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## The Vital Thyroid Hormone

### It Is Needed for Normal Brain Development And May Be Used to Improve on the Norm

By Joshua Lederberg

THE BIOCHEMISTRY of intelligence has an importance that can hardly be equaled, unless by the science of education. Both sciences have a common aim, perfecting the mind. It is hard to say which is a more perfect vacuum in its content of objective facts, which are obscured by introspection, intuition and speculation.

One rare fact of mental chemistry has been known to medicine for 75 years: the need of the thyroid hormone for normal development of the brain. Many factors are known to influence the thyroid function of a pregnant woman, the fetus and the newborn child.

They include genetic defects in the metabolism of thyroid hormone; infectious and allergic diseases of the gland; iodine in the diet; exposure to anti-thyroid substances in food, or to drugs with inhibitory effects on the gland.

Until we learned how to override these conditions by administering thyroid hormone, this medley of genetic and environmental influences was quite important in child health and above all in the quality of mental development of many children. A gene for thyroid disease was a gene for impaired intelligence.

Today, cretinism is so readily diagnosed and treated, when it appears as a severe disturbance of thyroid function, that it no longer looms

as a major cause of mental retardation.

FAR LESS is known about subtler aspects of thyroid regulation in brain development. From animal experiments, we know that thyroid hormone has a direct effect on the maturation of brain cells and their nerve fibers and is particularly important in the process of myelination. This is the completion of the insulating sheaths of the fibers and is necessary for the rapid conduction of nerve impulses.

Conversely, the function of the thyroid gland is regulated by a complicated feedback loop in which the hypothalamic part of the brain senses the level of thyroid hormone in the blood, integrates this information with data from other brain channels and signals the pituitary gland to secrete a certain level of a thyroid-stimulating hormone.

This exquisite mechanism is obviously vulnerable to many kinds of disturbances, possibly including emotional stresses, the more so as brain development is responsive to the hormone whose level the brain must regulate.

Correct functioning of the thyroid system is not merely a matter of sufficient dietary iodine and an intact thyroid gland, but also of the precision of the computer in the hypothalamus and its control channel through the pituitary.

Little is known of individual variation in this system in "normal" adults, and still less in young children through the critical period of brain development.

IN A RECENT issue of Science magazine, Drs.

Shawn Schapiro and Robert J. Norman of UCLA's Department of Psychiatry reported on the effects of administering thyroid hormone to rats one to three days old. They claim to have found an earlier maturation during the next two weeks of several functions, including startled response to sound, adrenal gland reaction to stress, electrical activity of the brain and speed of retreat from an electric shock.

The long term implications of this acceleration are a matter of conjecture. One might wish for a statement that the experiments were double-blind, and that the animals were not suffering from any dietary insufficiencies.

These results are hardly an indication in favor of the indiscriminate use of thyroid hormone, especially as no positive benefit of earlier maturation is assured. They do, however, point to a useful target for further investigation, both in animals and in human infants, concerning one possible source of individual variation in the development of brain mechanisms.

The understanding of a drastic disease, cretinism, could then have constructive implications for improving what we now accede to as normal development.

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