stitute presented mathematical arguments to the effect that photons are really not at all necessary as primary components. Charged particles suffice to explain everything if only one makes certain assumptions as to the way these particles behave. And Dr. Swann has found, by means of mathematics, just how particles must behave in order that the whole body of cosmic ray facts may be clarified on the particle basis alone.

Little is known of the habits of these fast-flying bits of electricity. Some of the characteristics which Dr. Swann has ascribed to them have been observed in the experiments of other scientists. Other traits with which he has endowed them are entirely original suggestions and have not, as yet, been brought to the test of independent experimental check.

Some of the things which must be true of the electrified particles if they are to constitute the whole cosmic ray story are the following:

1. There must be two kinds of particles.

2. As they pass through matter, both kinds must lose energy at a rate which increases as the energy of the original particle increases.

3. Both kinds of primary particles must produce other high speed particles (called secondaries) by collision with atoms in the air; but the facility with which they do this is different in the two kinds.

Crux of Theory

The crux of this theory is the way in which the secondary cosmic rays are treated. The existence of secondaries is a well-known fact. But heretofore they have constituted a sort of "mess" which obscured the real cosmic ray facts. According to Dr. Swann's view, however, they are practically the only thing anyone observes, and, more than that, they can serve to lead the experimenter back to those real facts which lie behind the scene.

Puzzling to physicists has been the scarcity of very high energy particles when cosmic rays were being watched in the Wilson cloud chamber. For it was known from experiments dealing with the effect of the earth's magnetic field that much of the incoming radiation must have energy greater than ten billion volts.

This paradox disappears in Dr. Swann's theory. Compared with the large number of lower energy secondaries, the high speed primaries are very rare indeed. They may be likened to an "unseen hand" which guides the behavior of the secondaries, and it is through the study of these locally generated particles that the true nature of the ones from outer space can be decided.

Science News Letter, September 12, 1936

PHYSIOLOGY

Dr. James Bertram Collip—Pituitary Governs Behavior

THE SMALL pituitary gland located in the head has more to do with man's behavior than any of the other glands, Dr. James Bertram Collip, professor of biochemistry at McGill University, told scientists at the Harvard Tercentenary celebration.

All of the glands have an important influence on behavior, but the pituitary, because of the way it affects each of the other glands and various other organs of the body, has the greatest effect. Dr. Collip explained how the glands and nervous system work together in man and higher animals. The glands themselves are influenced by the nervous system, but the chemicals they produce, known as hormones, may in turn affect the nervous system.

Scientific knowledge of the glands shows how widespread their influence on behavior is, but it does not justify some of the "fantastic" claims that have been made. Dr. Collip warned his hearers against overlooking basic principles in interpreting behavior on glandular grounds.

As an example of the way in which the pituitary gland affects behavior, Dr. Collip cited the case of a wolf-hound puppy studied in his laboratory. Soon after removal of this animal's pituitary gland, it was noted that the puppy, although belonging to a naturally aggressive stock, became extremely timid and stupid in his behavior, which was entirely different from that of a normal wolf-hound puppy. A few days after treatment with anterior pituitary extract, the animal's behavior changed markedly again, so that he became much more like the normal puppy of his breed. The change was so apparent that a worker in the laboratory, unaware that treatment had been started, commented on the unusual activity of the puppy and asked if anything had been done which might account for it.

Even more dramatic was the case Dr. Collip cited to show how more than one set of glands may similarly affect body mechanisms and behavior. This was the case of a man who had diabetes and was having insulin treatment. In this condition it sometimes happens that too much insulin has been given, or not enough carbohydrate food is eaten. The patient then suffers from too little sugar in his blood, has convulsions and will become unconscious unless given some sugar or other carbohydrate at once.

The patient Dr. Collip described was walking down the street one day when he felt such an attack coming on and realized that he had forgotten to provide himself with a chocolate bar for the emergency. He went at once to a drug store and tried to explain to the druggist what he wanted. But by that time his gait was unsteady and his speech incoherent. The druggist thought he was a drunken man and threw him into the street. The patient became enraged at this treatment, promptly recovered, and was able to proceed to another drug store where he made known his wants, obtained what he needed and continued on his way.

In this case, Dr. Collip explained, another set of glands, the adrenals, became activated by anger and released enough of their hormone, adrenalin, to cause an increase of the patient's blood sugar sufficient to restore his equilibrium and powers of speech. The insulin-producing islets of Langerhans in the pancreas are the glands primarily concerned with control of the body's use of sugar, but the case of this patient shows how the adrenal glands also may affect sugar utilization and also behavior.

Science News Letter, September 12, 1936

PSYCHOLOGY

Prof. Charles Gustav Jung—Hunger Most Important

NOT sex alone, but five groups of instinctive factors were listed as the primary motivating forces of the mental behavior of man by Prof. Charles Gustav Jung, of the Technische Hochschule, Zurich, father of "Analytical Psychology," speaking before the scientists gathered at the Harvard Tercentenary Conference.

The instincts, with their compelling power over human behavior, are originally physiological phenomena, Prof. Jung holds, but they may become "psychified" by becoming important as determiners of mental behavior. First among these is hunger.

"No matter how unequivocal the physical state of irritation called hunger may be, the psychic consequences resulting from it can be manifold," Prof. Jung said. Hunger, he explained, can appear as denatured, or even as meta-

phorical. By combination with other factors, hunger can assume the most varied forms. Originally simple, it can appear transformed into pure greed, or into many aspects of boundless desire or insatiability, as for example, the lust for gain or inordinate ambition.

"Hunger, as the characteristic expression of the urge of self-preservation, is without doubt one of the primary and most powerful factors influencing behavior," declared Prof. Jung. "In fact, the lives of primitives are more affected by it and more powerfully, than by sexuality. At this level of existence, hunger means the alpha and omega—existence itself."

Sexuality, like hunger, undergoes a radical "psychification" Prof. Jung said. This makes it possible for the primary purely instinctive energy to be diverted into new channels.

Third among the instinctive factors controlling human behavior is the drive to activity. Under this grouping comes restlessness, love of change, wanderlust, and the play-instinct.

The urge for reflection was listed fourth among these instinctive groups by Prof. Jung. This means an interruption by mental processes to the otherwise automatic impulse-to-action circle. Thus, in place of the compulsive act, there appears a certain amount of freedom, and in place of the predictability a relative unpredictability as to the effect of the impulse, Prof. Jung explained.

Creative Urge

Finally, among these instinctive control groups, Prof. Jung places the creative urge, which is not precisely an instinct but closely allied with them.

"Like instinct it is compulsive, but it is not common, and it is not a fixed and invariably inherited organization. Therefore I prefer to designate the creative impulse as a psychic factor similar in nature to instinct, having indeed a very close relationship to the instincts, but without being identical with any one of them. Its connections with sexuality are a much discussed problem, and, furthermore, it has much in common with the activity-urge as well as with the reflection-urge. Still it can repress all of these instincts, or make them serve it to the point of the self-destruction of the individual. Creation is as much destruction as construction."

Besides these dynamic factors, human behavior is influenced by "modalities" including the age, sex, and hereditary disposition of the individual, which are semi-physiological but not, by any means, wholly so. Then there are three others which are entirely psychological. First among these is the degree to which a person functions consciously or the extent to which he is dominated by compulsive instinctive processes. Next is the extent to which the individual is an extravert or introvert; the extent to which his life is directed outward toward other persons or material things or the extent to which it is turned inward toward his own feelings and experiences. Prof. Jung is the author of this extraversion-introversion conception.

"The third modality points, to use a metaphor, upward and downward, because it has to do with spirit and matter," Prof. Jung thus described the last of the "modalities." "From the existence of these two categories, ethical, esthetic, intellectual, social and religious systems of values eventuate, which on occasion determine how the dynamic factors in the psyche are to be finally used.

"Perhaps it would not be too much to say, that the most crucial problems of the individual and of society turn upon the way the psyche functions towards spirit and matter."

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PSYCHOLOGY

Prof. Jean Piaget— A Moving Picture World

A GLIMPSE into the mental world of the baby and small child was afforded the scientists at the Harvard Tercentenary Celebration when Prof. Jean Piaget, professor of the history of scientific thought at the University of Geneva, described a child's way of thinking.

The little baby lives in a sort of moving picture world, Prof. Piaget's report indicated. He sees his surroundings as a series of pictures that have no permanence, no reality when they pass out of his sight. Almost to the end of his first

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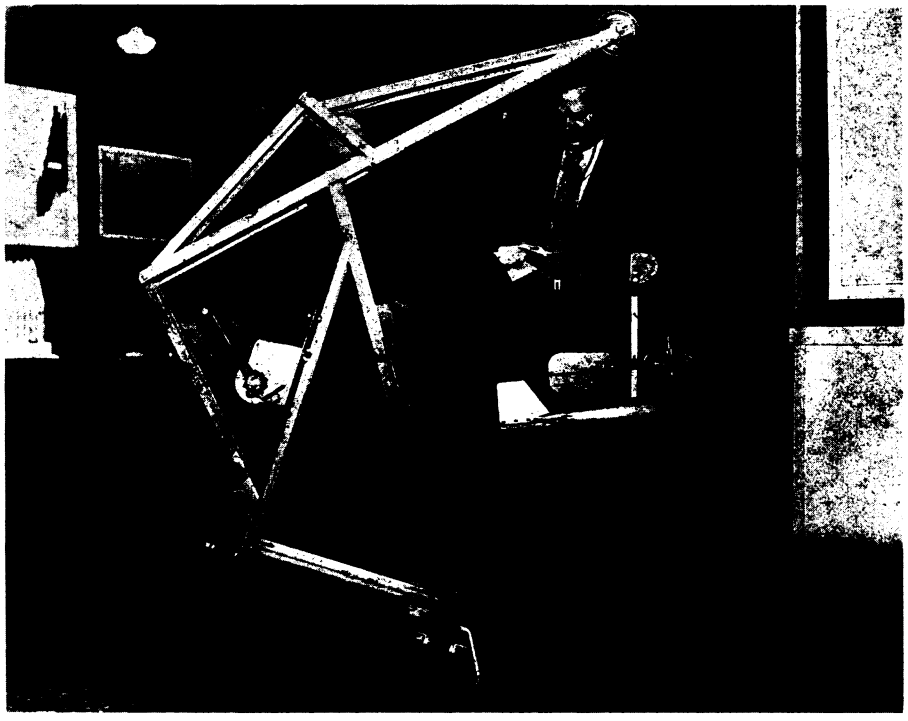

MEASURES FLOW

This object is neither a model seaplane nor a midget torpedo. It is the newest stream flow gaging apparatus on exhibit at the Third World Power Conference in Washington this week. J. G. Bloise, Puerto Rican expert of the Division of Water Utilization, Dept. of Interior, at Guayama, P. R., records the electrical clicks in his earphones as the ring of cups makes one revolution. The torpedo-shaped heavy base of the equipment points in the direction of current flow when placed in the water, while the whirling cups above measure the speed of the stream's flow. The small derrick on wheels rolls along a bridge, in actual use. To fix accurately the stream flow, scientists must not only know the contour of the bottom but also the speed of the current flow at many points so that the "volume" of water can be calculated.