IMPORTANT HINTS ON VENTILATION.

BY E. M. RICHARDS, C.E.

[Written expressly for the Scientific American.]

Air is more necessary for our existence than any other substance provided for our use by bounteous nature. Man can live longer when deprived of any other requisite than this; if put into a vacuum, he dies almost as quickly as if shot through the heart, and if compelled to breathe poisonous gas in a concentrated form, the same result ensues. Most people know this, but very few are aware (if we are to judge by their acts) that the partial deprivation or vitiation of the breathed air will cause injury to the health of the individual, no less certainly than the total loss of it will produce death as above stated.

The atmosphere is essentially composed of two gases called oxygen and nitrogen, in the proportion of 1 part of the former to 4 parts of the latter. The oxygen is the portion that supports animal life and combustion; the presence of the nitrogen is required to dilute the oxygen, and prevent its too active properties from affecting us injuriously. At each inspiration a certain quantity of air is taken into the lungs, one-fifth of which is oxygen; this gas, by its contact with the blood, restores its vitality, which was impaired by its circulation through the body, and sends it on again in its never-ending journey, giving life and power to all parts of the frame. When the air is breathed out again, the nitrogen is apparently unchanged, but the oxygen is no longer possessed of the life-giving properties it had before its entrance into the lungs; by combining, in part, with a certain matter in the body called carbon, which comes from the food, it is converted into a very noxious substance—diluted carbonic acid gas. The attempt to breathe this air, when pure, would cause death; taken when largely mixed with atmospheric air, however, it may be inhaled, but the effects produced by it resemble those of apoplexy.

Though we are thus constantly manufacturing a deadly poison, we are, by a most beautiful and benign provision of our Maker, shielded from its bad consequences. The out-going breath is always considerably heated; this makes it lighter, and causes it to ascend over our heads; when we are out of doors it is rapidly carried away, and is in time purified by another process no less beautiful. If our houses were properly constructed, this constant carrying away of the foul products of respiration would always go on, and we should never suffer any more inconvenience from them than when out in the open air. But it seems that it is hard for us to learn nature's laws; for, with an intense stupidity that in future times will appear incredible, we have, almost without exception, constructed our edifices so as to retain that very poisonous gas under consideration, and thus frustrate all its endeavors to rise and fly away from us. It is true that its bad effects are not so readily visible when largely diluted (as is generally the case), especially when we have been much in the habit of inhaling it; but it is none the less surely undermining our health, and laying the foundation for future disease and premature death. Most of the readers of the SCIENTIFIC AMERICAN have read or heard of men losing their lives from going down into wells where foul gas was present in large quantities; but they may not be so well aware that the same gas is likewise doing its deadly work, though more slowly, in ninety-nine out of every hundred buildings in the land. The following are a few examples of the effects of living surrounded by this poison:—

In the Dublin Lying-in-Hospital, in 1781, every sixth child died within nine days after birth, of convulsive disease; but after means of thorough ventilation had been adopted, the mortality in the five succeeding years was reduced to nearly 1 in 20.

In the Island of St. Kilda, in 1838, eight out of every twelve children died between the 8th and 12th day after birth; the great, if not the only, cause being the filth in which they had lived and the noxious effluvia which pervaded the houses of their parents.

Dr. Bell says that an action (brought by the commonwealth) ought to lie against those persons who—either for sale or to rent—build houses containing rooms constructed so as not to allow of free ventilation; and that a writ of lunacy should be taken out against those persons who are willing to occupy them.

Dr. Andrew Combe, the great and popular physiological writer, says that one cause of convulsions is the breathing of impure air; and he gives it as his opinion that bad food and deficient clothing are not to be compared with the constant inhalation of a vitiated atmosphere, for injurious effects on children.

Mr. Carmichael, writing in 1810, stated that the extreme prevalence of scrofula in the Dublin House of Industry, was to be accounted for by the fact that the children always slept in a frightfully impure bed-room, and that the air of the rooms they occupied in daytime was very little better.

Mr. Ritchie, in commenting on the diseases produced by vitiated air on shipboard, states that climate is blamed for every disease that appears in foreign stations; but he declares himself convinced that the want of a thorough method of ventilation on shipboard has, in very many cases, laid the system open to disease, which, in more favorable circumstances, could have been easily removed.

Bandelocque insists that impure air is the true cause—perhaps the *only* cause—of scrofulous disease.

Sir James Clarke gives it as his opinion that the public generally are most ignorant of the bad effects of foul air, and that it is more injurious to the growing body than defective food.

In an English parliamentary report it is stated that when the density of population and the affluence are the same, the rate of mortality depends on the efficiency of the ventilation.

It is the opinion of well-informed physicians that the greatest cause of that scourge of our race, consumption, is the habitual breathing of vitiated air.

Living in a pure atmosphere is just as necessary for the inferior animals as for man. It is stated that the glanders in horses, the pip in fowls, and a disease in sheep, are produced by a want of pure air; and also that £10,000 a year has been saved to the English nation by the army veterinary surgeons adopting a simple plan for the ventilation of the cavalry stables. The writer once knew a groom (said to be an intelligent one, too) who stopped up the foul air escapes of a stable under his charge, because "the circulation of air would injure the horses' coats!" This man was constantly obliged to doctor his horses for one disease or another. It is very likely his air-tight stable had something to do with the sickness of the animals inhabiting it.

Dr. Arnott states that many animals were killed at the Zoological Gardens, in London, by putting them into houses that had only an opening a few inches from the floor; it was like putting them under an extinguisher. Canary birds have been found dead in their cages in the morning after having passed the night hung up at the top of a large curtained bedstead, in which the foul exhalations from the sleepers below were retained. Bees take good care to have their hives well supplied with pure air, notwithstanding that the construction of hives is not favorable to ventilation, by a peculiar method of producing currents of air with their wings—one current to carry out the foul air and one to bring in the fresh. Their plan of operating is said to be highly interesting; they adapt the power of their ventilating apparatus to the existing circumstances of the case, as regards the number of active bees in the hive, the heat of the weather, &c. Bees thus show themselves to be better physiologists than are many of our large manufacturers, most of whose workshops are hardly better than hotbeds of disease on account of the noisome atmosphere within them.

[To be continued.]

REWARDS OF GENIUS.—It affords us pleasure to record the fact that both Stephenson and Brunel—the recently-deceased English engineers—had obtained considerable fortunes, and that they were not, like many other eminent men of by-gone days, suffered to live in poverty. It is related of Brunel that he was worth £90,000 (four hundred and thirty-six thousand five hundred dollars), and that Stephenson's personal estate amounted to £400,000 (one million nine hundred and forty thousand dollars). It is said of Stephenson that he was of a very kind and generous disposition, and that all his old workmen were devoted to him with the deepest affection. He left £10,000 to the Newcastle Infirmary, £7,000 to the Philosophical Society, £2,000 to the Mining College, £2,000 to the Institute of Civil Engineers, £2,000 to the Curate's Society, and a like amount to the Society for promoting Christian Knowledge. The greatest amount he has left to a cousin. He has gone down to the grave, the last of his race.

STATISTICS OF HEADACHE.

The *Medical Times and Gazette* contains some interesting medical data, obtained by inquiries made in the usual course of professional experience, concerning the causes of headache. Of 90 cases cited, 76 were females, a number which establishes pretty strongly the fact testified to by most of the old writers, that females are more frequent sufferers. Of the 76 females, 40 were single. The predisposition in the case of females is believed to originate in the nervous system—susceptibility of nervous disorder being much oftener found in the female than in the male subject. It is likely to exist in organisms which evidence a capacity of so much fineness and delicacy of perception, united with so much proneness to emotional excitement, and in which the functions of organic life are observed to be so readily wrought by passing states of thought, sensation and emotion.

Of the exciting causes, emotional disturbance has the highest number. Out of 90 cases, 53 declared this to be one of the causes of their attacks, 48 also considered that atmospheric states were to be blamed, and 25 specified thunder. In regard to inheritance of the liability, in 19 cases the mother is mentioned, in 9, the father, and in 12, both parents; in all, 40 gave explicit evidence of hereditary predisposition, and a few other mentioned cases in collateral branches. Out of the 90 cases, only 19 blamed their diet. As to the influence of climate, 29 seem very clear that they are least liable to attacks of headache in places where the air is dry and bracing; 6 commend cold atmosphere, and 6 condemn it; 8 praise warm atmosphere, and 3 dislike it; 6 are in favor of sea-air, and 4 are averse to it. Fatigue is mentioned as an exciting cause in 32.

THE GORILLA.—Some years ago, we publisned an account of the first discovery of this, the largest of all the monkey family; and last year we gave an account of the arrival in England of the remains of one of these rare animals in a state of putrefaction and of its examination by Professor Owen. Within a few weeks, M. Du Chaillu, a gentleman who was sent to Africa by the Philadelphia Academy of Sciences, has returned, bringing with him several skins and skeletons of the gorilla, with a large collection of African curiosities, which are now on exhibition at No. 635 Broadway, this city. He says that the statements made by Professor Owen, on the authority of those who caught his specimen, in regard to the intelligence of the animal, are greatly exaggerated; that it does *not* use a club as a weapon, but is, in fact, simply a brute. It is among the most formidable of animals, its arms being as large as some men's legs, and one specimen in M. Du Chaillu's possession measures 8 feet, 3 inches from tip to tip of its fingers when its arms are extended. It looks very much like some of the wild African tribe of negroes, and its skeleton bears a wonderful resemblance to that of a man.

COPPER-SMELTING. — Hitherto all the smelting of American copper ores have been conducted at but three places in our country, namely, Cleveland, Ohio; Baltimore, Md.; and Charlestown, Mass. Another new establishment has been added to the number, which is located at Bergen Point, N. J. Copper ore is being received from Chili, Cuba, Venezuela, Mexico, and various parts of the United States. Two or three mines in New Jersey are being worked successfully; Vermont is doing something like 100 tuns of copper ore per month; Tennessee has valuable copper mines, as yet imperfectly developed; also, Pennsylvania and North Carolina. Connecticut mines are doing nothing at present. Instead of obtaining a large proportion of our copper from Europe, as was the case a few years ago, this valuable metal is now an article of export.

FREE ADVICE TO INVENTORS.—It is the custom, at the office of this paper, to examine models or drawings and descriptions of alleged new inventions, and to give written or verbal advice as to their patentability without charge. Persons having made what they consider improvements in any branch of machinery, and contemplating securing the same by Letters Patent, are advised to send a sketch or model of it to the SCIENTIFIC AMERICAN Office, and obtain the opinion of the publishers as to the prospects of obtaining a patent. Such advice is rendered free by Messrs. MUNN & Co., Patent Solicitors, who have had fifteen years' experience.