

## muscle physiology lecture 23

### hormone signaling

autocrine: VEGF, MGF, immune chemicals (ex: interleukins), myostatin, etc.

paracrine: fibroblast growth factor, transforming growth factor, clotting factors, myostatin, etc. endocrine: insulin, glucagon, leptin, ghrelin, testosterone, estrogen, GH, IGF-1, myostatin, etc.

cellular signaling cascades - Carl Cori & his wife Gerry Cori & physiologist Bernardo Houssay discovered and outlined the "Cori" cycle - glycogen catabolism/anabolism. all three won a Nobel prize in 1947. Carl Wilbur Sutherland Jr discovered the first second messenger and the role of second messenger systems in the function of hormones in 1950s, the second messenger he discovered was cyclic AMP.

his discovery was cAMP's role in glycogen regulation. lipolysis is regulated by epinephrine, glucagon, atrial natriuretic peptide, growth hormone, cortisol, tumor necrosis factor, and insulin. the cAMP system has receptors which, when activated, stimulate adenylate cyclase:  $R_s$  receptors. there are receptors which, when activated, inhibit adenylate cyclase:  $R_i$  receptors.

stimulation:  $\beta_1$  and  $\beta_2$  adrenergic receptors, glucagon receptors, ACTH

inhibition:  $\alpha_2$  adrenergic receptors, opioid receptors, cannabinoid, adenosine

there are many kinds of PDE; insulin activates PDE3B in fat. when that PDE is activated, it breaks cAMP down into AMP, which does not bind to (activating) PKA, so perilipin and HSL are not phosphorylated (activated.) steps - insulin binds to its receptor, PI3K gets activated, downstream of PI3K PKB gets activated, PI3K and PKB activate PDE, PDE breaks down cAMP, thus, PKA does not get activated so it does not phosphorylate anything so lipolysis doesn't happen.

functions of binding proteins - storage, fight degradation, extend half life, inactive form, modulate hormone activity, increase solubility in the blood.

follicle-stimulating - glycoprotein (binding protein) that binds to TGF- $\beta$  proteins.

it inhibits PKB, inhibiting protein synthesis through the mTOR signaling cascade, and binds to the activin II receptor.