BEHAVIORAL ENDOCRINOLOGY

Chemical Communication

Neurocrine

Neural chemical into a synapse (e.g. Ach)

Neuroendocrine

Neural substance into vascular system

(e.g. epinephrine)

Endocrine

Glandular substance into vascular system

(e.g. testosterone)

Pheromone

Glandular substance into the environment

(e.g. bombykol)

Classes of endocrines

Steroids (cholesterol-based)

Progestins

Androgens

Estrogens

Corticoids

Polypeptides (small proteins)

Releasing hormones of hypothalamus

Hormones of the pituitary, thyroid, pancreas, gut

Monoamines (single amine groups)

Catecholamines

Epinephrine, nor-epinephrine, melatonin, serotonin

Lipid-based

Prostaglandins (blood clotting, pain, fever, local vaso-diameters, onset of labor, fallopian tube activity)

Endocrine traits (especially steroids)

Actions:

1. Organizational effects (architectural)
2. Activational (thresholds)

Endrocrines as behavioral stimuli

1. Primers (sensitivity)
2. Releasers (stimulate)

Environmental / industrial endocrines

(aka endocrine disruptors)

Examples

DDE (organochlorine) – pesticide

Reacts with androgen receptors –
shifts juvenile development – demasculinates

Phthalates – makes plastics soft (billions lbs/yr)

Reacts with androgen receptors (disrupts development)

Pharmaceutics in municipal water supplies
(many instances of effective concentrations)

Endocrines operate on Negative feedback
(e.g., thyroid gland)

Hypothalamus/pituitary interface between nervous system and endocrine system. Releasing factors in hypothalamus for each pituitary hormone

Pituitary is "master gland"

Anterior Pituitary

1. (GH) Growth Hormone
2. (TH) Thyrotropic Hormone
3. (ACTH) Adrenocorticotropic Hormone
4. (MSH) Melanin-stimulating Hormone
5. (LH) Lutenizing Hormone
6. (LTH) Luteotrophic Hormone (prolactin)
7. (FSH) Follicle-stimulating Hormone

Posterior Pituitary (storage)

1. Oxytocin
2. Vasopressin

Examples

Oxytocin/vasopressin (short chain peptides)

Polygynous mountain voles/monogamous prairie voles

After mating, normally timid prairie vole male will attack any strange male.
Vasopressin blocker causes male to remain timid.

Vasopressin appears to induce monogamous pair-bonding, though mechanism not understood.

Vasopressin may also induces paternal behavior toward pups, Oxytocin induces maternal behavior

Adrenal Medulla

Epinephrine - fight/flight syndrome - sympathetic NS

Adrenal Cortex

Steroids (50+)

cholesterol

pregnenolone

dehydroepiandrosterone

(androgen)

progesterone

glucocorticoids	mineralcorticoids	sex hormones
cortisol		estosterone
cortisone	aldosterone	estradiol
hydrocortisone		
corticosterone		

Glucocorticoid Affects (basically the opposite of insulin)

1. > vasoconstriction (epinephrine)
2. > glycogen → glucose (epinephrine)
3. protein → amino acids
4. liver alters A.A.s to glucose
5. slow uptake of glucose
6. fat → glucose (+ fatty acids & ketone bodies)
7. anti-inflammatory (2-3X > normal) – stabilizes lysosomes, delays clearing of injury debris
8. inhibit formation of antibodies, > susceptibility to disease (thymus)
9. wound healing impaired
10. changes in mood & motivation (temper, compulsive urges, short-term psychosis)

Mineralcorticoids - kidney function - osmotic control

Sex Hormones - mimic gonadal hormones, but not in as high a concentration

Daniel Lehrman - ring-neck dove experiments

Reproductive Sequence

Day 1	male courts female - he "structs" & "coos"
2-7	Copulation & nest building (male carries material to female)
7-10	1st egg laid (2nd egg 2 days later) & incubation (male 6 hr, female 18 hr)
24	Eggs hatch - both parents feed squab pigeon milk
34-36	Squab leave nest, parents < feeding
38	Parents stop feeding, squab peck grain
39-49	Cycle begins over

Male cycle

[Daylength] "releases"

FSH → gametogenesis (seminiferous tubules)

LH → testosterone (interstitial cells)

Testosterone causes:

1. territorial behavior
2. courtship (bow/coo) [sight of female]
3. copulation [sight of receptive female]
4. "primes" male for following:

[_ soliciting nest material] → bring nest material

[sight of _ on nest] stimulates ACTH → progesterone

Progesterone causes:

1. > crop
2. inhibits courtship (bow/coo)
3. primes for [sight of eggs] → incubation
4. stimulates prolactin

Male cycle (cont.)

Prolactin (LTH) causes:

1. milk production
2. sustains incubation
3. inhibits gonadotropins
4. primes for [sight of squab] → feeding

[large squab] → inhibit prolactin, then:

1. crop <, milk production stops
2. gonadotropins no longer inhibited
3. FSH, LH > to start cycle over

Female cycle

[daylength] → primes [bow/coo] → FSH

FSH causes:

> follicle development → estrogen

Estrogen causes:

1. sexual receptivity
2. > LH → ovulation → corpus luteum → progesterone

Progesterone causes:

1. inhibits FSH & estrogen
2. > oviduct
3. > crop
4. nest solicitation of male
5. nest building
6. primes for [sight of eggs] → incubation
7. > prolactin (LTH)

Prolactin causes:

1. sustains incubation [sight of eggs]
2. > crop, milk production
3. feeding [sight of squab]

[large squab] → inhibit prolactin, then:

1. crop <, milk production stops
2. gonadotropins no longer inhibited
3. FSH, LH > to start cycle over

Dove reproduction depends on bi-parental care; thus, selection for coordinated behavior & physiological events within and between the male & female.

Thus, there is a precisely synchronized series of cause-and-effect events between:

1. Exogenous stimuli (abiotic & biotic)
2. Hormones
3. Behavior

Cannot start cycle in the middle, or skip a step without the cycle stopping