in the release of neurotransmitters. Calcium is a powerful messenger in the immune response of inflammation and blood clotting. Both PTH and calcitonin regulate calcium levels in the kidneys, the gut, bone, and blood.

PTH deficiency can be due to autoimmune diseases or to inherited parathyroid gland problems. Low PTH capabilities cause depressed blood calcium levels and neuromuscular problems. Very low PTH can lead to tetany or muscle spasms. Excess PTH can lead to weakened bones because it causes too much calcium to be drawn from the bones and to be excreted in the urine. Abnormalities of bone mineral deposits can lead to a number of conditions, including osteoporosis and rickets. Osteoporosis can be due to dietary insufficiencies of calcium, phosphate, or vitamin C. The end result is a loss of bone mass. Rickets is usually caused by a vitamin D deficiency and results in lower rates of bone formation in children. These examples show the importance of a balanced, nutritious diet for healthy development.

### Adrenal glands

The two adrenal glands sit on top of each kidney. Both adrenals have two distinct regions. The outer region (the medulla) produces adrenaline and noradrenaline and is under the control of the sympathetic nervous system. The inner region (the cortex) produces a number of steroid hormones. The cortical steroid hormones are derived from cholesterol and include mineralocorticoids (mainly aldosterone), glucocorticoids (mainly cortisol), and gonadocorticoids. Aldosterone and cortisol are the major human steroids in the cortex. However, testosterone and estrogen are secreted by adults (both male and female) at very low levels.

Aldosterone plays an important role in regulating body fluids. It increases blood levels of sodium and water and lowers blood potassium levels. Cortisol secretion is stimulated by physical trauma, exposure to cold temperatures, burns, heavy exercise, and anxiety. Cortisol targets the liver, skeletal muscle, and adipose tissue, and its overall effect is to provide amino acids and glucose to meet synthesis and energy requirements for metabolism and during periods of stress. Because of its anti-inflammatory action, cortisol is used clinically to reduce swelling. Excessive cortisol secretion leads to Cushing’s syndrome, which is characterized by weak bones, obesity, and a tendency to bruise. Cortisol deficiency can lead to Addison’s disease, which has the symptoms of fatigue, low blood sodium levels, low blood pressure, and excess skin pigmentation.

The adrenal medullary hormones are epinephrine (adrenaline) and nor-epinephrine (nor-adrenaline). Both of these hormones serve to supplement and prolong the “fight or flight” response initiated in the nervous system. This response includes increased heart rate, peripheral blood vessel constriction, sweating, spleen contraction, glycogen conversion to glucose, dilation of bronchial tubes, decreased digestive activity, and low urine output.

### Pancreas

The pancreas secretes the hormones insulin, glucagon, and somatostatin, also known as growth hormone inhibiting hormone (GHIH). Insulin and glucagon have reciprocal roles. Insulin promotes the storage of glucose, fatty acids, and amino acids, while glucagon stimulates mobilization of these constituents from storage into the blood. Insulin release is triggered by high blood glucose levels. It lowers blood sugar levels and inhibits the release of glucose by the liver in order to keep blood levels down. Insulin excess can cause hypoglycemia leading to convulsions or coma, and insufficient levels of insulin can cause diabetes mellitus, which can be fatal if left untreated. Diabetes mellitus is the most common endocrine disorder.

Glucagon secretion is stimulated by decreased blood glucose levels, infection, cortisol, exercise, and large protein meals. Among other activities, it facilitates glucose release into the blood. Excess glucagon can result from tumors of the pancreatic alpha cells, and a mild diabetes seems to result. Some cases of uncontrolled diabetes are also characterized by high glucagon levels, suggesting that low blood insulin levels are not necessarily the only cause in diabetes cases.

### Female hormones

The female reproductive hormones arise from the hypothalamus, the anterior pituitary, and the ovaries. Although detectable amounts of the steroid hormone estrogen are present during fetal development, at puberty estrogen levels rise to initiate secondary sexual characteristics. Gonadotropin releasing hormone (GRH) is released by the hypothalamus to stimulate pituitary release of LH and FSH, which propagate egg development in the ovaries. Eggs (ova) exist at various stages of development, with the maturation of one ovum taking about 28 days. The ova are contained within follicles that are support organs for ova maturation. About 450 of a female’s 150,000 germ cells mature to leave the ovary. The hormones secreted by the ovary include estrogen, progesterone, and small amounts of testosterone.

As an ovum matures, rising estrogen levels stimulate additional LH and FSH release from the pituitary. Prior to ovulation, estrogen levels drop, and LH and FSH surge to cause the ovum to be released into the fallopian
tube. The cells of the burst follicle begin to secrete progesterone and some estrogen. These hormones trigger thickening of the uterine lining, the endometrium, to prepare it for implantation should fertilization occur. The high progesterone and estrogen levels prevent LH and FSH from further secretion—thus hindering another ovum from developing. If fertilization does not occur, eight days after ovulation the endometrium deteriorates, resulting in menstruation. The falling estrogen and progesterone levels that follow trigger LH and FSH, starting the cycle all over again.

In addition to its major roles in the menstrual cycle, estrogen has a protective effect on bone loss, which can lead to osteoporosis.

Hormones related to pregnancy include human chorionic gonadotrophin (HCG), estrogen, human chori- onic somatomammotrophin (HCS), and relaxin. HCG is released by the early embryo to signal implantation. Estrogen and HCS are secreted by the placenta. As birth nears, relaxin is secreted by the ovaries to relax the pelvic area in preparation for labor.

Male hormones

Male reproductive hormones come from the hypothalamus, the anterior pituitary, and the testes. As in females, GRH is released from the hypothalamus, which stimulates LH and FSH release from the pituitary. Testosterone levels are quite low until puberty. At puberty, rising levels of testosterone stimulate male reproductive development including secondary characteristics. LH stimulates testosterone release from the testes. FSH promotes early spermatogenesis. The male also secretes prostaglandins. These substances promote uterine contractions which help propel sperm towards an egg during sexual intercourse. Prostaglandins are produced in the seminal vesicles, and are not classified as hormones by all authorities.

Further Reading

Karen Horney

1885-1952

Karen Horney was born in Hamburg, Germany, and educated at the University of Berlin and the University of Freiberg. She emigrated to the United States in 1932, after having taught for two years at the Berlin Institute of Psychoanalysis. From 1932-34, she was assistant director of the Chicago Institute for Psychoanalysis; she then left for New York City. In 1935, she was elected to the New York Psychoanalytic Society. Horney believed that personality is significantly affected by the unconscious mind, but she also theorized that both interpersonal relationships and societal factors were key factors contributing to mental development. She became increasingly outspoken in her disagreements with the theories developed by Sigmund Freud on the nature of neuroses and personality. Where Freud advanced a biological basis for neuroses, Horney believed that the environment of childhood played a key role in personality development. She felt strongly that negative experiences in early childhood could trigger anxiety in adulthood. In 1936, Horney published her first book, The Neurotic Personality of Our Time, a highly readable work. This was followed in 1939 by New Ways in Psychoanalysis, and Self Analysis in 1942.

In 1942, Horney cofounded the American Institute for Psychoanalysis. She is best known for broadening the