

GENERAL SCIENCE

National Security Lessons From Human Physiology

Dr. Walter B. Cannon, Retiring President of AAAS, Points to Readiness of All Body Parts To Act Together

LESSONS for the security and stability of the nation can be learned from a study of the workings of our own bodies, Dr. Walter B. Cannon, noted Harvard University physiologist, declared in his address as retiring president of the American Association for the Advancement of Science. Dr. Cannon titled his talk, "The Body Physiologic and the Body Politic."

Security and stability, ardently desired by all thoughtful citizens and striven for by statesmen, are indispensable for the individual body, Dr. Cannon emphasized at the outset of his address. Let the body temperature drop below a certain point for even a short time, let the blood content of oxygen or its alkalinity or its sugar concentration fluctuate too far outside certain narrow boundaries, and serious consequences, even death, follow promptly. Yet so great has the unconscious wisdom of the body become in the course of millions of years of evolution that all these vital balances are automatically maintained, with never a need for directing thought on the part of the brain.

Yet, said the speaker, in addition to the regulatory arrangements which work for stability, we should recognize the significant fact that "our bodily organization is set up, as a rule, with a large margin of safety. Except in parts of the brain we are not built on a scant and skimpy plan. For example, we have two kidneys, we need only one; we carry much longer intestines than are actually required; half of the lung area, half of the thyroid gland, more than half of the pancreas can be removed without markedly altering the uniform state of the fluid matrix. When we consider the possible damage to organs by accident or disease this liberal mode of construction is obviously important for the persistence of the organism."

Another highly important factor in maintaining bodily security in an unstable world is its ability to make emergency alterations in its own "internal environment." Realization of danger causes a rise in adrenalin secretion, and this in turn a quick rise in blood sugar concen-

tration, making increased energy available for fight or flight as the situation may dictate. Against smaller foes from the world of germs the body makes its own kind of chemical warfare, with anti-toxins, or the blood recruits increased numbers of its "soldier cells," the white corpuscles.

Key positions and vital labor supplies are recognized by the body, too. In accidents, or during starvation, the most protected organs, and the last to suffer, are the directing brain and the pumping heart.

All of these bodily functions, and others as well, can be studied profitably by the physicians of our body politic, Dr. Cannon suggested. Not, he added, that the analogy should be pushed too far, comparing muscle cells to laborers, bankers to fat cells, etc. More profitable, it would seem, is to think in terms of functional balance, in state affairs as well as in bodily physiology.

Obvious to everyone, Dr. Cannon indicated, is the fact that the body politic is nowhere nearly as well coordinated as the body physiologic. Especially distressing is the lack of internal regulators in the social body. Instead of correcting drifts away from optimum conditions, our tendency as a body politic seems to be to get caught in cumulative difficulties; a run on a single bank starts runs on others, until we are in a financial panic; a period of high production is followed by a time of slump and unemployment. The body politic seems to be chronically prone to chills and fever.

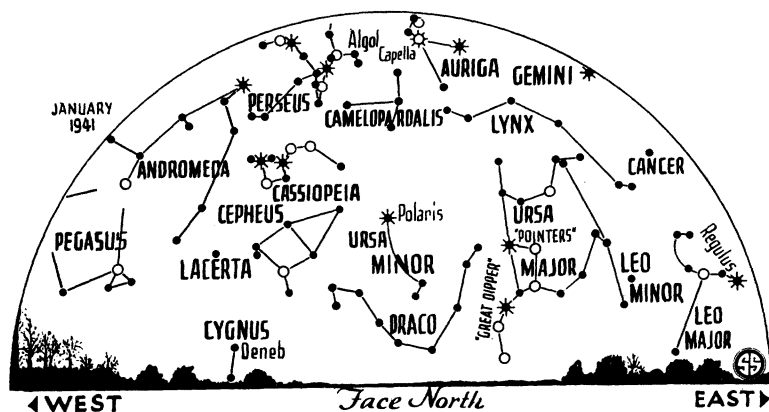
In the nutritional analogy, however, things are a little more satisfactory, Dr. Cannon admitted. We have learned to store surplus food by freezing or heat-sterilizing it, so that the spoilage and waste that used to contribute to later famines have been materially reduced. He also noted with approval the economic measures recently taken by the government which allow the withholding of surpluses in fat periods, for disposal when times become leaner.

"Instant readiness for defense against dangerous and destructive enemies is also suggested by the body," Dr. Cannon continued. "We have noted that, when faced with the necessity of physical combat, almost every part of the organism is almost at once intensely aroused to defensive action and that, for gaining victory, mobilization of the (Turn to Page 408)



NEW SPEED IN PHOTOGRAPHY

Three pioneering photographers are happily trying an innovation of photography, a 1/30,000th second flash outfit that can be carried around by the photographer. Prof. Harold Edgerton is using his new equipment powered by a battery in the case that is slung from his shoulder. It will be six months or a year before this apparatus that Prof. Edgerton is testing on Dr. C. E. K. Mees is put on the market. G. W. Wheelwright, of polaroid fame, is looking on. The photograph was taken at the conference on Photography held by the Carnegie Institution of Washington in connection with their annual exhibit. Dr. Mees, vice-president and director of research of Eastman Kodak Co., answered questions about the Eastman products and how they could be more effectively used by scientists. Prof. Edgerton talked about his high speed flash technique and Mr. Wheelwright showed many of his slides that gave the impression of depth.



we had a piece of this star on earth, we should call it a pretty good vacuum.

Celestial Time Table for January

Friday, Jan. 3, 1:00 p.m., Earth nearest sun—distance, 91,300,000 miles. **Sunday, Jan. 5,** 8:40 a.m., Moon in first quarter; 12:00 p.m., Moon farthest, distance 251,260 miles. **Tuesday, Jan. 7,** 2:11 a.m., Moon passes Jupiter; 7:17 a.m., Moon passes Saturn.

Friday, Jan. 10, 5:00 a.m., Saturn changes from westward to eastward movement through sky. **Monday, Jan. 13,** 6:04 a.m., Full moon. **Thursday, Jan. 16,** 1:04 a.m., Cunningham's comet nearest sun. **Sunday, Jan. 19,** 3:00 a.m., Moon nearest, distance 229,970 miles. **Monday, Jan. 20,** 5:01 a.m., Moon at last quarter. **Thursday, Jan. 23,** 4:48 a.m., Moon passes Mars. **Saturday, Jan. 25,** 3:10 p.m., Moon passes Venus. **Monday, Jan. 27,** 6:03 a.m., New moon.

PHYSIOLOGY

1840 Americans Could Drink Quart of Whisky a Day

Harm From Alcohol Comes From Increasing Calories In Proportion to Vitamin B₁ Intake; Diet Worse Now

THE AMERICAN of 1840 could drink nearly a quart of whiskey (29 ounces) every day and still keep his health and live to a good old age, but the average American of today cannot, Dr. Norman Jolliffe, of New York University, told the American Association for the Advancement of Science.

The immunity of our great grandfathers to the diseases of alcohol was due to their superior intake of vitamin B, Dr. Jolliffe explained. The vitamin deficiency that scientific study has recently demonstrated to be the real basis of the so-called alcoholic diseases, is due not so much to an absolute lack of vitamin B₁ as it is to a vitamin intake which is too low in proportion to the calories. Increasing the calories consumed by experimental animals that are getting too little vitamin B₁, only increases their liability to deficiency disease. Those that eat too few calories are safest.

The average American of drinking age today consumes more than 200 calories every day just from his alcohol in addi-

tion to the non-alcoholic calories in his drink and the calories in his food. This extra 200 calories cuts the important ratio between vitamin B₁ and calories from the alcohol-free 3.32 to 3.13. This means an 18.2 per cent reduction in the already slim margin of safety for this vitamin.

The average American of 1840 had a ratio of 7.2 and a margin of safety of 230 per cent.

It is a mistake, Dr. Jolliffe emphasized, to assume from the recent demonstration of the part of vitamin B deficiency in alcoholic diseases that alcohol itself is harmless—a mistake made by those opposed to drinking as well as those who like it. Although these diseases do unquestionably develop as a direct result of nutritional deficiency, he said, it is the consumption of too much alcohol and too little food that is responsible for the nutritional lack.

The alcohol acts in still another way to cut down the individual's ration of vitamin B₁—by irritating the intestinal tract so that food is lost or avoided.

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internal forces is likely to reach the utmost limit . . . Again observe that security is a primary objective. In a world where predatory nations, powerfully armed, are ready to attack, the ideal of security is not adequately respected. Internal forces are not trained for action. Protective instruments of warfare are lacking. At a time of crisis industry is obliged to begin to construct buildings and design tools and machines to manufacture the instruments which the crisis demands. Compare this unpreparedness with the preparedness of our bodies which through many generations of little use still retain the elaborate reactions of defense."

The physiological balance of the body would further suggest that stability is more important than economy. Excess of water or salt or sugar is thrown away when derangement of a steady state is approached. In personal and governmental practices, also, the principle of preferring security to economy has to some degree been recognized, in fields all the way from peaceful fire insurance and police departments to warlike armies and navies. These are not economical, in the narrow sense, but they are considered worthwhile because they contribute to the safety of the body politic.

The principal of the protection of the most vital organs, even at the expense of others, is observed to some extent in the body politic when national emergencies arise: we keep key men at home and exempt skilled workers and technicians from military duty, and even at the front we shelter the General Staff and the Service of Supply as much as possible.

However, lest this point be stretched in an attempt to justify dictatorships, Dr. Cannon cautioned his hearers against jumping to the conclusion that the brain is the all-dominant, and therefore the all-precious organ of the body. True, the brain can, by implementing an act of will, destroy the body by suicide and the other parts cannot save themselves. But in normal functioning, the whole body cooperates in self-direction, through the hormones or gland secretions that act with, and react upon, the brain and nervous system.

Likewise, in a democratic society, "the diffused functional groups have possibilities of continuing the life of the social organization and of controlling their own circumstances," Dr. Cannon said in conclusion. "When an arbitrary dictator seizes power these possibilities vanish . . . Experience has shown that the social body, like the human body, is integrated

by martial emotions and by preparations for conflict. A dictator, therefore, praises military powers, and rouses martial emotions by pointing to national insecurity or national destiny, and finally drives on to open aggression. Thus he obtains the

support of a unified people. But despotic domination lacks precisely what is required for continuance of despotic rule—provision for replacement by an equally despotic ruler.”

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HISTORY

Christmas Once Celebrated On Sixth of January

In Constantinople in Seventh Century, Date Was On What Is Now Epiphany; Candlemas Was on February 14

EVIDENCE that in the seventh century A.D., the birth of Christ was celebrated on Jan. 6, instead of the modern Christmas date of Dec. 25, has been dug out of ancient chronicles at the Catholic University of America, by Dr. Martin Higgins, a member of the University faculty. This celebration of the Feast of the Nativity on what is now known as Epiphany seems to have been the custom for some time in ancient Constantinople under the imperial successors of Constantine.

The clue to the different date was found, ironically enough, in accounts of a riot. The disturbance was caused by shortage of bread, and the angry mob threw stones at their monarch while he walked, barefoot, in a night procession commemorating the meeting of the aged

St. Simeon with the Christ-Child when he was brought to the Temple in the arms of his mother, 40 days after his birth. This riot occurred on Feb. 14, A.D. 602. Figuring backwards, this would throw the Feast of the Nativity on Jan. 6.

The same feast that caused the poor Emperor all his trouble is now celebrated as the Feast of the Purification, or Candlemas Day, on Feb. 2, when candles to be used in the church for the ensuing year are blessed. The blessing and distribution of candles in seventh-century Constantinople had a different and more direct significance, Dr. Higgins notes, since they were used immediately by the marchers in the procession as it moved through the dark streets.

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PHYSICS

Million-Volt X-Ray Unit Dedicated at G. E. Anniversary

See Front Cover

TAKING a picture through four inches of steel in less than two minutes, a job formerly requiring an hour exposure, is possible with the new million-volt X-ray outfit in the General Electric Company's Research Laboratory, at Schenectady.

This equipment made its debut before a group of scientists, journalists and industrialists who came to help celebrate the completion of 40 years of General Electric research.

Though three similar million-volt X-ray units are in use in hospitals, this is the largest to have an industrial application. Just as the physician or surgeon

is able by X-rays to look inside the body of his patient, so engineers can look into the casting from which, for example, a huge turbine will be made. Defects which might cause failure of the machine, possibly with fatal results, are detected before there is trouble. Up to now the largest industrial equipment in the world is a 400,000-volt unit, which the new apparatus supersedes.

With the 400,000-volt unit, three hours and a half were required to make a picture through five inches of steel. With the new one, only five minutes are required. The exposure time must be increased two and one-half times per inch of steel to be pictured.

The giant unit is housed in a special building of its own. Unique construction features are employed to make it the safest possible building for the operation of high-voltage X-ray equipment. For example, the walls of the structure are of solid concrete, 14 inches thick, plus 12 inches of brick on the interior, making a total thickness of nearly three feet or the equivalent of approximately four inches of lead.

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ASTRONOMY

Soviet Scientists Planning Observations of Eclipse

WHEN the tip of the moon's shadow next strokes the earth, along a path crossing Siberia and China on Sept. 21, 1941, some 200 scientists, in thirty groups at sixteen different points in Russian territory, will be making observations of the total eclipse of the sun. This is revealed in a dispatch just received from Tass, Soviet news agency.

The Soviet Academy of Sciences has set up a commission under the chairmanship of V. Fesenko, to take charge of preparations. A book in Russian and English is shortly to be published giving details of the planned observations, and a discussion of the weather probabilities in the various locations.

“The zone from which the total eclipse will be observable,” Dr. Fesenko is quoted as saying, “stretches from the shores of the Caspian Sea across that sea and the Aral Sea, through the cities of Kzyl-Orda and Alma-Ata, and then on to Chinese territory. The maximum duration of the total phase of the eclipse will be about 2½ minutes.

“The mountains of Kazakhstan through which the zone of total eclipse passes offer excellent points of observation.”

Among the subjects which will be studied, he said, are the Einstein theory of relativity; the sun's corona; its innermost atmospheric layer, the chromosphere; the sudden explosions in the sun that seem to cause electrical and magnetic disturbances on earth, and the zodiacal light, a glowing band sometimes observed near the sun.

To supplement the ground observations, it was announced, some astronomers will ascend high above the earth in airplanes and stratosphere balloons. These should be especially useful if clouds hamper the work of the ground parties.

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