striking examples of word-blindness have been recently reported by Dr. James Hinshelwood (Lancet, February 8, 1902, page 358), who has already made several contributions to this interesting subject. In one of the present cases a man familiar with four languages was found almost totally word-blind to one, less word-blind to two, and not at all word-blind to the fourth. The explanation of this strange phenomenon is thought to reside in the fact that only a portion of the center in the cerebral cortex—probably situated in the supra-marginal and angular gyri of the left hemisphere in right-handed persons—in which are lodged the word-visual images of language is destroyed, the cells sub-serving the function for each language forming separate groups. It has already been observed that a patient familiar with two languages may be word-deaf to one and not to the other, and an analogous explanation is probably applicable also here. In the second and third cases of word-blindness the patient could read printed letters quite well, but written letters with difficulty if at all. There was little interference with the reading of figures in these two cases, as well as in the fourth, in which there was complete word-blindness and also letter-blindness and an inability to designate by name objects seen, although these were apparently recognized. The first patient retained the power of reading musical notes.

In the second and fourth cases there was right lateral homonymous hemianopsia. The frequency with which this association has been noted suggests that the centers for visual memory and for the right halves of both visual fields, or the paths to them, must lie close together, and this inference is confirmed by pathological evidence. The question as to recovery from word-blindness depends upon the nature and the situation of the causative lesion. If this be destructive, recovery is quite out of the question, except in so far as the opposite hemisphere can be educated to take up the lost function. Whenever syphilitic infection is even suspected a vigorous course of mercury and iodid should be instituted.—Medical Record.

NEW TREATMENT OF NIOBITE—PREPARATION AND PROPERTIES OF CAST NIOBIUM.

From the French of M. Henri Moissan. Memoir presented to the Académie des Sciences.

The study of the metal niobium is still very incomplete, and we are unacquainted with its characteristics. Henry Rose endeavored to prepare this simple body by decomposing potassium fluoxyniobate by sodium. According to Delafontaine, the black powder obtained in this reaction is only a lower oxide of niobium. In the course of his valuable experiments on the fluorine compounds of niobium and of tantalum, Marignac studied this question. He first reduced potassium fluoniobate by sodium and collected a powder of blackish or grayish color, having a density varying from 6 to 6.6, which he regards as a hydride of the formula NbH. He then reduced potassium fluoniobate by aluminium and obtained an alloy of niobium and aluminium approximating the formula NbAl$_3$. Lastly, M. Roscoe, by the reduction of niobium chloride in a current of hydrogen, obtained a powder of a grayish color, having a density of 7.06, and not containing more than 27 per cent of hydrogen.

Treatment of Niobite.—My experiments were commenced with a niobite of American origin, having a density of 5.75. It was in the form of massive clustered and interlaced crystals and contained niobic and tantalic acids, 83.20 per cent; iron, 7.58; manganese, 3.82; also a small percentage of silicon. This niobite, crushed coarsely, was picked out by hand, so as to eliminate the pieces rich in silica.

The mineral, reduced to powder, received an addition of burnt sugar, was then massed together by pressure and heated in the electric furnace from 7 to 8 minutes with a current of 1,000 amperes under 50 volts. During the experiment, the whole of the manganese and the greater part of the iron and silicon were volatilized. There remained a melted mass of clear gray color having crystalline fracture, and containing all the niobium and tantalum, combined with carbon, without free graphite. This fused mass contains 2.18 to 2.34 per cent of carbon. Each preparation may yield 600 grammes.

The alloy was reduced to a coarse powder and subjected to the action of a solution of pure fluorhydric acid, increased with a small quantity of nitric acid. After filtration, the liquid was treated with the fluorhydrate of potassium fluoride, in such a manner as to produce, along with the tantalic acid, a fluotantalate, and, with the niobic acid, a fluoxyniobate. These two salts were separated, on account of their difference in solubility, by following exactly the delicate method described by Marignac. The small amount of iron in the fluoxyniobate was precipitated by ammoniacal sulphydrate. The potassium fluoxyniobate was purified by successive crystallizations. When the heating of the niobite and carbon has been well managed in the electric furnace, the fused mass ought to yield, by solution in fluorhydric acid, a colorless liquid. If any manganese remains, a brown solution is formed, which is due to the action of the fluorhydric acid on the manganese carbide.

The potassium fluoxyniobate was converted into niobic acid which, after calcination, is perfectly white.

Preparation of the Niobium.—A mixture of niobic acid, 82 per cent, burnt sugar, 18 per cent, corresponding to the formula Nb$_2$O$_5$+5 C=2 Nb+5 C O, was slightly moistened with turpentine pressed into the form of small cylinders, and slowly calcined in the Perrot furnace. A certain number of these cylinders were then arranged in a charcoal boat, placed in a tube of the same substance in my electric furnace. The time of heating is very short. With a current of 600 amperes and 50 volts, it ought to be about three minutes. The decomposition is violent. The niobic acid is fused rapidly, and the reaction takes place with an intense effervescence. As soon as this ceases, the heating is stopped. After cooling, the boat contains a well smelted ingot, slightly adherent to the graphite and having a distinct metallic cleavage.

Physical Properties.—The cast niobium is quite hard; scratches glass deeply and quartz easily. It has been

impossible to liquefy it with the oxyhydrogen blowpipe. Its fusing point is therefore above 1,800 deg. In the electric furnace it is easily liquefied.

Chemical Properties.—Cast niobium, heated slowly in an atmosphere of fluorine, becomes incandescent and yields copious white fumes of a volatile fluoride. At the temperature of + 205 deg. it is attacked by chlorine, with intense discharge of heat, and the volatile niobium chloride, Nb Cl$_5$, of a golden yellow color, is produced. Bromine vapor attacks it at a slightly higher temperature, producing a yellowish sublimate. At the fusing temperature of glass iodine has no action.

The cast niobium, reduced to powder, and heated in a current of oxygen, takes fire at 400 deg.; the incandescence is very vivid, and a light niobic acid is formed, which is abundant at the moment of combustion. The action is identical when heated in the air, although the temperature of the combination may be more elevated. Sulphur vapor, at the temperature of 600 deg., attacks it superficially only. Selenium and tellurium have no action upon it at the same temperature.

When this powdered niobium is heated in a current of nitrogen at 1,200 deg., each particle of the metal is covered with a beautiful yellow coating of a nitride of niobium, whose composition will be given later. But, at a temperature of 500 deg. to 600 deg. nitrogen, phosphorus, arsenic and antimony are without apparent action.

The influence of carbon is quite curious. Kept for a short period in the liquid state, in presence of graphite, niobium slowly absorbs carbon, which enters into combination. On heating the niobic acid in presence of an excess of carbon, I have not yet obtained metal containing graphite in excess.

Niobium combines with the metals with difficulty. Sodium, potassium and magnesium may be distilled with it without any combination. There is no combination with zinc. Heated with soft iron at the fusing point of the metal, a small quantity enters into combination. The examination of a polished surface of this alloy of iron and niobium has shown: (1) some pieces of unchanged niobium; (2) some irregular striæ of a combination of iron and niobium, or a double carbide of iron and niobium; a very abundant ferruginous medium serving as solvent.

Gaseous chlorhydric acid attacks the metal below dull red heat, and without incandescence, hydrogen is set free, and a yellowish white nitride is sublimated.

At ordinary temperature, niobium reacts on water; even at 600 deg., steam and hydrogen sulphide have no action on the powdered ingot.

Ammoniacal gas, passing at red heat over this fine powdered metal, is completely decomposed into hydrogen and nitrogen. Niobium in this experiment, does not change in weight, and a decomposition would seem to occur, similar to that described by Messrs. Ramsay and Young.

Sulphurous acid gas is reduced with incandescence at about 600 deg. Nitrogen protoxide, at the dull red, produces a very intense combustion, and a gray powder remains, containing no nitrogen. The reaction is incomplete. With nitrogen dioxide the same result occurs, with a more vivid combustion. Phosphoric anhydride is reduced by niobium at the dull red, with a copious discharge of phosphorus vapors. Carbonic acid gas is decomposed at red heat with production of carbon oxide. Iodic acid and arsenic anhydride are reduced with incandescence at a lower temperature. Chromium sesquioxide, placed in the electric furnace, with ingot of niobium, is easily reduced and yields a brittle alloy of chromium and niobium.

Lead protoxide and bioxide, on the addition of pulverized niobium, deflagrate when slowly heated. The two chlorides of mercury are decomposed at the dull red, with formation of niobium chloride, and mercury is set free.

Cast niobium is attacked by potash infusion; an alkaline niobate is formed and hydrogen is disengaged.

Potassium sulphate is reduced in fusion by niobium, with production of potassium sulphide, and some small blue crystals insoluble in boiling water, appearing under the microscope as small cubes. Potassium chlorate does not react on niobium before its temperature of decomposition is reached, but at this temperature reaction takes place with vivid incandescence. Likewise, potassium nitrate, heated at its temperature of decomposition, yields, on contact, a violent disengagement of nitrous vapors. A solution of fluorhydric acid slightly attacks this metal. On the contrary, chlorhydric and nitric acids have no action, even at their boiling points. Sulphuric acid is not decomposed, cold, by niobium, when reduced to a fine powder. On heating it is attacked very slowly; the acid becomes brown and some niobic acid is precipitated. Niobium is not attacked by aqua regia, but is dissolved rapidly in a mixture of fluorhydric and nitric acids.

Analysis.—Determination of the carbon in the fused niobium has been made by combustion in oxygen. The metal, powdered fine, was placed in a boat and heated in a Bohemian glass tube. The combustion occurred with great facility and was quickly completed. From the weight of carbonic acid collected the weight of the combined carbon may easily be calculated. In all the ingots prepared so far, free graphite has not been met with. Following is the result of analysis of some of the samples: Combined carbon, 3.40, 3.15, 2.95, 2.71, 2.30.

Conclusions.—The employment of the electric furnace allows of obtaining with great facility a fused mass of niobium and tantalum, from which these metals may be separated in the form of oxygenated compounds.

Niobic acid, which was irreducible by carbon at the highest temperature of our ordinary furnaces, and at that of the oxyhydrogen blowpipe, may be reduced in my electric furnace and yield a very hard ingot, containing only a small quantity of combined carbon. This mass, solid at the fusing point of platinum, almost impervious to attack by the acids, having no action at red heat on steam, burning readily in oxygen while producing a stable acid, possesses at the same time some very curious reducing properties. This series of reactions separates niobium from the metals, and places this simple element near boron and silicon.

THE ELECTRICAL AND MAGNETIC PROPERTIES OF IRON ALLOYS.

For the past ten years Prof. W. F. Barrett, F. R. S., of Dublin, in conjunction with Mr. W. Brown, B.Sc., and Mr. R. A. Hadfield, the managing director of the Hecla Steel Works, Sheffield, has been engaged in researches on the electrical and magnetic properties of iron alloys. As each series of alloys was made, the samples were cast into ingots. After rejecting unsuitable pieces, there remained 110 specimens, which were forged into bars, raised to bright-red heat, and rolled out to rods 40 inches long, 0.2 inch in diameter. These rods were tested, and afterward returned to Sheffield for thorough annealing at 1000 deg. Cent. and slow cooling during 100 hours, preparatory to further testing. Of the rods tested, 59 represented binary alloys, 44 ternary alloys, and 7 contained more than three elements, besides iron.

As standards of comparison there were employed hard-drawn electrolytic copper rods, and Swedish iron rods containing 99.89 per cent of iron, and thus only one-tenth per cent of total impurities. Rods and wires of this iron gave practically the same electric conductivity—namely, 16.5 and 16.44 (copper = 100). The resistances were determined by measuring the fall of potential over known lengths of rod; this method indirectly allows conclusions to be drawn as to the homogeneity of the materials. The highest resistance of any commercially useful wire—namely, 97.5 microhms per cubic centimeter—was found in an alloy of iron with 25 per cent of nickel and 5 per cent of manganese. This alloy is also distinguished by its thermo-electric properties and a low temperature coefficient; it is not expensive, and can easily be drawn into wire. An alloy with 15 per cent of nickel and 5 per cent of manganese makes a good material for resistance coils. It is known as resista, or rheostene. Prof. Barrett has used it for over five years, and finds that it has not deteriorated; some users have, however, complained that thin wires of this alloy turn brittle.

Looking at the general result of adding any metal to iron, we see that all admixtures diminish the conductivity, though the additional element—e. g., copper—be itself a better conductor than iron, and that the specific resistance of the element added affords no clew as to the intensity of its effect. Thus aluminium-iron alloys are far worse conductors than nickel-iron alloys of the same percentage, although aluminium conducts three times as well as nickel. Tungsten reduces the conductivity of iron least of all elements tested, and carbon undoubtedly most. The effect of carbon is, in fact, so marked that we can, in the absence of other impurities, guess the carbon percentage from the resistance. In all cases the conductivity curves fall very rapidly at first, and much more slowly afterward. In other words, the effect of a small quantity of any additional element is much stronger than that of subsequent additions to rich alloys. This is, of course, a fairly general rule. But Prof. Barrett arrives at the very interesting conclusion that the specific resistances (column S. R. of the table below) and the specific heats (column S. H.) of the 1 per cent alloys increase as the atomic weights (A. W.) decrease. The following table exemplifies this observation, which is a suggestive novelty so far as the specific heat is concerned:

Iron alloyed with	S. R.	S. H.	A.W.
Tungsten	0.9	0.035	184
Cobalt	2	0.107	59
Nickel	2.5	0.109	59
Chromium	3.0	0.1 (?)	52
Carbon	5	0.113, 0.16	(?)
Manganese	5.2	0.122	55
Silicon	10.3	0.183	28
Aluminium	11.1	0.212	27

Several qualifications have, however, to be made as regards this table. It will be noticed that chromium does not quite fit into the row. Two values are given for the specific heat of carbon, 0.16 (graphite), 0.113 (diamond); what atomic weight we are to assign, we do not know. But the chief point is that none of the materials were pure. Traces of carbon, manganese, and silicon cannot be eliminated. That signifies, in the first instance, that we are uncertain as to the properties of the pure metals—the chemist smiles at the mention of "pure" iron—and in the second instance, that we cannot speak definitively of their comparative effects. Further, none of the iron rods examined contained more than 1¼ per cent of carbon, so that the range of tests of carbon alloys was very limited; and, lastly, the peculiar condition or modification in which the carbon exists in the iron is undoubtedly of influence. For these reasons Prof. Barrett did not embody carbon in the table in which he summarized certain of his results, though he gave the respective figures which we have added to the table; nor did he place cobalt with the other metals. Prof. Barrett states that the cobalt and nickel curves lie close to one another. Further research will probably bring out differences between nickel and cobalt. The chemist has long recognized that the unmistakable resemblance of these two metals is superficial, and consists chiefly in their having both somewhat analogous peculiarities, which may frequently be called irregularities. G. Reichardt is at present investigating cobalt-copper alloys in the Reichsanstalt; and he finds them of little use so far, except for thermo-couples; and magnetically cobalt-copper alloys and nickel-copper alloys differ most decidedly from one another.

Annealing—to return to Prof. Barrett's results—always diminishes the resistance of the alloys, often to a remarkable degree. High-grade manganese steel is hardened by rapid cooling, and softened by slow cooling. Hardness, as a rule, goes with resistance. For his magnetic researches the author found a magnetometer method, making use of the magnetic system of a Lord Kelvin graded galvanometer, on the whole most convenient, considering the length of the specimens and the range of the experiments; Ewing's permeability bridge and the ballistic method were also applied. The length of the rods being about 200 diameters, a correction had to be made for the demagnetizing reaction of the ends. Some rods were turned down to diameters of less than 0.2 inch. The best Lowmoor iron