

A Brief Historical Background to Endocrinology

Dark Ages

- Victors of battle ate the organs (brain, heart, gonads) of enemies thinking that they contained important powers
- Modern endocrinology has refined this into pill form

History

- Humoral Hypothesis (Hippocrates) 400 BC

Remote Antiquity

- Aristotle noted the physical and behavioral effects of castration on roosters
- Eunuchs guarded the women's quarters of Hebrew kings and princes (*Bible*, Ester 1:10)
- Results of pre-pubertal castration in humans: short stature, long arms, no facial hair or pubertal change in voice

Castrati

- Once a common practice in Europe and Asia to castrate young boys with exceptional singing voices to prevent the pubertal changes in voice; prized in church choirs
- Popularity reached a peak in 17th and 18 centuries
- First castrato opera star: Baldassarre Ferri (1610-1680)
- Only recorded castrato: Alessandro Moreschi (1858-1922)
- Last performing castrato died in the 20th century
- Castrati had the range of a soprano, but the greater development of the male lungs gave their singing remarkable power.

History

- William Harvey (1628)
- John Hunter (late 1600's)
- Bordeau (1775)

First Recorded Endocrine Experiment

Arnold Berthold

Constancy of the Internal Environment

- Claude Bernard (in 1872) noted the importance of a regulated internal environment (*le milieu intérieur*) for the independence of animals in a changing, and challenging, environment.
- Communication among cells, tissues and organs in metazoans is essential for coordination of physiological activities.

Endocrine Replacement Therapy

- Charles Brown-Séguard, a French physician, was the first to seriously entertain the notion of replacement therapy.
- In 1889, at age 72, he injected himself with extracts of dog, guinea pig and rabbit testicles and proclaimed (in allegedly vivid language) remarkable rejuvenating effects.
- Since his preparations were aqueous extracts, it is believed that the results were placebo effects.

History

- Von Mering and Menkoski
 - Removed the pancreas from dogs and noticed changes in urine and blood glucose

The First Described Hormone (1902)

Sir William Bayliss (1860-1924)

Ernest Starling (1866-1927)

- In response to the delivery to the intestine of acidic chyme from the stomach, endocrine cells of the duodenum release secretin (an internal secretion) into the bloodstream.
- Secretin stimulates the exocrine pancreas to secrete bicarbonate into the intestine to neutralize the acid.

History

- 1900-1930's
 - Period of research on biochemistry, reproductive cycles, and surgery
 - 1902 – Epinephrine purification
 - 1904 - Epinephrine synthesis
- 1920-1930
 - Adrenalectomy and hypophsectomy perfected
 - All steroid hormones discovered
- 1940-1950
 - Different techniques developed, Radioisotopes, culturing methods, electron microscope
- 1950's and 1960's
 - Biochemistry and mechanisms of action

Hormone Structure, Synthesis and Assay

- Frederick Sanger determined the structure of insulin (1958)
- Vincent du Vigneaud synthesized polypeptide hormones (oxytocin and vasopressin) (1955)

- Rosalyn Yalow developed radioimmunoassay for measurement of hormone concentrations (1977)

Hormone Structure, Synthesis and Assay

- Katsoyannis synthesizes insulin (1963)
- Cleaver and Carlson discover Ecdysone
- Earl Sutherland CAMP (1950)

1970-current

Current Perspectives

- Scientific
- Clinical
- Food Production

Classification of Chemical Mediators

- intracellular (secondary) messengers
- (synaptic) neurotransmitters
- neuromodulators
- neurohormones (neurosecretions)
- glandular (“classical”) hormones
- local hormones (paracrine and autocrine factors)
- pheromones (and allelochemicals)

Communication Pathways Among Cells

- endocrine: fluid-borne transport of chemical mediators (*ex.*, insulin in regulation of glucose metabolism)
- paracrine: local diffusional transport of chemical mediators (*ex.*, histamine in the inflammatory response)
- autocrine: local action of a chemical mediator on its own secretory cell (*ex.*, norepinephrine to autoregulate further release from the nerve)
- neuroendocrine: endocrine-like secretion from a neuron-like secretory cell (*ex.*, oxytocin in the “milk let-down” response)
- pheromones: intraspecific, organism-to-organism chemical messengers (*ex.*, sex attractants in moths, alarm substances in fish)
- allelochemicals: interspecific, organism-to-organism chemical messengers (*ex.*, territory-marking substances)

Do all animals have endocrine systems?

- No!
- Only from worms up can we have an endocrine system because there is no circulatory system

Do all animals have Hormones?

- Yes!
- Hormones are not confined to the circulatory system

Categories of Hormone Action

Growth
Differentiation
Reproduction
Pigmentation
Metabolism

** Hormones influence and Mediate these processes

Otto Loewi*

Experiment on frog heart (1921):

Sir Henry Hallett Dale*

- discovered the oxytocic action of pituitary extracts
- conducted work on the action of histamine that led to studies on anaphylaxis and on conditions of shock
- examined pharmacology of plant alkaloids
- identified acetylcholine (ACh) as a constituent of certain ergot extracts
- studied ACh role in autonomic nervous system and in skeletal neuromuscular transmission
- Dale's Principle: "one cell-one messenger"

Homeostasis

- In 1929, Walter Cannon coined the term homeostasis (= the tendency of organisms to maintain steady state)
- He studied:
 - effects of stress and emotional stimuli on the digestive process
 - emergency function of the adrenal glands in countering vital threats to the organism

Neuroendocrine Systems

"Remember, synaptic chemical transmission wasn't even known at the time of our first

neurosecretion publications. The idea that neurons may be capable of dispatching neurohormonal, or blood-borne signals, an activity previously associated only with endocrine cells, met with powerful resistance."

Endocrinology

The study of the endocrine glands and responses to their secretions
Chemical integration and communication within and organism