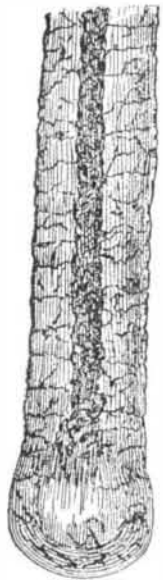
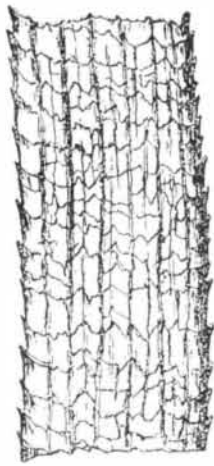


deed of alkali," adds Bowman, "the whole of the surface of the wool, and indeed its substance, is dissolved into a jelly-like mass." Dr. Knecht finds that wool will dissolve in a solution containing less than five per cent. of its weight of NaOH at boiling temperature. I have here micro-sketches of a human hair before and after treating with warm dilute alkali (Figs. 13 and 14).



Before treatment
with alkali.

FIG. 13.



After the treat-
ment.

FIG. 14.

You will observe the projecting and jagged edges of the scales (Fig. 14), indicating corrosion and injury. The same fibers that carried before boiling with water alone 500 grains without breaking, broke after boiling with 480 grains.

In the drying of wool in chambers in the carbonizing process, 121° C. may be used provided the vapors escape, for the rapid evaporation cools the wool, heat becoming latent in the steam at the expense of the fiber.

We see then that pitchy wools and rich merinos, richest, respectively, in wool fat and yolk, *i. e.*, the very finest wools, will be those needing most care in scouring with alkalies or soaps. Yet they are just the wools requiring most and strongest treatment to rid them of the extraneous matters of the yolk. Thus manufacturers have looked about for other scouring agents.

Carbon Bisulphide.—Among them are what are termed the *volatile scouring agents*, such as carbon bisulphide, fusel oil, ether, petroleum spirit, benzol, etc. However, these volatile bodies are solvents for fatty matters, and not for alkaline oleates and soaps. Hence, in conjunction with them, a washing with water must be combined, so as to follow the treatment with volatile liquid.

Bisulphide of carbon has, so far, among these agents received the most favor, as it so very readily dissolves the wool fat, even in the cold.

Bowman says: "Bisulphide of carbon dissolves the suint and fat of wool very easily and completely, without injury to the fiber. The bisulphide may then, when removed from the wool, be driven off at a steam heat, leaving the unchanged fats behind as a residue." However, lime soaps are not removed, and it is a fact that bisulphide of carbon, if hot, leaves the wool yellow, and bleaching will not remove that yellow color, for it is due to sulphur deposited in the fiber.

Hummel (p. 101, "Dyeing of Textile Fibers") says the use of volatile liquids has not yet met with much acceptance, but that the difficulties attending their use have been more or less overcome by Da Heyl, Van Haecht, and others, more especially by T. J. Mullings, yet the process of the latter, who employs throughout a low temperature, is not an unqualified success. A friend of mine who has witnessed and inspected it in operation, tells me that the water run off into the river after the washing which followed the CS₂ treatment had a dreadful odor, and made the river smell for some distance. However, if properly purified by rectification from half-slaked quicklime in powder, it has little or no odor.

Benzol and petroleum spirit have the serious objections that they are specifically lighter than water, and so can neither be so easily displaced by water from the fiber, nor be sealed by a layer of water kept above their surface. Combined with this great mechanical and statical advantage of CS₂, we have the additional one of its volatility, though this, as we shall shortly see, is by no means an advantage under some circumstances.

I have in this paper endeavored to explain the physical and chemical structure and properties of wool fiber and its natural accompaniments, so as to prepare the way for the consideration in the next of the advantages of a rational treatment of the raw wool with a volatile and inert solvent in the cold, along and alternately with water, over the treatment at present in vogue with warm dilute alkalies in the process known as scouring, and I hope to be able to prove to you that a new process just invented and patented by my friends, Messrs. Singer and Judell, fulfills all the demands made by such a rational treatment. The apparatus for this new process is now being constructed by Messrs. Mather & Platt.

(To be continued.)

A CORRESPONDENT of the *British Medical Journal* tells of a drunken doctor in the Alleghany Mountains, who, when in a state of semi-drunkenness, took a piece of ammoniac carb. out of his surgery bottle and chewed it. The effect was almost magical. The contents of the stomach were quickly ejected, the usual depression not following, so that he was able to at once resume his debauch. The remedy has been tried many times since with great success. The drunkard can generally be roused and got to swallow ½ drachm of ammon. carb. dissolved in a wineglass of water, which drunk off will prove immediately effective as an emetic and restorer.

PRINCIPLE OF FORCE AND DEMONSTRATION OF THE EXISTENCE OF THE ATOM.

By HUDSON MAXIM.

CO-EVIDENT with consciousness of our existence are certain truths.

Truth is the exact accordance with that which is, has been, or shall be.

Self-evident truth is that accordance with being which is too simple to require demonstration.

Complex truth is that accordance with being whose evidence requires demonstration.

A complex truth established upon self-evident truths is a concomitant certainty with the primary truths themselves.

There is no difference in truth. Self-evident truth is what, with all conditions necessary to its determination as absolute, is at once within consciousness of certainty. What truth is self-evident to one mind may not be so to every other. The greater the mind, the greater the truths that become self-evident. Some truths that are self-evident to the mind of a Newton, a Darwin, a Spencer, may be far beyond the comprehension of ordinary mortals. An axiom is any self-evident truth.

SELF-EVIDENT TRUTHS.

Axiom 1.—A thing cannot, at the same time, be and not be.

Axiom 2.—That which exists as a composite whole, its parts, as units of the whole, also exist.

Axiom 3.—The whole is greater than any of its parts.

Axiom 4.—Every whole is equal to all its parts taken together.

Axiom 5.—If any part be taken from a whole, there remains such a part of the whole as has not been taken.

Axiom 6.—Division of a body is not annihilation of the body.

Axiom 7.—Nature extends without limit in all directions and contains all bodies, all space, all causes, and all effects.

Axiom 8.—No two solid bodies can occupy the same space at the same time.

Axiom 9.—An absolute solid completely fills the space occupied by its dimensions of extension.

Axiom 10.—No absolute solid can occupy more space than is equal to its dimensions of extension.

Axiom 11.—No absolute solid can occupy less space than is equal to its dimensions of extension.

Axiom 12.—An absolute solid cannot pass through the same space at the same time that it is occupied by another absolute solid. (Axiom 8.)

Axiom 13.—If an absolute solid be taken from a given space, there remains an absolute void of dimensions of extension equal to the solid body taken.

Axiom 14.—Motion is alteration of position or changing of place.

Axiom 15.—Force is any action between bodies which changes, or tends to change, their relative condition as to rest or motion.

Axiom 16.—There exists a certain something which we call matter.

Axiom 17.—There exists an attractive force between different portions of matter which we call gravitation.

ARGUMENT.

Let us take the word nature, as best suited to our use, and consider the term as embracing in its meaning all space, all matter, all causes, and all effects.

It is self-evident that nature must be either all an absolute void or an absolute solid, or consist of both, perfect solids and void spaces.

Nature cannot be all an absolute solid, for in that case all motion were impossible. (Axiom 12.)

Nature, therefore, must be either all an absolute void, or consist of perfectly solid portions of matter and void spaces where matter exists not. (Axioms 9, 10, and 11.) One of these two alternatives must be true. (Axiom 1.)

Nature cannot be all an absolute void, for in that case all force and all motion were impossible; for if nothing existed, there would not be anything to move, or anything for force to act upon, or between. And motion and force are as stated in Axioms 14 and 15.

Hence the only alternative left is that nature embraces spaceless solid units of substance and absolute void where substance exists not. For to demonstrate existence impossible except as claimed, of what is known to exist, proves the truth of the claim.

But let us argue this point a little further.

Let us take at the ordinary temperature of the air, what is termed a *solid* iron ball or sphere.

Now, it is self-evident that the sphere in question must be either all an absolute solid, or all an absolute void, or consists of both absolute solids and void spaces.

If we heat the sphere, we find that it expands, increasing its dimensions of extension in all directions; and on cooling again, we notice that it contracts to its former dimensions as it reaches its former temperature.

During these alterations in size we find that the weight or gravitative force of the sphere toward the earth remains unchanged. Hence the quantity of matter contained in the sphere is neither increased nor diminished. And, as an absolute solid could neither expand nor contract in size (Axioms 8, 9, 10), we know that the sphere in question cannot be all an absolute solid, but must contain void spaces.

We know that it cannot consist wholly of spaces, or else it would be nothing but void. (Axioms 1, 8, 9, 10.) Hence the sphere must consist of both void spaces and spaceless solids possessing certain dimensions of extension in length, breadth, and thickness.

And the dimensions of extension of all the solid atoms plus the dimensions of extension of all the vacant spaces of any body are exactly equal to the dimensions of extension of the whole body; for the whole must be equal to all its parts (Axiom 4), and must require all its parts to complete the whole.

But it is argued that as we know nothing of matter except through force, force may be either a property of matter or matter be but a property of force.

It is self-evident that force is what it is claimed as being in Axiom 15, and hence cannot have being except in being what it is (Axiom 1)—the action or power of something exerted upon something, or action between two or more things or objects.

Therefore, as force can exist only as a condition of more than one thing, if we take away from the ultimate whole wherein force is considered, all of the parts except one, between which the exertion of force exists, we have one part left (Axiom 5), but no force. What, then, must that part be which is left?

The certainty that it exists (Axiom 1 and 5), the certainty that it cannot be force, the certainty that it can be nothing else, demonstrates that it must be absolutely solid substance. (Axiom 4.)

Let us now conceive of but one of these ultimate solid atoms as existing entirely alone in all space, assuming that it alone be all the matter or substance in existence.

It could have no motion in any direction, for space of itself without limit is without direction, and no place in space could have position relative to the rest of space—hence position and place as relative to but space are impossible, therefore, a single ultimate atom existing alone in space could have no motion, as it could not alter its position, having no position or place to change.

Hence, direction, distance, position or place are terms which relate to conditions of existence of more than one unit of existence or atom, excepting as relates to points within its own dimensions, and being an absolute solid, no point within itself can change its position relative to other points. Hence all motion were impossible with an ultimate atom existing alone in space.

The ultimate solid could have no axillary motion, as no point within its dimensions could alter its position relative either to other points in the solid unit or to space.

The conception of a centrifugal force from an axillary motion, as tending to separate the ultimate atom into parts, is untenable, for the ultimate atom being a perfect solid must also be absolutely unbreakable, as well as absolutely incompressible, as will be more fully shown further on.

A single ultimate solid existing alone in space could possess no attracting or repelling force or power—as there would be nothing for it to attract or repel.

Therefore position, place, force, and motion are conditions of existence of more than one ultimate atomic solid.

If we now conceive of another like ultimate solid atom as existing along with the first, an attracting force, or a repelling force, or both, according to distance, and the concomitant conditions of position and motion are possible.

But it is self-evident that as no change can take place in the ultimate solid, the only effect force is capable of producing, and the only force that is possible to exist, is the changing, or tending to change, the condition of the atoms as to rest or motion relative to one another.

Now, if a single ultimate solid existing alone in all space can possess no force, and in itself is incapable of undergoing any change; and if the addition of another ultimate solid along with it adds force, and the conditions of position and motion being the only conditions possible, if we add an infinite number of atoms we have an infinite force, and by infinite combinations of atoms we have infinite manifestations of force, but necessarily of the same force; as the only possible manifestation of force is in the change of the relative condition of atoms as to rest or motion, as all changes must occur outside of the atom, for the atom is of itself unchangeable.

ANSWERS TO ARGUMENTS AGAINST THE EXISTENCE OF THE ATOM.

The principal arguments against the existence of the atom which I have seen are those advanced by Herbert Spencer and by Bosovich. Spencer, in his "First Principles," page 51, says: "Were matter thus absolutely solid, it would be what it is not, absolutely incompressible, since compressibility, implying the nearer approach of constituent parts, is not thinkable, unless there is unoccupied space between the parts. Nor is this all. It is an established mechanical truth, that if a body, moving at a given velocity, strikes an equal body at rest in such wise that the two move on together, their joint velocity will be but half that of the striking body. Now it is a law of which the negation is inconceivable, that in passing from any one degree of magnitude to any other, all intermediate degrees must be passed through. Or in the case before us, a body moving at velocity 4 cannot, by collision, be reduced to velocity 2, without passing through all velocities between 4 and 2. But were matter truly solid—were its units absolutely incompressible and in absolute contact—this 'law of continuity,' as it is called, would be broken in every case of collision. For when, of two such units, one moving at velocity 4 strikes another at rest, the striking unit must have its velocity 4 instantaneously reduced to velocity 2, must pass from velocity 4 to velocity 2 without any lapse of time, and without passing through intermediate velocities; must be moving with velocities 4 and 2 at the same instant, which is impossible."

Spencer here bases his argument on what he supposes to be an immutable law of nature: that a moving body cannot pass from velocity 4 to velocity 2—that is, from a given velocity to a velocity half as great at the same instant.

Let us conceive of a body being projected perpendicularly from the earth in such wise that it shall ascend and descend in the same line. It certainly must stop at the point whence it begins to descend, and as it must move at some velocity until it stops, it must pass instantly from velocity something to velocity nothing, which is as great as from velocity 4 to velocity 2.

For, suppose the force of gravitation were instantly removed at the same instant that the ball was moving at its last degree of velocity, the ball would continue to ascend, and however slowly it moved, would travel a given distance, say twelve feet, in sufficient time, and if it moved with only half that velocity, it would travel six feet in the same time.

Now, a velocity of twelve feet in a given time is to a velocity of six feet in the same time as velocity 4 is to velocity 2. Therefore, to stop at all, a moving body must pass instantly from some velocity to some other equally less as from velocity 4 to velocity 2.

Again, suppose we were to project a body perpendicularly from the earth at the rate of a thousand feet per second.

From the moment it leaves the earth, the attraction of gravitation acting upon it, continually retards its

motion until it stops; and each point throughout the line of its ascent must mark a degree in the reduction of its velocity, and hence it must sacrifice one degree of its velocity in attaining the height of each succeeding point throughout the entire line of its ascent until it comes to a stop.

Now let us project a like body from the earth in the same manner and with equal force; but let us conceive of a gravitative force twice as great, which, acting upon the ascending body with double the retarding force exerted upon the first body, would bring it to rest at half the height attained by the first body.

Hence it must instantly lose twice as much velocity at each point of its ascent as did the first body. It must instantly lose twice as much velocity in the same time as did the other body when acted upon by the lesser gravitative force.

Therefore Spencer's argument amounts to nothing; for what he claims as impossible is so simple a truth that it may well be considered an axiom, as follows:

A moving body encountering a resisting force instantly loses such velocity as is exactly equal to the resisting force it at each or any instant encounters.

The theory of Boscovich is substantially that the constituents of matter are centers of force or ultimate units of force, points without dimensions which attract and repel one another in such wise as to be kept at specific distances apart. That is, that matter is but an attribute of force, instead of force being an attribute of matter.

We have already demonstrated this theory impossible. However, let us for argument's sake conceive of one of these force centers of Boscovich as existing entirely alone in all space, as we have already considered the ultimate solid.

Now it is self-evident that force as stated in Axiom 15, "is any action between bodies which changes or tends to change their relative condition as to rest or motion," and as a thing cannot be, and not be, at the same time, it is certain that force cannot be, where it can have no effect or tendency to induce change.

Now a single force center or unit of force existing alone in all space must still exist as force if it exist at all, and existing alone, there would be nothing but itself as an object of its action or tendency; and as force can exist only as action or tendency to induce change, the claim that a unit of force could exist alone is untenable, for it could so exist only in action or tendency to produce itself, which already existing would negative the possibility of such action or tendency, and consequently negative the possibility of a unit of force existing alone, and the possibility of any truth in the force center theory.

But it is asked in argument by disciples of Boscovich, if matter be composed of solid units of substance, what is it that holds together the parts of that body if it be not a cohesive force? And if one of these solid bodies were sundered by a sufficient force, what, but a cohesive force, would hold together a fragment into which it might thus be broken? And so on until we come to centers of force without any dimension.

Division of a body is not annihilation of the body, and no matter how far we carry division in thought, or how far conceive of possibility of carrying it, still a whole must be equal to all its parts taken together; and however infinitely small the parts into which a body may be divided, still the sum of the dimensions of extension of all the parts taken together must equal the dimensions of extension of the original whole; and thus any part, however small, must have dimensions of some extent.

The fact is, our ideas of breaking and separating of bodies are but our impressions from associated ideas. Could we possess infinite powers of vision, we would see that what we deem breaking of substance is in all instances but a moving apart of different substances, the same as the moving of a stone from the earth by lifting the stone, and that absolute fracture or breaking into fragments of absolutely solid substance is not in the course of nature or range of possibility.

We have come to reason inductively that all things must be breakable by the application of a sufficient force, and that some force must be sufficient.

Let us see about this. Suppose we conceive of an absolute solid, a perfect sphere in form and of sufficient size to be tangible to our senses.

Let us apply to every part of its surface a force "sufficient" to compress it. It is evidently not compressible. (Axiom 11.)

In the consideration of a force as tending to compress an absolute solid, all forces are equal to one another and hence all equal 0—thus the term sufficient is inapplicable, the same as no time could be sufficient to end eternity, or distance sufficient to extend to the end of space. Nothing could be sufficient to render an impossibility possible.

Let us reverse this force and let there be a force acting upon every point on its surface sufficient to pull an absolute solid asunder; is it not evident that it would be equally as unbreakable as incompressible?

It is self-evident that no force whatever, equally applied to every point of the surface of an absolute solid sphere could compress it. Suppose we reverse that force, and consider force in any degree of amount as drawing equally in all directions outward from every point of its surface, how and where could fracture occur? Being a perfect solid, its cohesive force or tensile strength, if considered in the light of a force or strength, must be absolutely equal throughout every point of its entire dimensions, hence such force could tend to produce no other effect than absolutely equal expansion throughout its entire dimensions. That is, it must expand so that no one point or portion shall be more solid or rarefied than any other—that is, it must expand and still retain itself a perfect solid, which is impossible. (Axiom 10.)

SUMMARY OF DEDUCED TRUTH.

First.—All matter exists in ultimate atomic units of absolutely solid unchangeable substance.

Second.—With but one ultimate atomic solid existing alone in all space, all force, motion, or change of condition would be impossible.

Third.—With but two or three ultimate atomic solids existing alone in all space, attraction, or repulsion, or both, according to distance from one another, would be the only possible forces that could exist. And the only possible change that could be wrought by these forces in the condition of these atoms would be a

change of their conditions as to rest or motion by changing their positions relative to one another. Adding any number of atoms adds no new force, neither makes any new force the more possible, but increases the possibilities of the same force directly as the squares of their numbers, and inversely as the squares of their distances from one another.

Fourth.—The sum of all the forces of all nature at the present moment is exactly that of the sum of gravitative force and of the momentum acquired by its ultimate atomic solid units in their nearer approach to one another, occasioning the passage of matter from a rarer to a denser form.

Fifth.—All events of all history, and all phenomena, and all evolutions of organic and inorganic, animate and inanimate nature during all time, have been exactly those which have resulted from the sum of the combined forces of all the atoms in existence acting upon one another.

Sixth.—Every atom in existence follows a course mathematically exact—that which is determined for it by the combined forces exerted upon it of all the other atoms in existence. And every atom in existence follows a course as mathematically exact under the combined influences exerted upon it as do the heavenly bodies.

Seventh.—Could all the atoms in existence be instantly placed in exactly the same position relative to one another that they occupied just one thousand years ago, possessing the same acquired momentum they then possessed, every heavenly body would again pass through exactly the same change of position relative to one another that they have passed through during the last thousand years, and all would again at the end of one thousand years be in exactly the same positions that they now occupy. And the same with every earthly event, everything would reoccur in the history of men exactly the same, and all things reoccur exactly the same and in the same order as they have occurred during the last thousand years, and we should again all be here, the history of all our lives be the same, and we should all again be actuated by the same influences which determine us to work our own destiny without changing the nature of a single atom or swerving one from its destined course.

There can be no effect without a cause, and there can be no cause which is not itself an effect of a preceding cause. Every effect is a cause for effects exactly equal to itself.

There can be no more effects in nature than are exactly equal to producing causes. And there can be no more causes for effects than is exactly equal to the effects to which nature owes those causes, which are the causes of those causes.

The ultimate atom is the unit of measure of power in all effects.

SCIENCE AT BREAKFAST.

By JOHN MICHELS.

THE sterling goodness of Dr. Johnson's heart, notwithstanding many apparently blunt demonstrations to the contrary, was never more clearly demonstrated than when he remarked to Boswell, "I encourage this house, for the mistress of it is a good civil woman, and has not much business."

The house referred to was the "Turk's Head Coffee House." But coffee houses, nay coffee drinkers, have much changed in outward form since the days of the sturdy old philosopher. The beau and the belle no longer, in picturesque costumes, discourse scandal sipping the Eastern beverage from exquisite specimens of china ware, and tea and coffee, no longer a luxury, are now enjoyed by the toiling millions, and esteemed a blessing by all classes.

Although tea and coffee is universally used by the civilized nations of the world, few understand the natural potent properties of these substances, or even are conscious of their powerful action upon the human system, and as it is a subject interesting to so many, I offer the following sketch, treating of the more important points:

Coffee, tea, and chocolate all contain in common a nitrogenized basis, to which they owe most of their important chemical properties. Tea and coffee even contain the selfsame basis, denominated indiscriminately *theine* or *caffeine*. In chocolate the cocoa principle called *theobromine* is richer in nitrogen than the *theine*.

The chemical constituents of these substances are as follows: While in tea the basis is combined with tannic acid, in coffee it forms a salt, with a peculiar tannic acid containing a greater proportion of nitrogen, which together with tanno-caffeic acid is united with potash into a so-called double salt. Tanno-caffeic acid when roasted develops the agreeable odor of coffee.

Not only the same basis, but also two similar organic acids, one contained in tea, the other in coffee, increase the conformity between the leaves of the former and the beans of the latter.

Legumin, cellulose, gum, sugar, citric acid in addition to oleine, and what is called palm fat, accompany the organic acids and the theine of the coffee beans.

But the tea leaves, apart from the basis and the acids, are composed of albumen, cellulose, gum and wax, the green pigment of the plant and the volatile oil of tea.

This peculiar oil is the principal source of the aroma of tea, by which, in spite of the conformity between tea and coffee, it essentially differs from the latter.

The inorganic constituents of tea and coffee are more or less different. While, in coffee, chlorine, phosphoric and sulphuric acids are combined with potash, lime, magnesia, and oxide of iron, tea contains another inorganic acid besides, consisting of manganese and a large proportion of oxygen.

So much for the chemical constituents of coffee and tea. Let us now examine their peculiar properties and nutritive qualities.

Chocolate, from its large proportion of albumen, is the most nutritive beverage, but at the same time, from its quantity of fat, the most difficult to digest. But its aromatic substances strengthen the digestion. A cup of chocolate is an excellent restorative and invigorating refreshment even for weak persons, provided their digestive organs are not too delicate. Cardinal Richelieu attributed to chocolate his health and hilarity during his later years.

Tea and coffee do not afford this advantage. Albumen in tea leaves, and legumin in coffee berries, are represented in very scanty proportions, for while in the former the albumen is coagulated by boiling water, in the latter the legumin is prevented from being dissolved by the lime with which it is combined.

The praise of tea and coffee as nutritive substances is, therefore, hardly warranted, because, as restoratives for the body, the alimentary principles and not the elements are to be taken into account. The former principle cannot be ascribed to "theine," which is excreted again as urea, with surprising rapidity, and to this swift transformation tea and coffee owe their diuretic action, which is considerably assisted by the warm water of the infusion.

Tea and coffee, though of themselves not difficult of digestion, tend to disturb the digestion of albuminous substances by precipitating them from their dissolved state. Milk, therefore, if mixed with tea or coffee, is more difficult of digestion than if taken alone, and coffee alone without cream promotes digestion after dinner by increasing the secretion of the dissolving juices.

The volatile oil of coffee and the empyreumatic and aromatic matters of chocolate accelerate the circulation, which, on the other hand, is calmed by tea.

Tea and coffee both excite the activity of the brain and nerves.

Tea, it is said, increases the power of digesting the impressions we have received, creates a thorough meditation, and, in spite of the movements of thoughts, permits the attention to be easily fixed upon a certain subject; a sense of cheerfulness and comfort ensues, the functions of the brain are set in motion, the thoughts are concentrated and not apt to degenerate into desultoriness.

On the other hand, tea, if taken in excess, causes an increased irritability of the nerves, characterized by sleeplessness, with a general feeling of restlessness and trembling of the limbs; spasmodic attacks may arise, with difficulty of inspiration in the cardiac region. The volatile oil of tea produces heaviness in the head, first manifesting itself in dizziness and finally in stupefaction.

These symptoms have been called an evidence of a real tea intoxication. Green tea, which contains much more of the volatile oil than the black, produces these obnoxious effects in a far higher degree than the latter.

While tea principally revives the faculty of judgment, and adds to this activity a sensation of cheerfulness, coffee acts also on the reasoning faculties, but without communicating to the imagination a much higher degree of liveliness.

Susceptibility to sensuous impressions is intensified by coffee; the faculty of observation is therefore increased, while that of judgment is sharpened, and the perceptions adopt more quickly certain forms, activity of thoughts and ideas is manifested, a mobility and ardor of wishes and ideas, which are more favorable to the shaping and combination of already premeditated ideas than to a calm examination of newly originated thoughts.

Coffee, also, if taken in excess, produces sleeplessness and many baneful effects very similar to those arising from tea drinking. Coffee, however, produces greater excitement, and a sensation of restlessness and heat ensues. For throwing off this condition fresh air is the best antidote.

Much depends upon the proper roasting of coffee, in which process it loses weight but increases in bulk, two pints of unroasted berries giving three pints when roasted.

Several empyreumatic substances created by roasting produce the reddish or brown color, and the tanno-caffeic acid, altered by roasting, produces the aroma; the sugar loses a part of its amount of hydrogen and oxygen, and is thus decomposed into burnt sugar or caramel.

Liebig states that the berries should be roasted until they are of a dark brown color. In those which are too dark there is no caffeine; and if they are roasted black, the essential parts of the berries are entirely destroyed, and the beverage prepared from them does not deserve the name of coffee. This fact should be noted by drinkers of *café-noir*.

The berries of coffee when once roasted lose every hour somewhat of their aroma in consequence of the influence of the oxygen of the air, the porosity of the roasted berries allowing it to penetrate easily. Liebig recommended a process by which much of this pernicious change can be avoided. "Strew," says he, "over the berries, when the roasting has been completed, and while the vessel in which it has been done is still hot, some powdered white or brown sugar; half an ounce to one pound of coffee is sufficient."

The sugar melts immediately, and by well shaking, or turning the roaster quickly, it spreads over all the berries, and gives each one a fine glaze, impervious to the atmosphere.

They have then a shining appearance, as though covered with varnish, and in consequence lose their odor entirely, which, however, returns in a high degree as soon as they are ground.

After this operation, they are to be shaken out rapidly from the roaster, and spread on a cool plate of iron, so that they may cool as soon as possible.

If the hot berries are allowed to remain heaped together, they begin to sweat, and when the quantity is large, the heating process, by the influence of the air, increases to such a degree that the coffee is permanently damaged.

In this city I have often observed that coffee is roasted to too high a color, and filled into sacks too quickly, before the process of cooling is complete.

The preparation of coffee as a beverage is accomplished by three processes: First, by *filtration*; second, by *infusion*; and third, by *boiling*.

Liebig states that filtration gives often, but not always, a good cup of coffee. When pouring the boiling water over the ground coffee, if done slowly, the drops in passing come in contact with too much air, whose oxygen works a change in the aromatic particles, and often destroys them entirely.

The extraction, moreover, is incomplete; instead of 20 to 21 per cent., the water dissolves only 11 to 15 per cent., and 7 to 10 per cent. is lost.

Infusion is accomplished by making the water boil and then putting in the ground coffee, the vessel being immediately taken off the fire and allowed to stand quietly for about ten minutes.