

to the impression of great volume which a large well conveys, the fact that a large area is drained being frequently overlooked. A study of the conditions in deep wells in the United States leads the writer to believe that the average amount of water present in

the earth is probably under rather than over the amount estimated. While it is believed that the present estimate of the amount of underground water is fairly close for the earth as a whole, it is to be expected that the amount in certain materials and at

certain localities will depart considerably from the figures given."

The report discusses in detail the factors used in the estimates, and gives a summary of estimates previously made by other investigators.

# OLD AGE AND DEATH

## SCIENTIFIC DEVICES TO WARD OFF DECAY.

BY F. W. BECK.

A SCIENCE of senility has come into being but its doctors disagree. Metschnikoff and Loeb attribute the phenomena of old age to the accumulation of poisonous products of metabolism, which they regard as a pathological process. Ribbert, of Bonn, on the contrary, asserts that the deposition of waste products in the cells is a normal physiological process. The obstruction of the wasting cells with pigment and the accompanying increase of connective tissue are especially marked in the brain; hence brain failure is the commonest cause of death from old age.

Ribbert relies wholly on the microscopic examination of tissues, and appears to ignore the possibility of changes in the chemical composition of the blood, which might cause senility, as other changes produce various diseases. Even if the cell theory of old age is the correct one, it is conceivable that the cells might be induced by external influences to expel their accumulated waste products. A phenomenon may be universal without being normal or inevitable. Almost every human being has one attack of measles, but physicians do not regard measles as a necessary physiological evil which cannot be combated. The decomposition of dead bodies is as universal as old age, yet men learned how to stay the process six thousand years ago.

An American school of biologists, headed by Loeb, is already almost promising centuries of life to future generations. It is not a mere coincidence that the revolt against old age and death comes simultaneously with the attempted conquest of the air, for the possibilities of development of a species would certainly be brought out by change in the medium of locomotion. This is proved by biological history and also in the metamorphoses of insects and amphibia. Hence the infinite capacity for improvement, which man is supposed to possess, should be developed as his conquest of the air progresses. It is still undecided whether such highly developed unicellular organisms as rhizopods, flagellates, and citadel infusoria ever die a natural death.

Dr. Tranjen, of Plevna in Bulgaria, the land of longevity, proposes to make young persons immune to the poison of old age by inoculating them with infusions of the tissues of old persons, and to employ serum obtained from these immunized young persons in the treatment of senility in the aged. He has made experiments with animals and obtained encouraging results. Tranjen's theory contravenes the established biological canon which asserts that the qualities of two multicellular organisms can be combined only by coalescence of reproductive cells, but the assumption that nature is compelled to employ, for the transmission of organic qualities, vehicles as large as cells appears antiquated in this age of electrons and radiant matter, and it is refuted by well established facts. Hybrids between the hawthorn and medlar, the nightshade and tomato, the laburnum and clover have been produced by grafting, and these hybrids exhibit the mingled characters of their parents, as hybrid seedlings do. Furthermore, the elaborated honey, containing glandular secretions, with which bees feed their young is capable of transmitting physical peculiarities to young bees of other varieties.

Nor is rejuvenation of multicellular organisms impossible. A plant of the nightshade family, *Scopolia carniolica*, normally dies after producing seed in May or June. This is certainly a case of physiological, not pathological, senility. Yet the French botanist Daniel rejuvenated dying branches of *Scopolia*, and even caused some of them to bear seed again, by grafting them on certain young tomato plants.

Certain microscopic animal organisms possess the power of spontaneous rejuvenation, as was first discovered by the French zoologist Maupas. The rejuvenation is accomplished by means of a process called conjugation, in which two individuals adhere to each other, exchange part of the constituents of their nuclei, and thereby acquire fresh strength and vitality. This is the habit of the ciliated infusoria which, although unicellular, are of complex and highly organized structure and, according to some biologists, are endowed with intelligence.

By an unconscious analogy with the conjugation of

infusoria man has attempted, from remote antiquity, to replenish the almost exhausted lamp of life with fuel drawn from healthy young bodies. The most harmless form of this practice consisted in sleeping with vigorous young persons of the same or opposite sex, and it may possibly have delayed, by suggestion, the death of the brain. This practice, which was followed even in the Middle Ages, was called "Shunamitism" from Abishag the Shunammite, who thus ministered to David. (I Kings I, 1-4.)

There were other and indescribable methods in which the influence derived from the youthful body was less ethereal and problematical than "nerve emanation," and there is historical evidence that such prominent men as the Duke of Alva and Prince Henry of Bourbon prolonged their lives several years by these methods. These cases appear to indicate that youth, like electricity and radioactivity, may be transmissible from one body to another, but the general practice of such methods would bring about the most grotesque sexual revolution that can be imagined.

Transfusion of blood was also in vogue, and was even recommended by physicians in the Middle Ages as a cure for senility. Even Hufeland discusses this method seriously in his *Makrobiotik*. An operation which often causes death, even when the fibrin is removed from the transfused blood, is too dangerous to be recommended, but an old man willing to sacrifice money and comfort might perhaps derive benefit from transfusion of blood accomplished by a different method. If superficial wounds are made in the flanks of two dogs or rabbits and the animals are bound together with the wounded parts in contact, they grow together and a slow exchange of blood takes place. In this condition of "parabiosis" with another, an animal can survive even the extirpation of so important an organ as the pancreas. Perhaps new life could be infused into an old person by such a Siamese connection maintained for some months with a healthy youth.

Soon after the discovery of radium some meal worms (larvæ of *Tenebrio molitor*) were exposed to the continued action of its rays. Most of the worms were killed, but some survived and continued to live in the larval state through two or three generations of weevils. In human life this is equivalent to prolonging childhood through two centuries. As the cells of insects and of human bodies are governed by the same vital laws, this experiment shows that the medieval search for the fountain of youth was not so absurd and contrary to nature as is commonly assumed.

All that human ingenuity can devise in the way of remedies against death may be compared for effectiveness to a single drop of water falling on a hot stone. A true science of death will not exist so long as we adhere to the naive assumption that all the causes of old age and death are to be sought within the body of the individual. If the law of conservation of energy is true and all things in the universe are connected together, the birth of a child must have an effect upon the longevity of every person on earth. Tables of vital statistics show, though vaguely, that the primal cause of any one man's aging and dying is to be sought in the children begotten by his fellow men. Goette, in 1883, announced, on biological grounds, that "propagation is the sole and exclusive cause of natural death," and Hartmann in his book on "Propagation and Death" (1906) calls these two vital phenomena the positive and negative sides of the same question. Regarded from this universal standpoint the universality of death is a synonym for the ubiquity of propagation, and the possibility of curing old age is tantamount to the possibility of suppressing the production of children. An experiment of great interest from every point of view could be made if all mankind could be induced to abstain from propagation for five or ten years, in order to determine the influence of such abstention upon the death rate.—Adapted from Prometheus.

### CHINESE INCENSE STICKS.

THE following information regarding the manufacture of Chinese joss sticks in the city of Canton was prepared by Vice-Consul-General Willard B. Hull:

The manufacture of joss sticks (often known as punk in the United States) in Canton is quite an extensive industry, and the exports to foreign countries during the last few years indicate an increasing trade in that direction. During 1906 there were 1,598,800 pounds of this article shipped out of Canton, the value of which was \$65,616, United States currency, while in 1907 the exports increased to 2,239,400 pounds, valued at \$104,806. The declared value of exports to the United States during recent years was \$26,175 in 1905, \$3,015 in 1906, \$20,339 in 1907, and \$9,333 for the first nine months of 1908.

Having received several inquiries regarding joss sticks, especially the method of manufacture and the materials used, I recently visited one of the large firms where they are manufactured. I was told that in the manufacture of the best grades the following materials are used in making up a quantity of 30,000 joss sticks, namely:

Pounds.	Kind.	Cents per pound.	U. S. currency.
9....	Sandalwood .....	5	\$0.45
13....	Kung heung wood.....	9	1.17
4....	Cedar .....	4	.16
2....	Sik liu powder.....	3	.06
3....	Rhubarb .....	3	.09
½....	Cloves .....	20	.10
13....	Sheung shek .....	4	.52
11....	Cheap sandalwood .....	4	.44
2....	Yellow powder .....	3	.06
1....	White sugar .....	3	.03
½....	Chinese wine .....	2	.01
30,000	bamboo sticks.....	*50	1.50
	Cost of labor for 30,000 joss sticks .....	*32	.96
Total .....			\$5.55

\* Per 10,000.

Some of the woods used in the manufacture of this incense are found only in China, and therefore no foreign names can be given them.

#### FACTORY PROCESSES—CURRENT PRICES.

The method of manufacture is very interesting. The various kinds of woods used are reduced by hand to a dust with rasps or files. The sugar and minerals used are ground to a fine powder in millstones. The materials, in the proportion mentioned, are then mixed in an urn, Chinese wine being used to moisten them, and are there thoroughly kneaded. When sufficiently mixed the mass is given to the man who rolls the sticks. This person sits before a table sprinkled with sandalwood dust, with a basket in his lap, in his right hand a wooden trowel, and in his left a bunch of bamboo sticks. The mixture is worked down to a body about the size of a large wire, when a stick is put onto the table and with the trowel the substance is skillfully rolled onto the bamboo stick. The alcohol in the wine causes it to dry rapidly and the sticks are ready for packing almost immediately. The workers are paid at the rate of 32 cents United States currency per 10,000 sticks, and an experienced man is able to roll as many as 8,000 per day, while the average is about 6,000 per day.

There are many kinds of joss sticks manufactured in Canton. The best grades are all made on bamboo sticks and vary in size, some being as long as 3 feet, while the shortest are about 1 foot. Others are made in the shape of spirals. The bulk of those shipped to the United States are of the cheaper quality, and are made chiefly of paper or bamboo pulp with nothing added to give it a scent. The market prices f. o. b. Canton of these poorer grades are as follows: With bamboo sticks, 1 box containing 200 bundles, each bundle 10 packets, and each packet 18 joss sticks, per box, United States currency. \$3.70 Without bamboo, 1 box containing 100 packets, each having 24 sticks 19 inches long, per box. 1.00 With bamboo, 1 box containing 400 packets, each having 12 sticks 9½ inches long, per box..... 1.10

The four-masted schooner "Pendleton Sisters" is said to be the only sailing vessel in the world equipped with a wireless telegraphic outfit.