

Outline for today

Questions

Mini-lecture

Discussions

Next week assignments

Break

Lab

With non-invasive monitoring you can evaluate

Endocrine patterns female reproduction

Socio-ecological correlates of stress

Dominance & competition

Physiological changes during ontogeny

Nutritional status/balance

Cooperation & social bonds

Immune function & activity

Endocrine patterns female reproduction

Markers: Estradiol, Progesterone, LH, & FSH

- Historically used to measure menstrual cycles in zoo animals
- Reliability of behavioral/morphological signals of ovulation
- Environmental conditions conducive to fertility & conception

Socio-ecological correlates of stress

“Stress” = stressor + stress response

2 players in stress response: SNS catecholamines & HPA axis glucocorticoids

- Rule of thumb for GCs: acute elevation adaptive, chronic elevation damaging
- Correlate environmental conditions with either intensity of acute response (difficult in wild animals) & chronic elevations (requires repeated sampling)

Physiological changes during ontogeny

- Marker DHEA, DHEA-S: development of adrenal glands
- LH (luteinizing hormone), testosterone: onset of puberty, reproductive maturation of testes & ovaries
- Estradiol, progesterone: onset of menarche in females
- GH (growth hormone): physical growth

Dominance and competition

Behringer Deschner focus on testosterone

- Anabolic steroid increases muscle mass and facilitates aggression
- “Challenge Hypothesis”:
 - Seasonal changes in testosterone levels ~ mating system, aggression, parental care
- Arguably, many measurable systems associate with dominance and competition:
 - energy balance - C-peptide
 - metabolic rates - T3, T4, TSH
 - stress response - GC
 - inflammation - CRP, neopterin, IL-6

Nutritional status and balance

C-peptide of insulin, T3 (triiodothyronine), T4 (thyroxine)

- Measure energetic costs of lactation, immune function/infection, reproductive competition, thermoregulation
 - Valuable to quantify energetic costs - reveal potential trade-offs
- C-peptide
 - Integrated signal of energy expenditure and intake
 - Only found in urine
- Thyroid hormones
 - Indicate actual metabolic rates, rapidly decrease w energetic deficits
 - Available in all media

Cooperation and social bonds

OT (oxytocin), AVP (arginine vasopressin), prolactin

- Explore status of parental care -
 - Increase w maternal care & often with paternal care, even anticipatory
- Establishment & maintenance of social ties & bonds
 - OT heightened during affiliation, synchronous variation in some pair bonds

Prepare for wonderful OT nuance with Carter 2014 reading later in quarter.

Immune function and activity

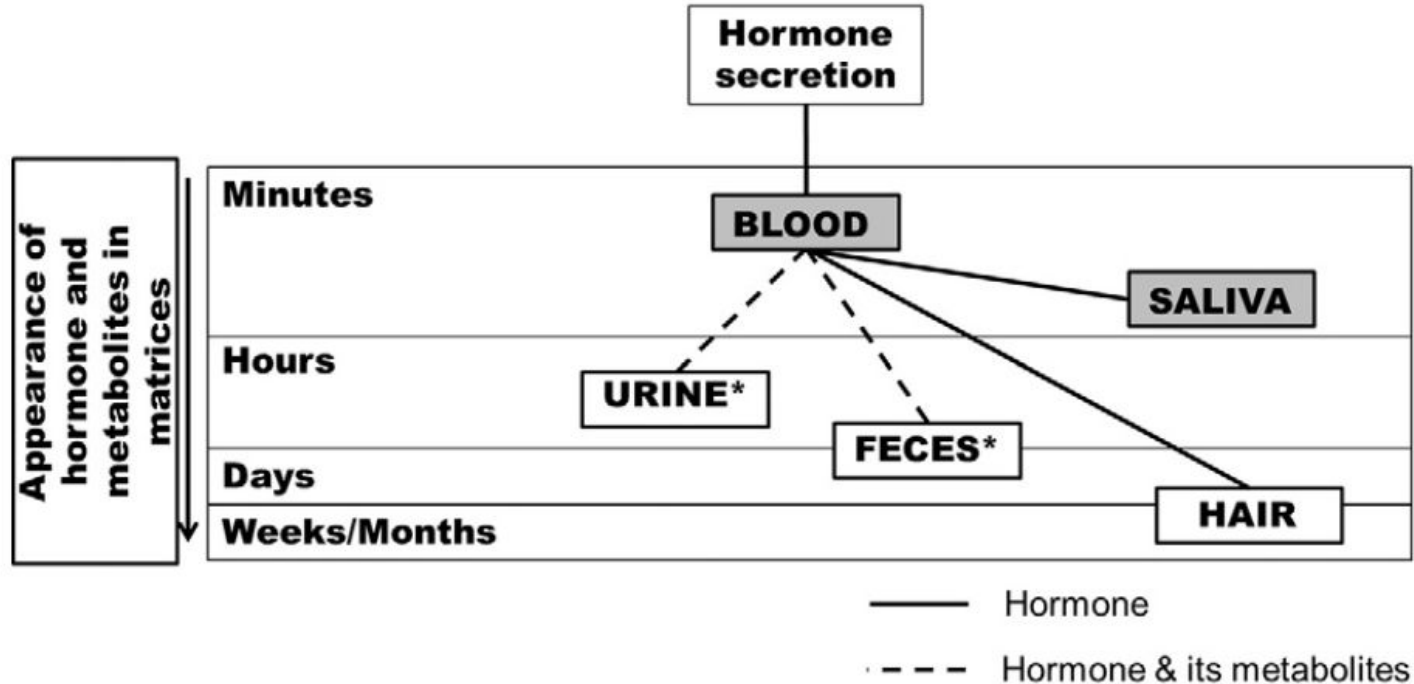
Behringer Deschner briefly mentions these under “other”

CRP, Neopterin, fibrinogen, haptoglobin, IgA (immunoglobulin A)

- Disease activity
- Aging & dysregulation of cellular and humoral branches
- Consequences of stress exposure

Measuring hormones in non-invasive matrices

V. Behringer, T. Deschner / *Hormones and Behavior* 91 (2017) 3–18



Saliva

Advantages?

Saliva

Seconds to minutes lapsed since biomarker secretion

Easy repeated sampling

Contains hormones, peptides, amines

Viscosity makes pipetting difficult - better after freeze thaw and centrifuge

Avoiding contamination important

- avoid smoking eating drinking before collection
- avoid collection with organic materials

Do not stimulate salivary flow, confounds concentrations

Saliva

Seconds to minutes lapsed since biomarker secretion

Easy repeated sampling

Contains hormones, peptides, amines

Challenges?

Saliva

Seconds to minutes lapsed since biomarker secretion

Easy repeated sampling

Contains hormones, peptides, amines

Viscosity makes pipetting difficult - better after freeze thaw and centrifuge

Avoiding contamination important

- avoid smoking eating drinking before collection
- avoid collection with organic materials

Do not stimulate salivary flow, confounds concentrations

Urine

Advantages?

Urine

~ Hours lapsed from biomarker secretion

Steroid hormones & metabolites, peptides, pteridines, cytokines, & some neurotransmitter metabolites

Repeated sampling also feasible

Stability of marker in urine varies, steroid hormones highly stable

Urine

~ Hours lapsed from biomarker secretion

Steroid hormones & metabolites, peptides, pteridines, cytokines, & some neurotransmitter metabolites

Repeated sampling also feasible

Stability of marker in urine varies, steroid hormones highly stable

Challenges?

Urine

~ Hours lapsed from biomarker secretion

Steroid hormones & metabolites, peptides, pteridines, cytokines, & some neurotransmitter metabolites

Repeated sampling also feasible

Stability of marker in urine varies, steroid hormones highly stable

Necessary to control for concentration, fluid intake

- Specific gravity preferable measure to control for concentration
- Creatinine - breakdown of muscle metabolism - common but many limitations

Feces

Advantages?

Feces

Ideal for measuring cumulative levels of biomarker - covering hours/days

Many steroid metabolites, THs, and IgA available in feces

Sometimes easier to collect than urine

Feces

Ideal for measuring cumulative levels of biomarker - covering hours/days

Many steroid metabolites, THs, and IgA available in feces

Sometimes easier to collect than urine

Challenges?

Feces

Ideal for measuring cumulative levels of biomarker - covering hours/days

Many steroid metabolites, THs, and IgA available in feces

Sometimes easier to collect than urine

Best to freeze, dry, or extract asap - markers prone to bacterial degradation

Solid phase extraction cartridges useful for long storage time

Hair

Excellent for very long term cumulative levels - months

Mostly used for cortisol but also useful for reproductive hormones

Processing protocols in a nascent phase of development

Important to standardize for site of hair sampling

Blood

Invasive - not included in Behringer Deschner

Very short time lapse from secretion, also some longer term markers (e.g. HbA1c)

Most markers of interest available

Vials require trained phlebotomist to collect

Blood spots easily collected by anyone

Vials need freezing, centrifugation

Markers preserved well in blood spots on cards