centims., reduced to 0° C., and 1 metre pressure. This was divided into three portions for analysis as follows :—

			h	m
Portion A....	52·02	per cent. of the whole was collected in	2	30
Portion B....	24·11	,, ,, ,,	2	20
Portion C....	23·87	,, ,, ,,	9	40
	100·00		14	30

It will be seen that the greater part came off within the first two hours and a half; but the process lasted *fourteen hours and a half*, and was not entirely over at the end even of this time. The heat had been gradually raised from dull redness to something nearly approaching whiteness at the end of the time; and when the experiment was stopped very small but still perceptible traces of gas were still coming off, though their appearance was immediately arrested whenever the temperature was allowed to fall but a little below the high point which had been reached.

The piece of iron taken out from the tube when it had become quite cold was found glazed by a thin film of fused phosphide of iron and nickel (Schreibersite), thickest on the edge which had been lowest, this phosphide having oozed out from the mass at the very high temperature used.

The tubes used to collect the gas during the first portion of the time occupied in the experiment were found slightly moistened on the inside, and the moisture, which had a distinctly acid reaction, was proved to contain hydrochloric acid, this having no doubt been derived from the chlorine existing in the iron in combination with that metal and with nickel.

Careful analysis of the gas yielded the following results by volume for the three portions separately collected: the fourth column of figures, obtained by summing up the three which precede it, gives the percentage composition of the whole of the gaseous matter extracted from the iron :—

	Portion A.	Portion B.	Portion C.	Total gas.
Hydrogen	22·12	10·52	3·19	35·83
Carbonic oxide	15·99	11·12	11·22	38·33
Carbonic anhydride .	7·85	1·02	·88	9·75
Nitrogen	6·06	1·45	8·58	16·09
	52·02	24·11	23·87	100·00

Other gases were tested for, but none could be found; no free oxygen could be detected, nor any compound of carbon and hydrogen.

From these figures it appears that hydrogen maintains about the same proportion to the other gases in A and B, but diminishes largely in C, that carbonic oxide increases in amount in B as compared with A, but remains about the same in relative amount in C, that carbonic anhydride diminishes throughout the whole continuance of the experiment, and that nitrogen falls off in B as compared with A, but largely increases again in C.

Contrasting the results with those of Graham, and noticing first the total volume of gas obtained from the iron, it becomes necessary to reduce this volume to the same standards of pressure and temperature employed by him. In the paper read before the Royal Society, as reported in its 'Proceedings,' I find no statement in regard to such standards; but, supposing it probable that the barometer at 30 inches and thermometer at 60° F. were referred to, I have calculated the volume of gas obtained in all from 15·87 cub. centims. of iron as equivalent under these conditions of pressure and temperature to 50·40 cub. centims., or 3·17 times the volume of the metal. This is a somewhat larger quantity than that of Graham, namely 2·85 times the volume of the Lenarto iron used; but the time of heating was longer in the experiment now described, and the temperature attained probably much higher.

As to the nature and relative amount of the constituent gases, the results differ very noticeably from those of Graham, as is evident when the figures of the two analyses are placed side by side:—

	Lenarto iron.	Augusta Co., Virginia iron.
Hydrogen	85·68	35·83
Carbonic oxide	4·46	38·33
Carbonic anhydride	——	9·75
Nitrogen	9·86	16·09
	100·00	100·00

The gases obtained in the experiment now in question agree more nearly with those of common wrought iron (clean horseshoe-nails) as found by Graham*, viz. in the first portion collected,—

Hydrogen	35·0
Carbonic oxide	50·3
Carbonic anhydride	7·7
Nitrogen	7·0
	100·0

and the conclusion arrived at by him, that "the predominance of carbonic oxide in its occluded gases appears to attest the telluric origin of iron,"

* *Loc. cit.*

would deny to the Virginia specimen the right to be classed amongst meteoric masses, with which, however, all its other physical and chemical characteristics agree most fully.

It is to be noted that the analysis of the gases from the Lenarto iron was not made with the whole of the gaseous matter collected: the first portion, amounting to about 32·5 per cent. of all collected, was used for merely qualitative examination; the second portion, 57·6 per cent., was that fully analyzed; while no mention is made of the disposition of the remaining third portion of 9·9 per cent.; and it is stated that the iron was not fully exhausted at the end of two hours and thirty-five minutes, for which time only the experiment was continued. In my own experiment it appears probable that the amount of hydrogen (and with it the total volume of gas) has been slightly diminished by its union with chlorine of metallic chlorides to form the minute quantity of hydrochloric acid observed in the faint film of moisture on the sides of the first tubes; and probably also this moisture itself may have been caused by the partial reduction, by means of hydrogen, of carbonic anhydride to carbonic oxide. Although it might be assumed, especially in view of the strong tendency of iron to take up and "occlude" carbonic oxide, that this gas had been the original form in which the gaseous carbon compounds obtained existed in the iron, and that it had in part broken up at the temperature of the experiment into carbon (remaining united with the iron) and carbonic anhydride (which escaped as gas), yet, in view of the steady decrease in the quantity of this latter gas collected as the experiment proceeded and the temperature became higher, and bearing in mind the ready decomposition it undergoes in contact with ignited iron, it seems more likely that a larger amount of carbon originally existed in the iron in this higher state of oxidation than appears from the figures of the analysis. Although the proportion of hydrogen found is so much less in the Virginia than in the Lenarto iron, it yet represents for the former about 1·14 times the volume of the iron itself, whereas common terrestrial iron occludes but about ·42–·46 of its own volume under ordinary pressure.

I am quite satisfied, from the condition of the masses of iron as they came into my hands, and especially from the character of the crust, that the metal has not been subjected to any heating in a blacksmith's fire or otherwise by human hands since it was found, as has sometimes happened to similar specimens in the endeavour to discover their nature, or to make use of them.

Whether or not this analysis be considered as furnishing presumptive evidence of the Virginia iron having come to our earth from a different atmosphere to that of which the Lenarto meteorite brought us a sample*, the result differs so far from that of our sole previously recorded determi-

* Some of the observations of Secchi and Huggins seem to render it probable that carbon may play an important part in some regions of the universe, though the results on this head are not as full or satisfactory as those in reference to hydrogen.

nation of the kind as to make it a matter of much interest that a larger number of meteoric irons from various localities should be subjected to careful examination in the same direction, thus supplementing our knowledge of the fixed constituents of these curious bodies by a study of their gaseous contents.

III. "On the Structure and Function of the Rods of the Cochlea in Man and other Mammals." By URBAN PRITCHARD, M.D. Communicated by Prof. LIONEL BEALE, M.D. Received April 18, 1872.

(Abstract.)

The ear is, it is well known, one of the most complicated organs of the body, consisting of the external, middle, and internal sections, the two former being concerned in collecting and conducting sounds or vibrations, while the duty of the internal portion consists in receiving, localizing, and clearly distinguishing them. It is simply with this last function of the organ that I purpose to deal, my aim being to describe the true construction and use of the cochlea, so far as its task of distinguishing the various sounds is concerned. This cochlea, it must be borne in mind, consists of a spiral canal, in form and shape very similar to the inside of a snail-shell. From the axis of this spiral, there proceeds horizontally a plate of bone, the lamina spiralis, almost dividing this canal into two; from this plate, again, there extend two membranes, the membrane of Reissner and the lamina spiralis membranacea, as far as the walls of the canal, thus separating it into three minor canals.

Between the layers of the membranous spiral lamina are situated the so-called Rods of Corti. These were first discovered and described by the Marquis de Corti; and although since then many observers have studied the subject, yet scarcely two investigators are agreed as to their exact form.

Deiters has published the results of two investigations, in which the form of the rods is differently described; Kölliker, Henle, and others appear to agree with Deiters's later view, and most of our text-books have copied their drawings. Recent writers, such as Dr. A. Böttcher, Waldeyer, &c., give varying drawings, some of which are nearer the true form of the rods than that of Deiters, while others exhibit them in all kinds of extraordinary shapes.

In a general view of the rods from above, they appear similar to two rows of pianoforte-hammers, rather than like the keys of that instrument, to which they have been likened. In a lateral view, these two rows of rods are seen sloping towards each other, like the rafters of a gabled roof. The rods consist of a shaft and two enlarged extremities, but the two rows differ considerably in form; the inner rods are attached by their