SCIENCE AT BREAKFAST.

By The Editor.

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 are even 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 nitrogenised basis, to which they owe most of their important chemical properties. Tea and coffee even contain the self-same 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 tannio-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 moreover 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 albumin 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, if tea is taken in excess, it 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 ideals, 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 *caffe-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 a 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 cold 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 is 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 10 minutes.

This method gives a very aromatic coffee, but one containing very little extract.

Boiling is the custom in the East, and yields excellent coffee. The powder is added to the water when cold, and then placed over the fire and merely allowed to boil a few seconds. The fine particles of coffee are drunk with the beverage. If boiled long, the aromatic parts are volatilized and the coffee is then rich in extract, but poor in aroma.

Further, Liebig gives what he calls the best method; this I produce, not because I think the plan will make a coffee acceptable to most palates, but because Liebig speaks highly in its praise, and states that it is without those heating properties, common to most preparations, causing it to be rejected by many in delicate health.

"My method," said Leibig, "is the union of the second and third. The usual quantities of coffee and water are to be retained; a tin measure containing half an ounce of green berries, when filled with roasted ones, is generally sufficient for two small cups of moderate strength, or one so-called breakfast cup; one pound of green berries, equal to 16 ounces, yielding after roasting 24 tin measures (of ½ ounce each) for 48 small cups of coffee.

With three-fourths of the coffee to be employed, (after being ground), the water is made to boil for 10 or 15 minutes.

The one-quarter of the coffee which has been kept back, is then flung in, and the vessel immediately withdrawn from the fire, covered over and allowed to stand from five to six minutes.

In order that the powder on the surface may fall to the bottom, it is stirred around, the deposit then takes place, and the coffee poured off ready for use. In order to separate the dregs more completely, the coffee may be passed through a clean cloth, but generally this is not necessary and often prejudicial to the pure flavor of the beverage.

The first boiling gives the strength, the second addition the flavor. The water does not dissolve more than the fourth part of the aromatic substances contained in the roasted coffee.

The beverage when ready ought to be of a brown black color, somewhat like chocolate thinned with water; this want of clearness in coffee thus prepared, does not come from the fine grounds, but from a peculiar fat resembling butter, about 12 per cent. of the amount the berries contain, and which, if over roasted, is partly destroyed.

In the other methods of making coffee, more than half of the valuable parts of the berries remain in the grounds, and is lost.

"Judging," said Liebig, "as favorably of my coffee as I do myself, its taste is not to be compared with that of the ordinary beverage, but the good effects which my coffee has on the organism should be taken into consideration.

Many persons who connect the idea of strength or concentration, with a dark color, fancy my coffee to be thin and weak, but these were at once more favorably inclined, when I gave it a dark color by means of burnt sugar."

Adulteration of coffee sold in a ground state, is largely carried on, especially of that sold to the poorer classes—out of 34 samples purchased by an English analytical chemist in London, 31 contained chickory, chickory itself being adulterated with all manner of compounds.

There is no falling back, says Dr. Hopall, upon tea and chocolate, as these seem rather worse off than the coffee. Tea is not only adulterated here, but in China, while as to chocolate, the processes employed in corrupting that manufacture, are described as "diabolical." It is often mixed with brick dust to the amount of 10 per cent., ochre 12 per cent., and peroxide of iron 22 per cent., and animal fats of the worst description. while the names "Flake," "Rock," "Granulated," "Soluble," "Dietetic," are merely employed as disguises to cover the fact that they are compounds of sugar, starch and other substances.

The microscope is the most effective instrument in the work of detecting adulterations, the microscopic appearance of coffee and chickory being very distinctive, while the presence of starch granules discovers the particular cereal employed in adulterations.

The adulteration of coffee by the addition of chicory is fraudulent but harmless, chickory containing little that is injurious to the system; coffee indeed is the more active substance of the two; its effects on some delicate constitutions being so strongly manifested, that without a violation of language, it may almost be designated a weak poison.

Some persons positively like the flavor of chickory, others detest it; its presence, however, can be at once detected by its peculiar odor, and if thrown into cold water it imparts a deep tint, which coffee does not.

In conclusion, I offer a useful receipt of Leibig's for preparing coffee in a ground form for special cases, such as marches and journeys, where it is inconvenient to be burdened with the necessary machines for roasting and grinding; by this process its aromatic properties can be preserved.

One pound of the roasted berries is reduced to powder, and immediately wetted with a syrup of sugar, obtained by pouring on three ounces of sugar, two ounces of water, and letting them stand a few minutes.

When the coffee powder is thoroughly wetted with the

syrup, two ounces of finely powdered sugar are to be added, mixed well with it, and the whole is then to be spread out in the air to dry. The sugar locks up the volatile parts of the coffee, so that when it is dry they cannot escape.

Ground coffee prepared in this way, and which lay exposed to the air for one month, yielded, on being boiled, as good a beverage as one made from freshly roasted berries.

I have described the mental influence of tea and coffee; much could be written on their influence upon modern society and civilization.

Anne Boleyn makes mention in one of her letters of having partaken of half a pound of bacon and a quart of beer for breakfast; now, after making due allowance for custom and habit, it must be confessed that modern ladies must rise from their morning meal of a cup of coffee with some bread and butter and an egg, with many different sensations and sentiments to those experienced by the fair Queen after her more masculine repast.

BACTERIA IN THE AIR.

M. Miquel has succeeded in seizing and numbering the spores or eggs of bacteria, and while confirming M. Pasteur's observation, that they are always present in the air, shows that their number presents incessant variations. Very small in winter, it increases in spring, is very high in summer and autumn, then sinks rapidly when frost sets in. This law also applies to spores of champignons; but while the spores of moulds are abundant in wet periods, the number of aërial bacteria then becomes very small, and it only rises again when drought pervades the soil, a time when the spores of moulds become rare. Thus, to the *maxima* of moulds correspond the *minima* of bacteria, and reciprocally. In summer and autumn, at Montsouris, one finds frequently 1,000 germs of bacteria in a cubic mètre of air. In winter the number not uncommonly descends to four and five, and on some days the dust from 200 litres of air proves incapable of causing infection of the most alterable liquors. In the interior of houses, and in the absence of mechanical movements raising dust from the surface of objects, the air becomes fertilizing only in a volume of 30 to 50 litres. In M. Miquel's laboratory, the dust of five litres usually serves to effect the alteration of neutral bouillon. In the Paris sewers infection of the same liquor is produced by the particles in one litre of air. These results differ considerably, it is pointed out, from those published by Tyndall, who says a few cubic centimètres of air will, in most cases, bring infection into the most diverse infusions. M. Miquel compared the number of deaths from contagious and epidemic diseases in Paris with the number of bacteria in the air during the period from December, 1879, to June, 1880, and certainly, each recrudescence of the aërial bacteria was followed at about eight days' interval by an increase of the deaths in question. Unwilling to say positively that this is more than a mere coincidence, he presents further observations regarding it. M. Miquel further finds (contrary to some authors) that the water-vapor which rises from the ground, from rivers, and from masses in full putrefaction is always micrographically pure; that gases from buried matter in course of decomposition are always exempt from bacteria; and that even impure air sent through putrefied meat, far from being charged with microbes, is entirely purified, provided only the putrid filter be in a state of moisture comparable to that of the earth at 0.30 metres from the surface of the ground.

The International Congress of Anthropology and Prehistoric Archæology holds its next meeting at Lisbon, on September 20-29, this year. Several important questions concerning the prehistoric archæology of Portugal will be discussed. Excursions will be made to several places of archæological interest.

DEYER'S ASTRONOMICAL RECORD.

MR. J. L. E. DEYER, of the Observatory of Trinity College, Dublin, has prepared and published *A Record of the Progress of Astronomy during the year* 1879.

This interesting digest is similar in every way to the summaries given for 1877 and 1878 by Professor Holden, in the *Annual Record of Science and Industry*. It was intended originally to add a bibliographical list of books and memoirs on Astronomy published during the year, but for various reasons this was left out. Such a list ought to embrace a longer space of time than a single year, and besides, the "Bibliographie Générale" the publication of which has recently been announced from the Brussels Observatory, is to include the year 1880. Mr. Deyer's paper therefore calls attention to such publications only as appeared to possess more than a passing interest. These are mentioned under the following heads: Spherical astronomy, theory of instruments, celestial mechanics, the sun, the moon, the inter-mercurial planet question, planets and satellites, comets, meteors and meteorites, fixed stars, nebulæ and clusters, photometry, history of astronomy, bibliography; observatories, miscellaneous notes.

Although the number of working observatories in this country is small, the present summary would indicate that these few had been reasonably active, since nearly one-third of the memoir (fifteen out of forty-seven pages) is devoted to the results of astronomical work done in the United States. O. S.

THE LATE MR. GREENE SMITH.

In regard to our statement in SCIENCE for July 31st, respecting Mr. Greene Smith's offer of his collection of specimens of birds to the American Museum of Natural History, we are reminded by Professor Burt G. Wilder, M. D., that shortly after the opening of Cornell University, in 1868, Mr. Smith presented that institution with a collection of 362 birds, mostly from North America, all perfect specimens and finely mounted.

We have authority for stating, that in regard to the present disposition of the late Mr. Greene Smith's collection, for the present, at least, it will remain in the possession of his widow. Mrs. Greene Smith informs us that she will devote her attention to making the collection as complete as possible, by the addition of the specimens now absent; and at some future time when she considers she has accomplished this task, she will present the collection to some institution, where it will be most appreciated, and do the greatest good.

THE use of steel for marine boilers has of late increased rapidly, but if the latest news from the Clyde is trustworthy, steel boilers have failed under the test, and have been condemned. Some eminent marine engineers refuse to use it, but several new passenger steamers have been fitted with boilers of steel, and a grave responsibility has been incurred by their owners.—*Eng. Mech.*