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THE SCIENTIFIC AMERICAN SUPPLEMENT,

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For the Week ending September 29, 1877.

DISGUST.

A remarkable and ingenious analysis of the sensation of disgust and the causes to which it is owing, has recently appeared in the *Revue des Deux Mondes*, over the signature of M. Charles Richet. We regret that our limited space precludes notice of the wealth of illustrative instances which the author brings forward to negative the old saying, and to reach a result which shows that, if "there is no accounting for taste," there is at least a very plausible accounting for *dis*taste. The reasoning, however, of which we have prepared the following summary, is well worth consideration:

There exists in nature, for man as well as for all other living beings, certain substances which are alimentary and others which are not. There exists also a special sense which warns us of the nutritive value of different substances. This sense depends upon the sense of taste. Milk, sugar, and meat are aliments, and taste testifies to the fact, inasmuch as it is agreeably excited by all three. Nor could the contrary be true. Nature could not have inspired us with repugnance for that which should and does constitute our nourishment. Moreover, and besides the sense of taste, by a very simple association of ideas, the senses of smell and sight are affected so that these aliments gratify us both by their odor and aspect.

Co-ordinate with taste exists a totally opposite sense, namely, disgust. This is a sort of pain which, if it is too prolonged or too intense, leads to nausea. But if taken in its restricted meaning, it is simply the perception of a disagreeable odor or flavor. Thus bitter and fetid substances produce disgust. If by an effort of the will we eat such bodies, then nausea supervenes. Similarily sight and feeling may also produce in us disagreeable sensations comparable to the foregoing, so that there may be recognized, first, gustative and olfactory disgust, and second, visual and tactile disgust, all of which produce similar effects.

It is certain that the exterior objects themselves are not inherently disgusting; but are so only in their relation to ourselves. For if our organs were otherwise constituted, we should experience other sensations. Fetidity, bitterness, or ugliness are not essential qualities of objects. Such attributes are a portion of our own perception. This is evident from the fact that certain objects disgust some animals, while the same are a source of pleasure to others. The odor of decomposition is insufferably disagreeable to human beings, yet it is delightful to flies, vultures, and carrion crows. Objects disgusting to one person are not necessarily so to another. Laplace ate spiders and enjoyed them. A king of France sickened at the odor of strawberries. Digger Indians eat grasshoppers. A recent Chinese traveler gives an instance of where the inhabitants, while devouring a meal of decayed fish, turned in violent disgust from roast duck. The toad is to many people repulsive. Yet it is not essentially hideous. "The female toad to the male toad," says Voltaire, "is an ideal of beauty." Nothing is ugly or fetid in nature; but things seem so only because they are in a certain relation with our organization.

Despite the mass of contradictory facts which envelope it, there appears to be an underlying law which connects this instinct of disgust to the instinct of self-preservation. How the first is to be acquired is to be explained only as a fact of heredity. The struggle for existence and natural selection have given to our ancestors an accumulation of instinctive sentiments, each appropriated to the protection of certain organs. Bitterness no more exists in strychnine than does pain in a knife or redhot iron. Yet strychnine seems to be bitter and the knife cut painful; and in these sensations nature provides us with a safeguard against the dangers of both. Similarily, reptiles dangerous to man inspire us with an extreme repulsion. Foul gases and purulent liquids, by affecting the three senses of taste, smell, and feeling, likewise by the disgust produced, warn us of their perils. But instinct is, nevertheless, blind. Quinine, for example, which it recognizes as bitter and distasteful, is often salutary and beneficial.

As a consequence of this hereditary acquisition of instinct, it follows that the substances not met with in nature cannot have any action on our senses if their constitution is totally different from those with which we or our ancestors are or have been familiar. Suppose, for example, that a plant should be discovered containing a dangerous but hitherto unknown alkaloid. As this might have some properties of, and hence the taste of, other alkaloids, such as quinine or strychnine, we should thus be warned; but if, on the contrary, it had all the chemical properties of sugar, then its savor would be sweet, and we could not tell whether it was or was not a healthy and useful aliment. The same is true of artificial bodies: the cyanides and prussic acid are found but in very minute quantities in nature, yet their taste is not disagreeable. Carbonic oxide, a most dangerous gas, is without odor, and is unrecognizable to the senses. It is not a natural product, inasmuch as it is due to incomplete combustion; hence, as it must be artificially made, the ancestors of our race never encountered it.

Besides this law of nocuity, there is another which may be termed that of inutility, as being at the foundation of disgust. Everything useless is revolting. The products of secretion, for example, are repulsive to sight and smell, when the organism rejects them as useless. Milk, on the other hand, is agreeable both in taste and odor.

Disgust, lastly, may be produced by mere recollection, without any actual sensual impression. When we speak of a toad, we think of a toad and the idea may be disgusting; but if, while speaking, we consider the toad from a special point of view, as, for example, its habits, its physiological nature, its use to the farmer, etc., then the sentiment of disgust vanishes. Similarly, in works of art, where the dominant idea may be one which naturally would cause disgust, yet the idea may be so combined with others that the feeling is not experienced, but, on the contrary, the general impression is agreeable.

To sum up, disgust is an instinctive sentiment of self-protection, variable with the species, and according to the alimentation, habits and education of individuals. It is the consequence of heredity, but it is an imperfect instinct, since it judges simply by form and appearance.

ANOMALIES IN THE TEMPERATURE OF THE BOILING POINT.

It has been observed that the mere contact with certain surfaces retards the boiling. For instance, in a metallic vessel water boils with perfect regularity, and at a temperature properly corresponding to the pressure to which it is exposed; the vapor bubbles which develop on all points of the walls of the vessel are very small and follow one another with perfect regularity. In vessels of glass and porcelain, to the contrary, the vapor bubbles develop only at few points, which are always the same. The bubbles are large, and do not follow one another with rapidity. The temperature of water boiling in glass vessels is also higher, often as much as 2° Fah., than the temperature of water boiling in metallic vessels under otherwise the same circumstances.

The boiling of sulphuric acid takes place in glass vessels only with intermittent impulses. The temperature rises above the regular boiling point, until at the bottom of the vessel a large vapor bubble is formed, the appearance of which is always accompanied by a lowering of the temperature. Such irregularities in the boiling are easily avoided by throwing platinum wire on the bottom of the vessel containing the liquid.

Water deprived of air, and enclosed in a glass tube from which the air has been exhausted, boils only at a very high temperature. A water hammer, which is arranged as described, may sometimes be heated to 275° or 300° Fah. without the water boiling; when, however, the boiling commences it is so sudden and explosive that the glass tube bursts in fragments.

Dufour found that a liquid may be heated far above its normal boiling point without actually boiling when it is surrounded with another liquid of higher boiling point, in which it will not dissolve. If water is gradually poured, drop by drop, on linseed oil heated to 220° to 230° Fah., the drops fall slowly through the oil without showing the formation of any vapor, while this only takes place when they come in contact with the bottom of the vessel, when they boil away violently, and steam passes rapidly upward through the oil. By mixing some fatty oil with a liquid may be obtained, which, when hot, has the same specific gravity as water, and in which globules of water, of various diameters varying from $\frac{1}{20}$ to $\frac{1}{8}$ of an inch, will remain suspended without rising or falling. By careful heating the temperature can be raised to 250° and even to 340° before the water commences to boil. When, however, a drop of water so heated comes in contact with the side of the vessel, or with a solid body, such as a wooden or glass rod, it boils at once away with great violence, almost explosive.

That this property is not confined to water but to other liquids has been proved by various trials. So, for instance, when chloroform, which, when heated by itself, boils at 142°, is poured in a solution of chloride of zinc, brought to the same specific gravity by proper dilution, the chloroform globules will remain suspended and the solution of chloride of zinc may be heated to 200° or 212°, before the chloroform will boil; but also here the contact of any solid body will cause it to flash into vapor.

All these phenomena are explained by the fact that liquids adhere very strongly to certain solids, and more to glass than to metal. But that liquids adhere still more to other liquids, even when they do not intermingle (such as water to oil or chloroform), is proved by the last mentioned interesting experiments of Dufour, in which the water globules suspended in a mixture of two oils of the same specific gravity, also demonstrate the mutual adhesion of the water particles, in the same way that in the experiment of Plateau the suspension of oil globules in a mixture of water and alcohol, of the same specific gravity, demonstrates the mutual adhesion of the oil particles. But the experiment of Dufour is the most remarkable, demonstrating as it does how the effect of heat in separating the liquid particles and changing them into vapor needs the contact of solid bodies to be effective, and may be counteracted to a certain degree by withdrawing the liquid from the contact of any solid body, by supporting it floating in another liquid.

SUN SPOTS AND FAMINE.

It has been surmised that some relation exists between sun spots and prevalent weather on the earth, and the theory has been proposed that periodic variations in climate bear some relation in recurrence to the cyclical periods when the sun spots are most or least numerous. Dr. Hunter, Official Director-General of Statistics, has recently directed the attention of the government of India to this alleged connection between the periods of maxima and minima sun spots and the amount of rainfall at corresponding times in the Madras Presidency, where a great famine is now impending. General Strachey, however, in a recent communication read before the Royal Society, after a careful examination of the