"It appears to me, that what is wanted is, not a test which will simply tell us whether or not the milk contains more than the normal quantity of water, without giving any indication whether the water has or has not been added to the milk. If this were all, the estimation of the water, by evaporation, would accomplish it; but, what really is required, is a test which will show if the milk has been purposely diluted with water, and, if so, what quantity of water has been added. Such a test, I believe, we have in the specific gravity of the serum, or liquid portion of the milk, from which the casein and fat have been removed by coagulating and straining. The gravity of this liquid I have found to be remarkably constant, ranging, in that obtained from genuine milk, from 1·026 to 1·028; and, by carefully ascertaining the specific gravity of the serum of genuine milk diluted with various quantities of water, we may obtain a standard of comparison which will enable us to say, within a few per cents, what quantity of water has been added to any sample of milk that may come under our notice."

DIVISIBILITY OF MATTER AND SIZE OF CHEMICAL ATOMS.

Atoms as indivisible material elements of unchangeable form, size, and weight, are a convenient hypothesis conceivable in so far as the properties above enunciated are concerned. But any attempt to conceive of them as they really are is futile. Even if we could by improvements in optical instruments render them visible and demonstrate their existence by actual sight there would still be inconceivable things about these seen atoms, differing, as they would, from all other things that we can see, and from each other, not only in size and weight, but in qualities, of which we can have no conception, but which are inferred to exist from the chemical comportment of the elements to each other.

A correspondent has asked in what solution is the extremest division of matter apparent, and the nearest approximation to the size or bulk of the atom made. The first part of this query may be answered; the second is unanswerable, because the size of neither the atomic or molecular intersticial spaces are yet determined, so that if we could determine that a definite number of atoms were mingled with a given number of atoms of another kind we should still lack data for any estimate of their relative size. Assuming them to be spheres with their sides in absolute contact, such a calculation might be made, but all we know of the various states which matter assumes teaches that they do not touch each other.

To answer even the first part of the query would, however, require much research. We shall content ourselves with giving some remarkable instances of extreme divisibility. One three-hundred-and-sixty millionth of a grain of gold may be seen by the use of a microscope magnifying 500 diameters. A grain of copper dissolved in nitric acid will, upon addition of ammonia, give a blue tint to 392 cubic inches of water; one three-hundred-and-ninety-two millionth of which may be seen by the aid of a microscope. The ammonia contained in a small drop of water may be detected though only one part in two hundred thousand by the use of chloride of mercury.

Thompson, the celebrated physicist, has lately been performing a very interesting calculation with a view to determine approximately the size of atoms, the calculation being based upon the phenomenon of capillary attraction, the work performed in overcoming the contractile force of soap bubbles, the kinetic theory of gases (first suggested by Bernouilli, and since worked out by Herapath, Joule, Clausius, and Maxwell), together with the laws of optical dynamics. As the result of these calculations, he concludes that the diameter of gaseous molecules, or atoms of elmentary gases, are not less than 0·00000000007942 of an inch. How much larger than this they may be, he does not tell us in numbers, but he does say that, if a drop of water should be magnified to the size of the earth, and each molecule magnified in the same proportion, the molecules would even then be smaller than cricket balls.

ENTERPRISING JOURNALISM.

The Atlantic Cable dispatch containing a full account of the great battle of Gravelotte sent to the New York *Tribune* and published in that paper on the 24th ult., is probably the longest and most costly dispatch ever sent over the transcontinental wires. It cost the *Tribune* $2,260 in gold. As a specimen of enterprising journalism this is absolutely unprecedented, but it may be surpassed ere the war closes. The slow moving dailies of London and other foreign cities will stand wide-mouthed with astonishment at the absolute disregard of expense shown by their American cotemporaries in obtaining news. We doubt whether any of them ever paid as much for news in an entire week as the *Tribune* paid for this single dispatch.

$20,000 BONUS FOR A NEW PRESS.

The circulation of the New York *Sun* has become so enormous that the publisher, Mr. I. W. England, finds it almost impossible to print the edition. Five presses are now employed for that purpose, but the utmost capacity of either is only equal to printing 17,000 copies per hour.

Mr. England wants a press that can strike off 40,000 copies per hour, printed on both sides, and he authorizes us to offer a bonus of $20,000 for such a press—one that will do its work well. This question of more rapid printing is one that must engage the earnest attention of our inventors, and it seems that the tendency of the *Sun* is in that direction.

THE School of Mines, of Columbia College, will re-open on Monday, Oct. 3. The announcement of Dean Chandler appears in our advertising columns.

SCIENTIFIC INTELLIGENCE.

FUORIDE OF SODIUM.

This valuable reagent can be made on a large scale by fusing 100 parts fluor spar, 140 parts of carbonate of lime, 200 parts of sulphate of soda, and an excess of carbon. The fluor spar is completely decomposed, all of the sulphur remains with the lime as sulphide of calcium, and the flux yields a colorless, pure solution.

The difficulty of obtaining a sufficient amount of material has prevented an extensive use of the fluoride of sodium, but now that it can be easily made it ought to attract more attention. It could be advantageously used for the resolution of many silicates, as it forms insoluble double salts with some of the sesquioxides, and in this way the soluble protoxides could be removed. Take, for example, the beryl, by treating it with fluoride of sodium, the aluminum would combine with the soda to form the insoluble double fluoride of aluminum and sodium (cryolite) while the glucina would be separated in an insoluble state.

Feldspar, treated in a similar way, would, no doubt, leave the potash in an available state, while the aluminum would form insoluble cryolite with the sodium. Fluoride of sodium would prove a valuable flux and reagent in the laboratory.

PLATINIZING GLASS.

R. Bottger recommends the following process: Pour rose mary oil upon the dry chloride of platinum in a porcelain dish, and knead it well until all parts are moistened; then rub this up with five times its weight of lavender oil, and leave the liquid a short time to clarify. The objects to be platinized are to be thinly coated with the above preparation and afterwards heated for a few minutes in a muffle or over a Bunsen burner.

This recipe is much simpler than the one given by us some time ago, and can be easily tried by any one. In order to recover the platinum from defective or broken glass, moisten with hydrochloric acid, and touch the spot with a zinc rod, when the platinum will fall off in thin leaves.

WRITING INK.

According to R. Bottger, a very good copying ink can be prepared as follows: Pulverize 30 grammes of extract of Campeachy wood and 8 grammes of crystallized carbonate of soda, and pour on 250 cubic centimeters of distilled water, and boil until the liquid has assumed a deep red color, and the extract is fully dissolved. Then remove the vessel from the fire, and add, with constant stirring, 30 grammes of glycercin of specific gravity of 1·25, and also 1 gramme of the yellow chromate of potash, previously dissolved in a little water, and 8 grammes of finely-pulverized gum-arabic, also previously moistened with water, and the ink will then be ready for use. This preparation will keep indefinitely in well-stoppered bottles, and there is nothing in it to attack the pens. Manuscripts can be copied by it without the aid of the press, by simply moistening the paper and using an iron knife or the thumb nail. The carbonate of soda prevents the gelatinizing of the ink, and the glycerin is a substitute for the sugar formerly employed.

TO DETECT THE AGE OF HANDWRITING.

Attempts have been made to invent a method for approximately determining the age of any writing. Iron inks suffer a change in process of time, and become yellow, the organic constituents disappear, and the iron becomes more prominent. By moistening the writing with weak hydrochloric acid (1 acid, 12 water) if the ink is old only a faint copy can be obtained, and the newer the writing the plainer will be the copy.

In experiments made by Carre, handwriting 30 years old gave scarcely any impression—an authentic document from the year 1787 yielded mere traces. Soaking the paper in weak hydrochloric acid gives opposite results, as handwriting a few months or a few years old is at once removed by the acid, while old ink has suffered such a chemical change that the acid no longer acts upon it. After the experiment it is well to neutralize the acid by suspending the paper over a capsule containing sal ammoniac. The test appears to be only applicable to writing several years old, and is confined to iron inks.

TO RENDER PAPER WATER-TIGHT.

The ammonia oxide of copper is a solvent for silk, paper, and cellulose. If its action be limited to a few moments it converts the surfaces into a gelatinous mass, and Scoffern proposes to employ this property to render the paper water-tight. If in the mill the endless sheet of paper is made to pass at a proper velocity through the ammonia copper solution, and is afterwards dried and pressed, the surfaces will be converted into a species of parchment, and will be water-tight. The rate of speed for the rollers must be a matter of experiment.

LIQUID GLUE.

Experience has shown that glue undergoes a chemical change when dried in the air, and its adhesive properties are decidedly deteriorated. To avoid this, says Prof. Wagner, in his report for 1869, some of the manufacturers have introduced a pure liquid glue in close packages, which is said to be superior to the dry article. It is prepared by digesting bones in a peculiarly constructed apparatus, and is sold according to a fixed specific gravity, so that the purchaser does not pay for the water, which in dry glue sometimes amounts to 12 per cent. The price is also less than for dry glue.

CEMENT FOR IRON AND STONE.

Glycerin and litharge stirred, to a paste, hardens rapidly, and makes a durable cement for iron upon iron, for two stone surfaces, and especially for fastening iron in stone. The cement is insoluble, and is not attacked by strong acids.

HIGHT AND WEIGHT.

[Condensed from Nature.]

One of the earliest efforts made to obtain anything like a fixed relation between hight and weight was that of Dr. Boyd, who weighed a certain number of inmates in Marylebone Workhouse. He took the hight and weight of 108 persons laboring under consumption, and found they measured 5 feet 7 inches, and weighed 90 pounds. He then measured and weighed 141 paupers who were not consumptive, and found that their average hight was 5 feet 3 inches, and that they weighed 134 pounds.

This subject attracted the attention of the late Dr. John Hutchinson, and he determined to take the hight and weight of all classes of persons in the community. In this way he collected the hight and weight of upwards of 5,000 persons. This list, however, included persons who exhibited themselves as giants and dwarfs, and other exceptional cases. He therefore reduced his instances to 2,650 persons, all of whom were men in the vigor and prime of life, and included sailors, firemen, policemen, soldiers, cricketers, draymen, gentlemen, paupers, and pugilists. This group of cases was intended to make one class as a set off against another, so as to get a fair average.

The following is the result of Dr. Hutchinson's observations:

Hight.		Weight.	Hight.		Weight.
Ft.	In.	lbs.	Ft.	In.	lbs.
5	1	130	5	7	148
5	2	136	5	8	155
5	3	138	5	9	162
5	4	139	5	10	169
5	5	142	5	11	174
5	6	145	6	0	178

Of course the result of these investigations of Dr. Hutchinson can only be considered as approximative, and he himself thought that a larger number of observations would lead to a more perfect law. The fact is, his observations are quite sufficient to establish all that we need, and to show that among a certain set of healthy men his estimate of weight and hight may be regarded as an approach to a healthy standard. It is only where considerable departures from the estimates given by Dr. Hutchinson take place that any particular case demands attention.

If the table is examined, it will be seen that the increase in weight for every inch of hight is a little more than five pounds. In fact, allowing for any error in observation, we may say that Dr. Hutchinson's table is reducible to the law that for every inch of stature beyond 5 feet 1 inch, or sixty-one inches, a healthy man increases five pounds for every inch in hight. If this deduction be accepted, we may very much simplify Dr. Hutchinson's table, and say that, as a rule, a man's weight increases at the rate of five pounds for every inch of hight, and this rule holds good for all practical purposes.

Although this law is approximately good for a certain number of cases, even above and below this table; it is practically found, and especially in the case of children and growing persons, that there is a wide difference of weight at hights below 5 feet.

Attention may also be drawn here to the fact that there will constantly occur in the community instances of persons where either the muscular or bony systems are excessively developed, and who consequently weigh more or less than their hight.

Dr. Chambers gives the hight and weight of certain celebrated prize-fighters, the result of Mr. Brent observations, which makes it very obvious that in certain cases the great weight depends on muscular and osseous development.

	Hight.		Weight.
			lbs.
Perrins	5	9	228
Caunt	6	2	211
Sayers	5	11	158
Barclay	5	11	146
Heenan	5	10	168
Johnson	5	8	187
Slack	5	8	192
Mendoza	5	7	174

The conclusion we come to with regard to these weighings and measurings is that all ordinary departures from the average hight and weight of the body deduced from Dr. Hutchinson's tables are due either to an increase or decrease of the fatty matter or of the adipose tissue in the body. Thus, taking the composition of a human body weighing 154 pounds, and measuring 5 feet 8 inches, it will be found that it contains 12 pounds of fat. It is then mainly due to the diminution or increase of this substance that human beings weigh more or less than the standard weights given in the above table. It will be therefore here worth while to inquire what is the use of fat in the system, and what indications are afforded by the hight and weight of the human body for caution in diet and regimen.

The exact way in which fat is produced in the tissue of plants and animals is not known, but there is evidence to show that it is found very generally in the tissues of plants and especially in the seeds. Oil when used for commercial purposes is mostly obtained from the seeds of plants, as seen in castor oil, rape oil, linseed oil, cocoa-nut oil, palm oil, and a hundred others. As it is found in the seeds of plants, so it is found in the eggs of animals. The embryo of all animals is developed in contact with oil, of which we have a familiar instance in the yelk of the egg of birds. It appears also that the muscular and other tissues grow under the fostering influence of the adipose tissue.

Besides this primary influence on the growth of the body, fat subserves many other purposes. In the first place it seems to be a reserve of material for producing muscular force when needed. Animals grow fat in summer, but as the supply of this material becomes scanty in winter

they lose their fat and get thin. Man himself gets fat in summer and grows thin in winter from the demand on this store for heating purposes. Hybernating animals go to their winter sleep sleek and fat, but wake up in the spring lean and meager, from the loss of fat in maintaining the animal heat necessary for life. Fat is thus seen to be an essential of animal life. Where there is too little deposited for the purposes of life, then serious disease has already commenced or may set in; while on the other hand a redundancy of this deposit may seriously interfere with the functions necessary to life.

It is from this point of view that the value practically of a knowledge of the hight and weight of individuals becomes apparent. When the weight of a person is much below his hight, then it may be suspected that some disease has set in, which may go on to the destruction of life. One of the earliest symptoms of consumption, the most fatal disease of the civilized inhabitants of Europe, is a tendency to loss of weight. Long before any symptoms are present of tuberculous deposits in the lungs, this loss of weight is observable in persons afflicted with consumption. And at this stage a large amount of evidence renders it probable that the fatal advance of this disease may be prevented.

Within the last thirty years a practice has been resorted to with great success of administering to persons losing weight and threatened with consumption, cod-liver oil, pancreatic emulsion, and fatty substances, as articles of food, for the purpose of preventing or arresting the tendency to loss of fat, which obviously results in the production of fatal disease. In fact, it may be stated generally, not without exceptions, that wherever the weight is much below the hight, there the commencement of dangerous disease may be suspected, and precautions taken to prevent the loss of fat. That this treatment has been successful in really preventing disease, and loss of life as the consequence, is the conviction of a host of intelligent practitioners of medicine. At the same time, it should be remembered that it is not only necessary in these cases to administer cod-liver oil or pancreatic emulsion as medicines, but that the consumptive should have recourse to a fatty diet, and should eat butter, cream, cream-cheese, fat and fatty articles of diet.

Obituary.---Samuel V. Merrick.

It is with great regret that we are called upon to record the death of Mr. Samuel V. Merrick of Philadelphia, Pa., the Founder and President of the Franklin Institute, and for many years an esteemed client of this office. A man of inflexible integrity, liberal culture, and great business capacity, he has for a long time been one of the most honored of the citizens of Philadelphia. His connection with the Franklin Institute has made his name familiar to the scientific world.

A meeting of the Board of Managers of the Institute was held to notice his death, and a series of highly complimentary resolutions were passed in relation to the character and acts of the deceased.

We also notice the recent death of T. A. Wasson, the well known car builder, at Springfield, Mass.

Province of Quebec Fair.

The Province of Quebec Fair of 1870, will be held at Montreal, Sept. 13, 14, 15, 16. $15,000 prizes.

American exhibitors are admitted on the same footing as Canadians. An entrance fee of one dollar covers all entries and entitles the exhibitor to four tickets to the grounds. Custom duties to be refunded. It is expected that American manufacturers, stock breeders, etc., will be fully represented. Entries for implements, etc., on or before the 3d September. For further particulars apply to the Secretary, Council of Agriculture, Montreal.

Ridicule.

Sometimes our correspondents make the mistake, in their replies to published letters, of attempting to heap ridicule upon the opinions expressed by other correspondents who happen not to agree with their theories. We are obliged to decline all such letters. Abuse is one thing, fair criticism is quite another, and the latter only is acceptable to us.

WATERING STREETS WITH SALINE SOLUTIONS.—It is stated that, of the two deliquescent salts which have been applied for this purpose--viz., the chlorides of magnesium and calcium—the last-named suits best, the quantity being adjusted at one half a pound per square yard. In 1860 and 1863, the Place Bellacour, at Lyons, France, was (experimentally, and during great heat) watered with a mixture of chloride of calcium and commercial hydrochloric acid, properly diluted in water, the effect being highly appreciated by the inhabitants also on account of the perceptible purification of the air.

How perfectly almanac makers hit it, was verified in the weather word in one of the almanacs against the second Sabbath in August. "Scorching," was its prophecy. It was about the only Sabbath that was not scorching, and was the only one to which it applied that epithet. Thick clothes were its uniform. The almanac guessers should employ better mediums.

CANADIANS can now apply for patents in the United States upon the same terms as citizens. Full information can be obtained by applying to the publishers of the SCIENTIFIC AMERICAN.

IN the year 1811 Kirchoff, a celebrated German chemist, discovered that it was possible to convert starch, by means of sulphuric acid, into sugar.

NEW BOOKS AND PUBLICATIONS.

ON MICROSCOPICAL MANIPULATION. Being the Subject-Matter of a Course of Lectures Delivered before the Quekett Microscopical Club, January–April, 1869. By W. T. Suffolk, F.R.M.S. Illustrated with forty-nine Engravings and seven Lithographs. Philadelphia: J. B. Lippincott & Co.

The microscope and the spectroscope are now leading the way to the interpentralia of Nature's profound mysteries. Not that when all that human mind and human hands can do has been done there will remain nothing mysterious, we look for no such consummation; but to these instruments science is indebted for keys by which it has been enabled to enter whole realms of facts utterly inaccessible without them. But these keys are of but little value unless used in the proper manner. Fortunately for those unskilled, the manipulations necessary to success in microscopy, can be so described in books that an intelligent person may practice the most of them after a few attempts. But that this desirable result shall be attained it is necessary that the book upon which he relies for guidance be prepared, not only by one who understands the use of the microscope in its most approved forms, but is able to convey his knowledge and experience in plain unmistakable language. The book under present consideration is written by a man who ranks high among the many accomplished English microscopists. This is a sufficient guarantee that his knowledge and experience are ample for the task he has undertaken. The pages of the book bear the evidence of his ability as an instructor. The book contains seven chapters, with an appendix and notes, containing full information upon the construction of the instrument, its various parts, their uses, and adjustments; the mechanical processes of glass cutting, drilling, bending, and working of tubes; how to select the various tools and implements, and to keep them in perfect order; how to mount objects dry, in balsam, and in fluid; illuminating apparatus, comprising all the most approved devices for this purpose; polarized light, and its uses in microscopic examination; drawing and micrometry, etc.; six lessons upon the examination of various representative substances, with notes upon various collateral subjects connected with the art of microscopy. The work is handsomely printed and bound, and is really the most practical and complete manual for beginners in this delightful field of science we have ever met with.

THE PRACTICAL AMERICAN MILLWRIGHT AND MILLER. Comprising the Elementary Principles of Mechanics, Mechanism, and Motive Power, Hydraulics and Hydraulic Motors, Mill-Dams, Saw Mills, Grist Mills, the Oat-Meal Mill, the Barley Mill, Wool Carding and Cloth Fulling and Dressing, Windmills, Steam Power, etc. By David Craik, Millwright. Illustrated by numerous Wood Engravings and Folding Plates. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. 1870. Price, by mail, free of postage, $5·00.

See notice in editorial columns.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.

All reference to back numbers should be by volume and page.

M. G., of N. Y., asks whether there would be any power gained by placing a turbine wheel higher in the draft-box—or tube which conveys water to the wheel—than the hight to which atmospheric pressure will sustain a column of water in a tube from which the air is exhausted, at the locality in which the wheel is placed, say, as an outside figure, thirty-three and one third feet above the tail water. We answer, that as all the water below the wheel can do, is by its weight and motion in falling to overcome the pressure of the atmosphere against the flow of the water through the wheel (the same as the condensation of steam in the steam engine removes the pressure of the atmosphere from the advancing piston), it is evident that when the wheel is placed at a hight sufficient to secure this action below the wheel, nothing can be gained by placing it higher. On the contrary, loss must result, from the diminished head above the wheel. In fact there can be no gain in placing the wheel above the level of the tail water, although it may for convenience be raised, without loss, within certain practical limits, varying somewhat with circumstances, but always less than the theoretical hight above specified.

T. S. K., of Ill., and several others, write in regard to the balancing of shafts and pulley systems, all agreeing that pulleys should be balanced separately, if they are to be run together, and also that the heaviest sides should be placed opposite each other on the shaft, so that centrifugal force shall act equally on opposite sides. This would not of course work where the number of pulleys is odd, and each required balancing; nor would it answer in all cases where the number of pulleys is even, as some may need more counterpoising than others. Most agree that the shaft should be large enough so as not to spring by the tension of the belt. One correspondent, however, erroneously thinks this of little consequence. For ourselves, we still adhere to the opinion that where pulleys have wide faces, and thin rims, they should have more than one spider, and the spokes ought also to alternate, so as to prevent springing of the rim. We also would make the arms of the spider straight and radial, instead of bent, or tangential to the hub, as is often done, as we believe a pulley unevenly weighted at the rim, and running at high speed, will maintain its shape better with straight, radial arms.

W. H. S., of Va.—Thin rubber, of the kind you describe, and used for tying over the tops of jars, as well as for other purposes, may be obtained at all the dealers in rubber goods. It is, however, not wholly impervious to water when long immersed, and gases will also pass through it. It will not do to seal fruit jars in this way, unless the fruit be preserved in sugar "*pound for pound*," according to the old rule, in which case a loose cover will be as serviceable as the rubber.

J. D. B., of Pa.—It is impossible, without knowing the exact consistence of the varnish you have invented, to advise you what material added to it will make it dry more rapidly. If the vehicle is alcohol, it ought to dry quickly without such addition; if siccative oils are used, acetate of lead or litharge will make it dry quicker.

H. B. D., of O.—Wheels for ordinary canceling presses are made of composition, and cannot be used for perforating. Perforating stamps should be made of steel, and hardened, and it is better to make the figures separate, and set them in, so that in case of falling or breaking, they can be taken out and replaced.

H. W. G., of Mich.—To clean brass or silver, and polish the same, use aqua-ammonia and rotten stone, followed by rouge, applied with soft leather.

D. S., of Md.—The steam plows in use in this country are very few, and, so far as we know, have been imported from England. We do not think they can be obtained in this country.

F. H., of N. Y.—What is called "lodestone" is simply a species of magnetic iron ore.

G. L., of Kan.—We cannot give you the address of an emery and crocus cloth manufactory.

S. S. H., of Ala.—English flint glass expands 1 part in 1,248 in length, and 1 part in 316 in bulk, in heating from 32° Fah. to 212° Brass expands under the same treatment 1 part in 536 in length, and 1 par in 179 in bulk. Iron, 1 in 846 in length, and 1 in 282 in bulk. These substances will expand nearly in the same proportions for higher temperatures below the point of fusion. Brass melts at 1,650° Fah. Iron at from 1,920° Fah. to 2,910°. Glass requires a very high temperature to fuse it to anything like fluidity. It, however, becomes soft and plastic at a red heat. It varies much in this respect, according to composition, that containing soda being more fusible than those containing potash.

J. F. G., of Mass.—In computing the power and resistance that will produce equilibrium in hydraulic presses or accumulators, it is the *areas of pistons only* that is taken into account, the areas of the supply pipe sections have no bearing upon the subject, other than that if too small they will increase the friction.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.