MOST OF US can easily give a brief description of the functions of the muscular or skeletal systems, but when asked about the endocrine system, we are stumped. The endocrine system may be one of the least studied and most mysterious systems of the body. Nonetheless, it is one of the most important systems in regards to our growth, reproduction, and survival.

Objectives:

1. Identify and describe the functions of the glands that compose the endocrine system.
2. Examine the use of synthetic hormones to promote animal growth, and identify examples of growth hormones.

Key Terms:

- adrenal glands
- bovine somatotropin
- estrogen
- hormone
- insulin
- melengestrol acetate
- parathyroid glands
- pituitary gland
- placenta
- progesterone
- somatotropin
- testosterone
- thyroid gland
- thyroxine

The Endocrine System

The endocrine system consists of ductless glands that release hormones that are transported throughout the body by blood vessels. A hormone is a chemical substance that has a specific effect on an organ or, in some cases, on all body tissues. The endocrine system is composed of a network of glands that include the pituitary gland, adrenal glands, thyroid gland, parathyroid glands, pancreas, testes (males), ovaries (females), and placenta (in females of most species). These secreted hormones control a variety of functions from metabolism and blood pressure to reproductive traits and ability.
PITUITARY GLAND

The pituitary gland is located at the base of the brain near the hypothalamus. The hypothalamus controls the pituitary gland. The pituitary gland is considered the master gland because it secretes many hormones that control various endocrine glands. However, not all glands are under the control of the pituitary. Some glands react to concentrations of substances in the bloodstream and secrete hormones based on these concentrations.

ADRENAL GLANDS

The adrenal glands are located near the kidneys. The adrenal glands secrete hormones to regulate metabolism, maintain blood pressure, and regulate sodium and potassium balance. Salt balance in the body is critical for normal body functioning, and it is controlled by the adrenal glands.

THYROID GLAND

The thyroid gland, which is located near the larynx, regulates the body’s metabolism and iodine uptake. The thyroid gland influences tissues in the body to produce hormones and can also increase the rate of oxygen use by cells. Thyroxine, a hormone secreted by the thyroid
gland, influences body weight and lean tissue growth. The **parathyroid glands** are located on the surface of the thyroid gland and secrete parathormone, which regulates calcium and phosphorus metabolism.

### PANCREAS

The pancreas secretes hormones (insulin and glucagon) and digestive enzymes. **Insulin** lowers blood sugar, and glucagon raises blood sugar. The pancreas also controls the metabolism of proteins and fats throughout the body.

### REPRODUCTIVE ORGANS

The testes in males secrete the hormone **testosterone**, which is the male sex hormone that is responsible for the development and function of the male reproductive system. The ovaries in females secrete estrogen and progesterone. **Estrogen** is responsible for the development of the reproductive tract and mammary glands. **Progesterone** is necessary for the preparation for and maintenance of pregnancy. The **placenta**, which is the organ that unites the fetus to the uterus, secretes relaxin to relax pelvic ligaments and cartilage during the birthing process.

### Synthetic Hormones

Most agricultural animals are raised to produce food products, such as meat and milk. It is important to livestock producers that their animals grow quickly and in the most efficient manner possible. Growth is highly dependent on the endocrine system and the hormones that the endocrine system secretes. Natural and synthetic hormones are used to control or regulate body functions in practical livestock production to increase growth rates.

### SYNTHETICS

**Melengestrol acetate** (MGA) is a synthetic progesterone used to increase the rate and efficiency of gain in cattle. Progesterone is produced by the corpus luteum in the ovaries. By negative feedback, it reduces pituitary function, thus preventing a female from coming into heat.

When females are in estrus, or heat, they are restless; they stand to be ridden by other animals and do not eat feed at normal levels. Many of the behaviors exhibited while in heat lead to reduced weight gain by the animal in heat and those around it. By using MGA, producers are able to keep female livestock from entering the heat cycle, thereby producing a more consistent and predictable rate of gain.

**Somatotropin** is a growth hormone that regulates the growth rate in animals and influences milk secretion. Somatotropin is a major factor required for maintenance of lactation in ruminants. **Bovine somatotropin** (bST), a synthetic hormone, increases the milk production of dairy cows by as much as 15 percent during peak lactation and even more during late lactation.
Injections of bST in dairy cows every two weeks beginning at nine weeks of lactation is a common procedure for many dairy producers. Although bST is a synthetic hormone, it is based on the naturally occurring somatotropin in the cow, making it safe for both cow and consumer.

**Summary:**

The endocrine system consists of ductless glands that release hormones that are transported throughout the body by blood vessels. The endocrine system is composed of a network of glands that include the pituitary gland, adrenal glands, thyroid gland, parathyroid glands, pancreas, testes (males), ovaries (females), and placenta (in females of most species). The pituitary gland is considered the master gland because it secretes many hormones that control various endocrine glands. Growth is highly dependent on the endocrine system and the hormones that the endocrine system secretes. Natural and synthetic hormones are used to control or regulate body functions in practical livestock production to increase growth rates.

**Checking Your Knowledge:**

1. List four different glands that are part of the endocrine system.
2. Why is the pituitary gland considered the “master gland” of the body?
3. What role does the pancreas play in the function of the body?
4. List the main hormones secreted by the male and female reproductive organs, and give a brief description of the function of each.
5. List two synthetic hormones. For each hormone, list two benefits of using it.

**Expanding Your Knowledge:**

Visit a local dairy farm where bST is being used, or invite a dairy farmer to speak with your class regarding the benefits of using bST. Possible questions to ask could include the advantages and disadvantages of using a synthetic hormone to boost milk production.

**Web Links:**

- **Bovine Somatotropin Information**

- **Interactive Endocrine System**

- **A Tour of the Endocrine System**