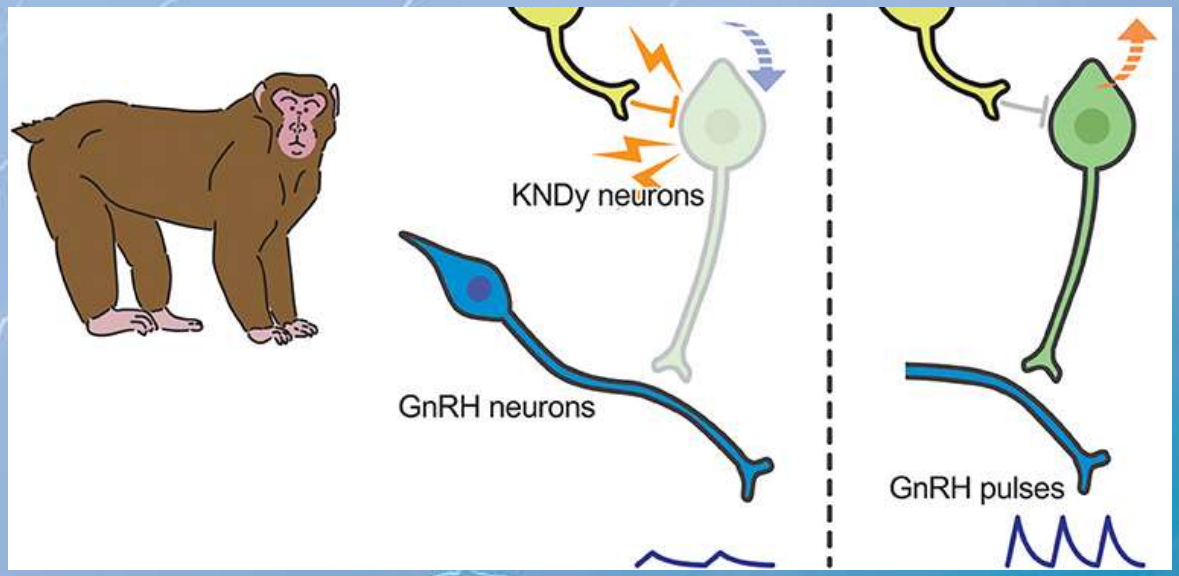


Молекулярна фізіологія: вісцеральні системи

Тема 8. Молекулярні механізми регуляції статевого циклу

Олексій Болдирєв

Інститут фізіології ім. О.О. Богомольця
НАН України
«Моя наука»

Естрогени та андрогени

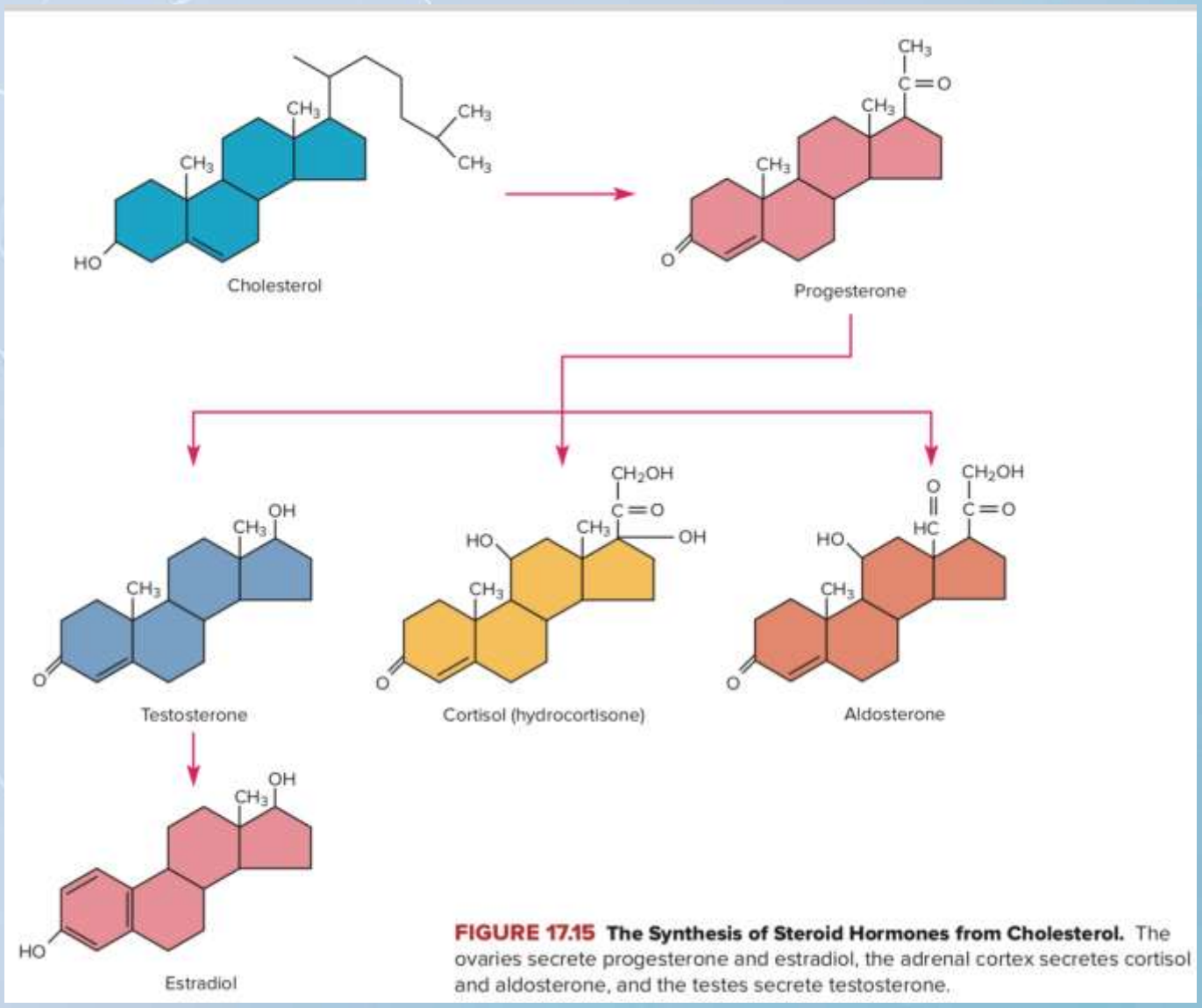
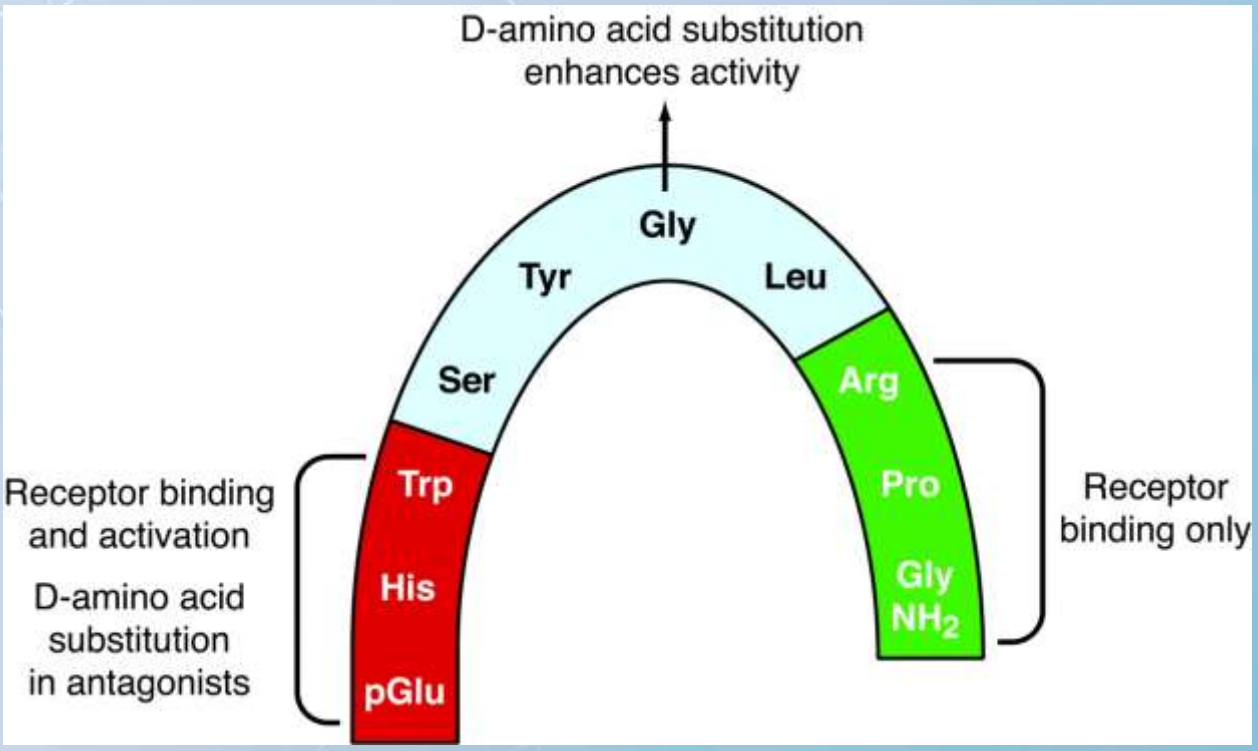


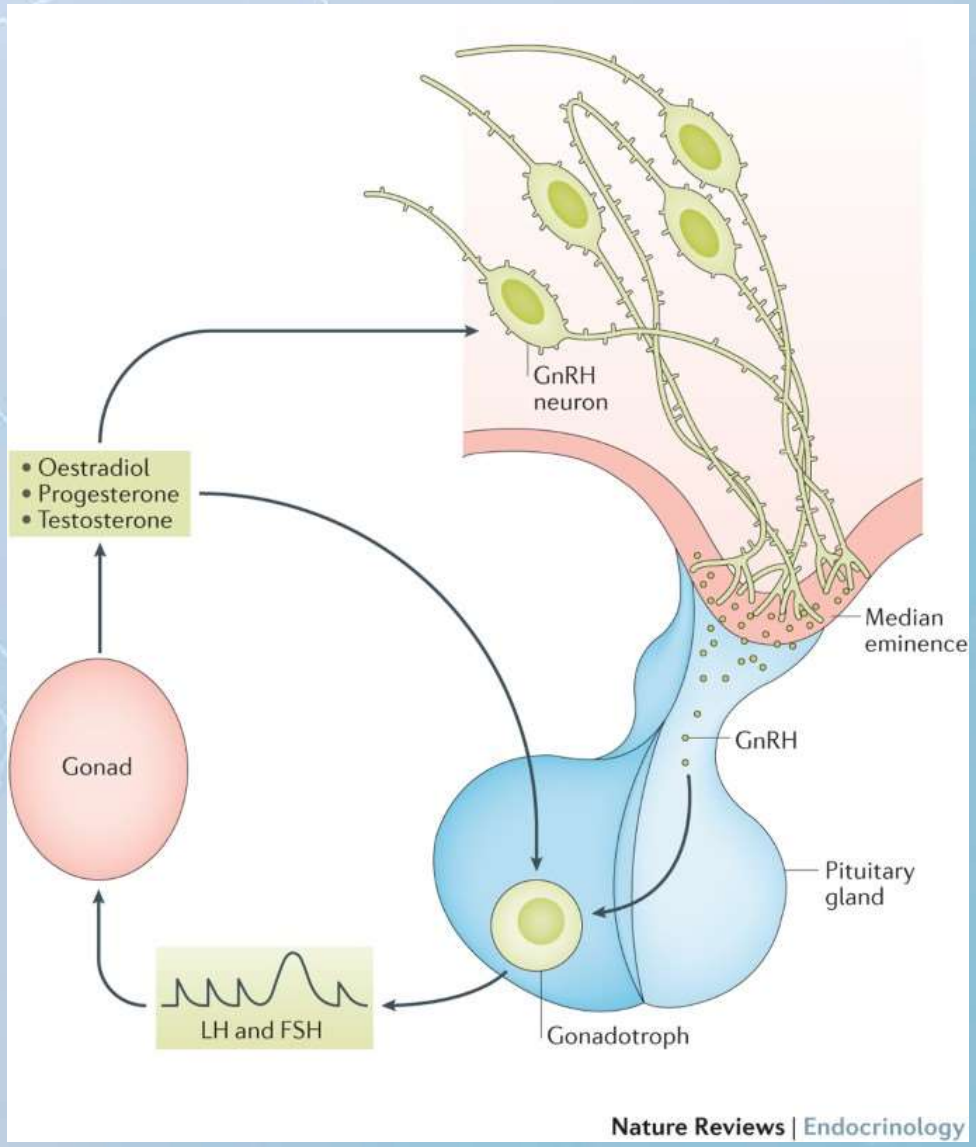
FIGURE 17.15 The Synthesis of Steroid Hormones from Cholesterol. The ovaries secrete progesterone and estradiol, the adrenal cortex secretes cortisol and aldosterone, and the testes secrete testosterone.

Гонадотропін-релізінг гормон (ГРГ)

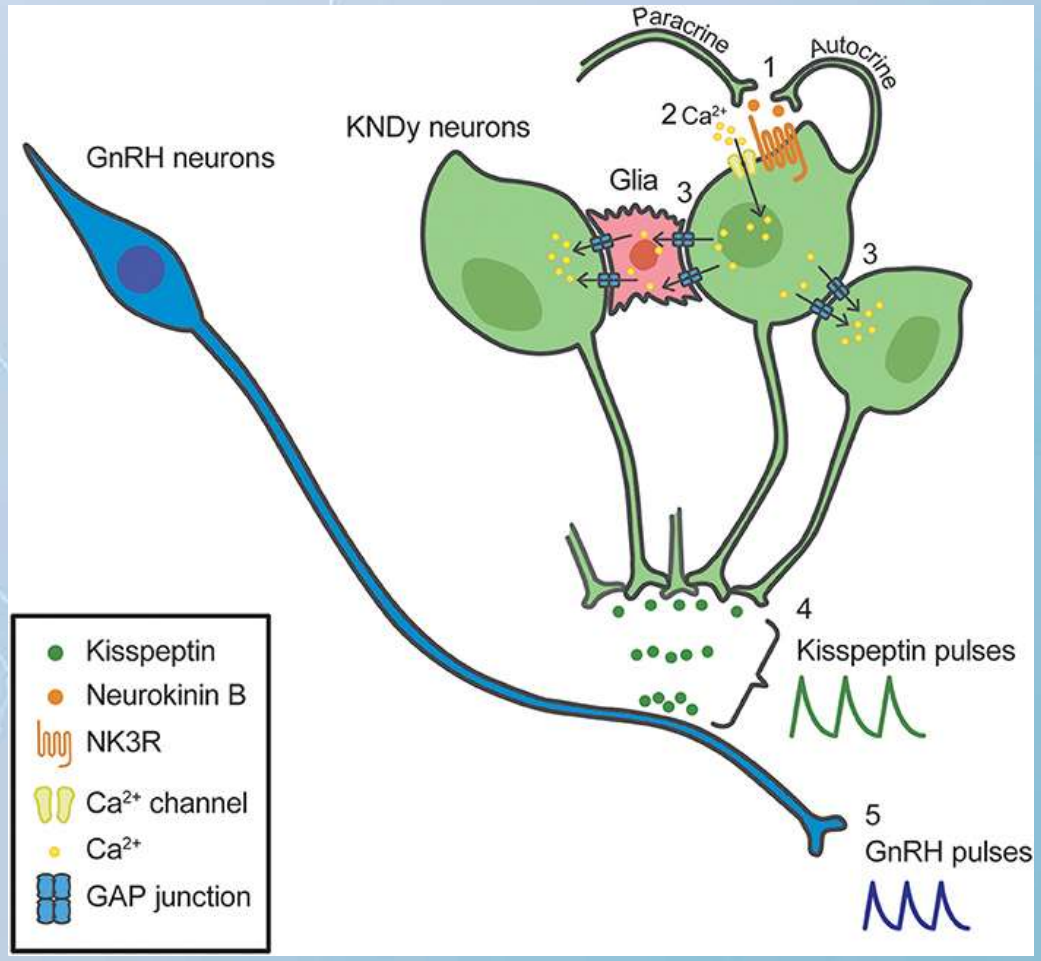


Endocr Rev, Volume 25, Issue 2, 1 April 2004, Pages 235–275, https://doi.org/10.1210/er.2003-0002

Контур гормональної регуляції

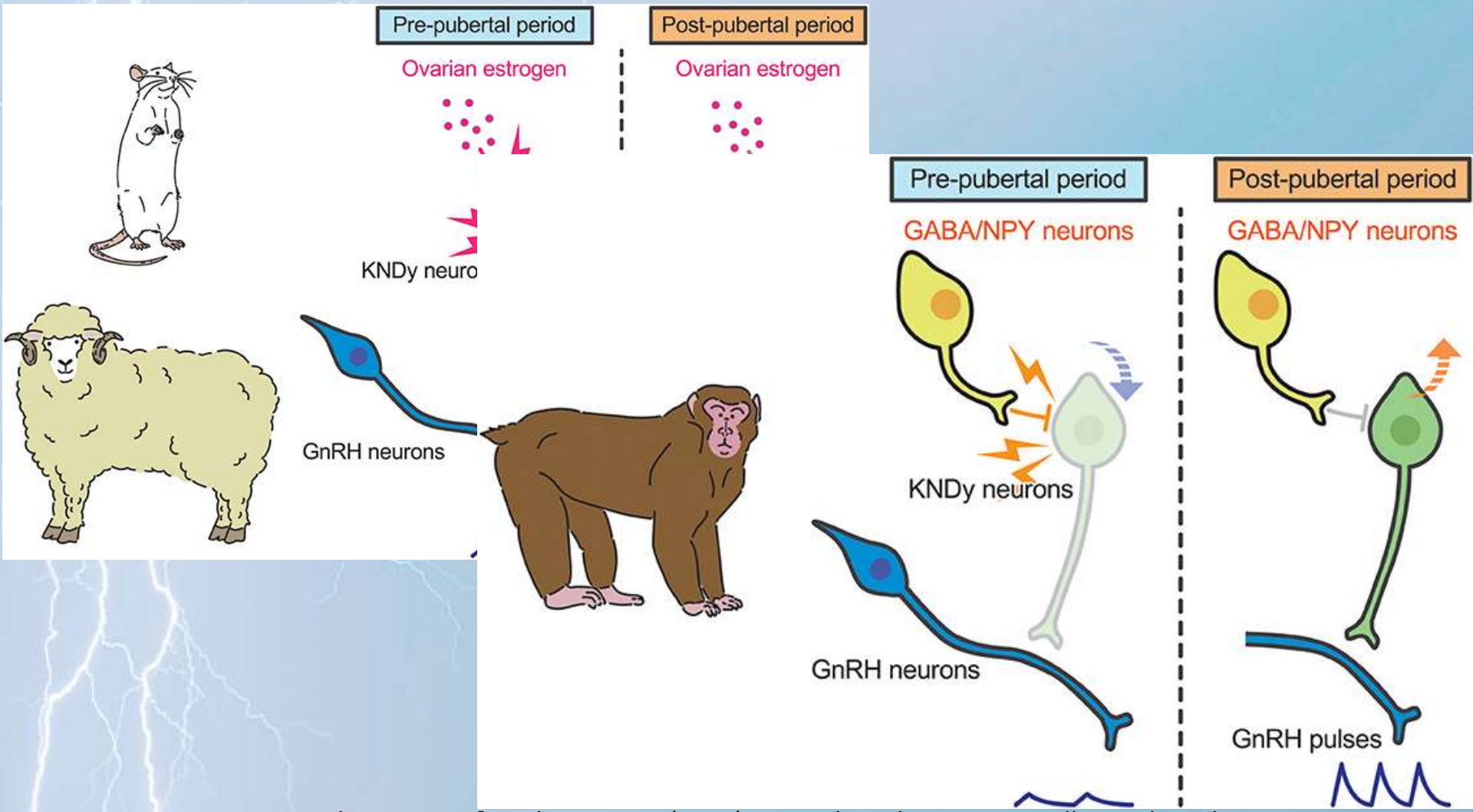


Кіспептини і ГРГ



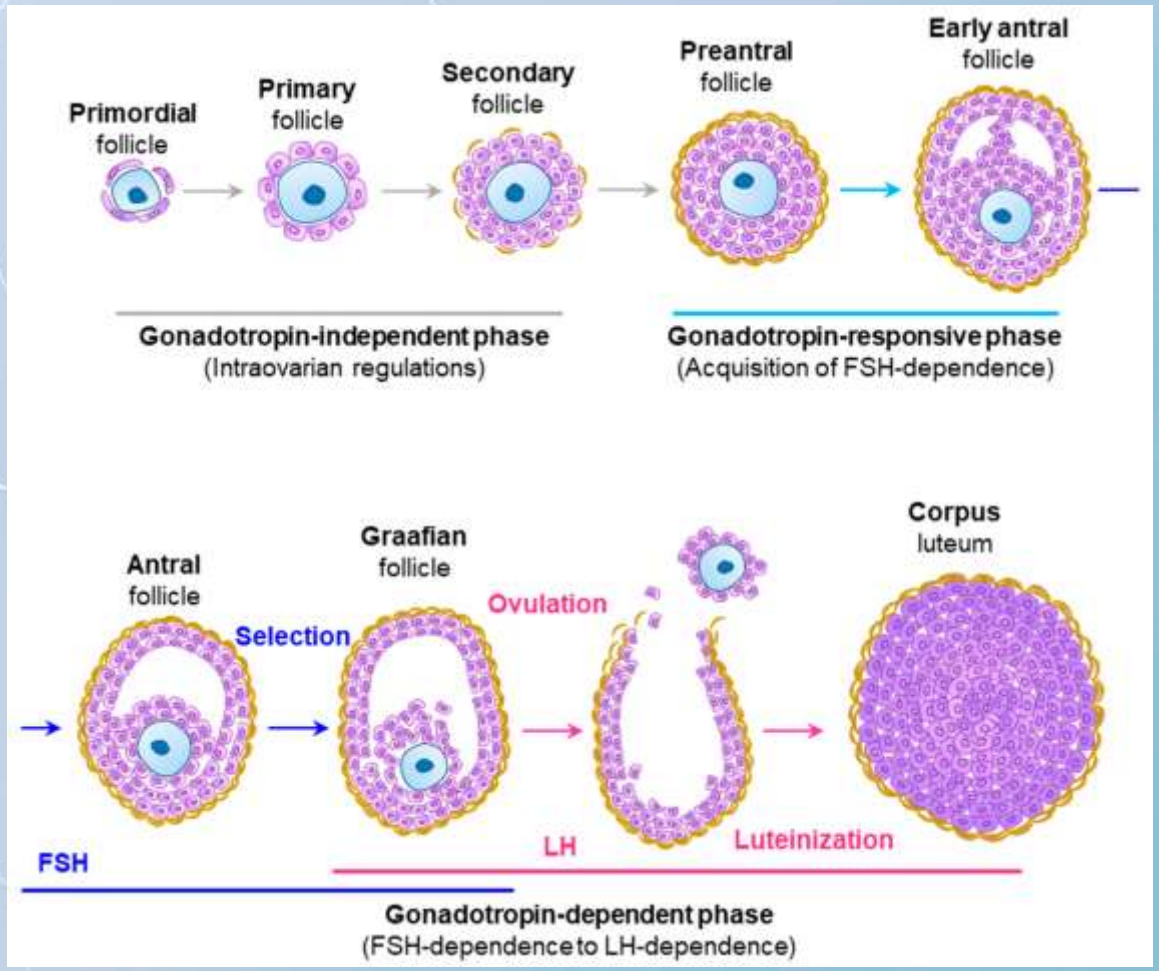
Uenoyama, Y., Inoue, N., Nakamura, S., & Tsukamura, H. (2019). Central mechanism controlling pubertal onset in mammals: A triggering role of kisspeptin. *Frontiers in endocrinology*, *10*, 312.

У різних тварин по-різному



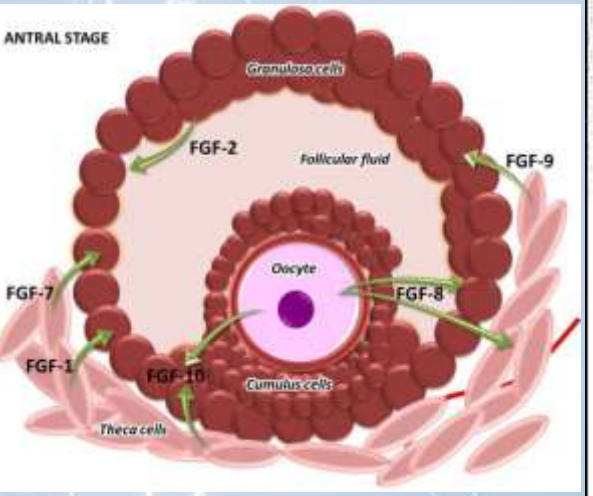
Uenoyama, Y., Inoue, N., Nakamura, S., & Tsukamura, H. (2019). Central mechanism controlling pubertal onset in mammals: A triggering role of kisspeptin. *Frontiers in endocrinology*, *10*, 312.

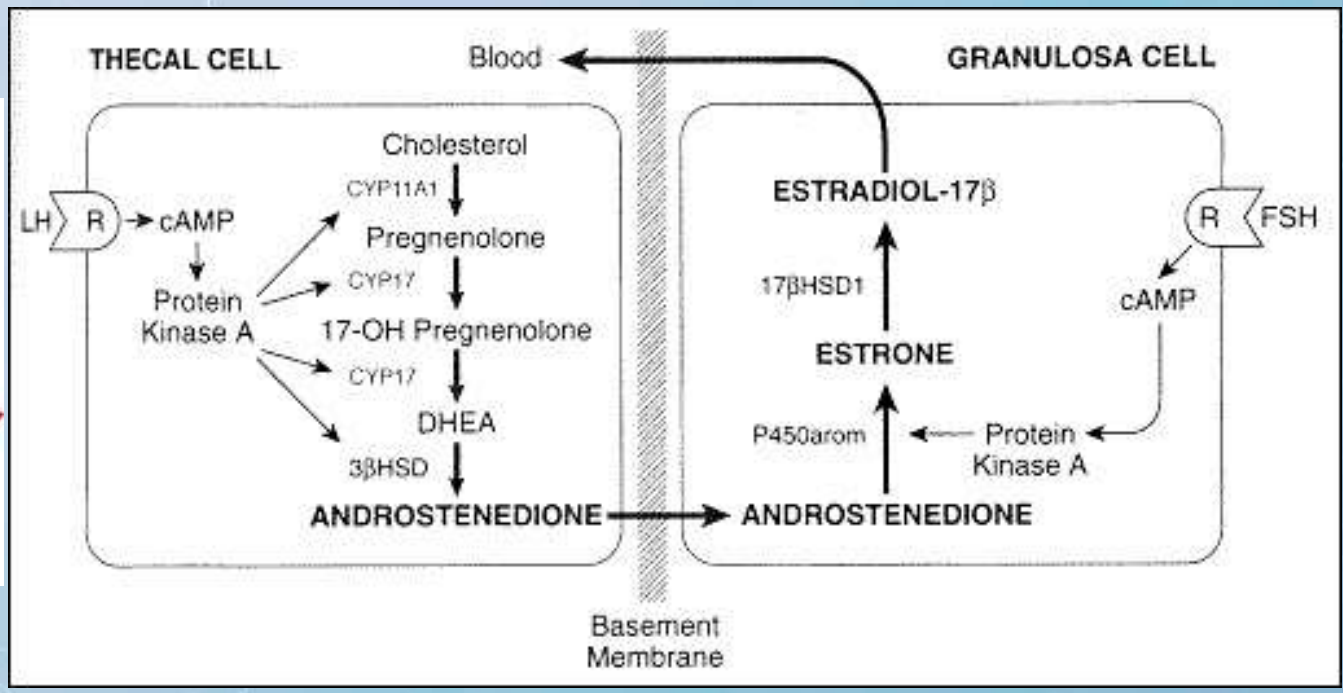
Стадії дозрівання фолікула



Lee, E.B.; Chakravarthi, V.P.; Wolfe, M.W.; Rumi, M.A.K. ERβ Regulation of Gonadotropin Responses during Folliculogenesis. *Int. J. Mol. Sci.* **2021**, *22*, 10348. https://doi.org/10.3390/ijms221910348

Регуляція синтезу естрогенів





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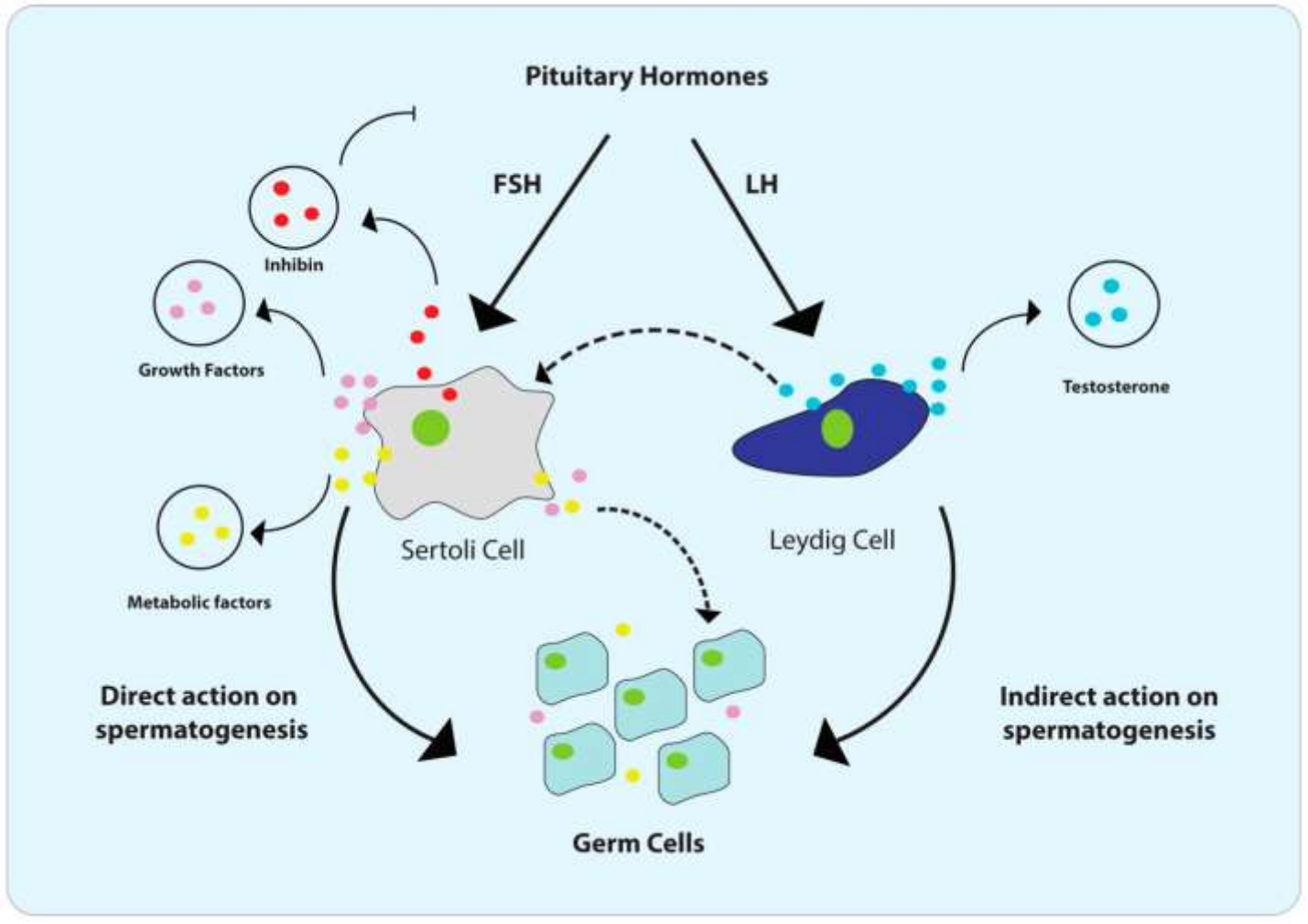
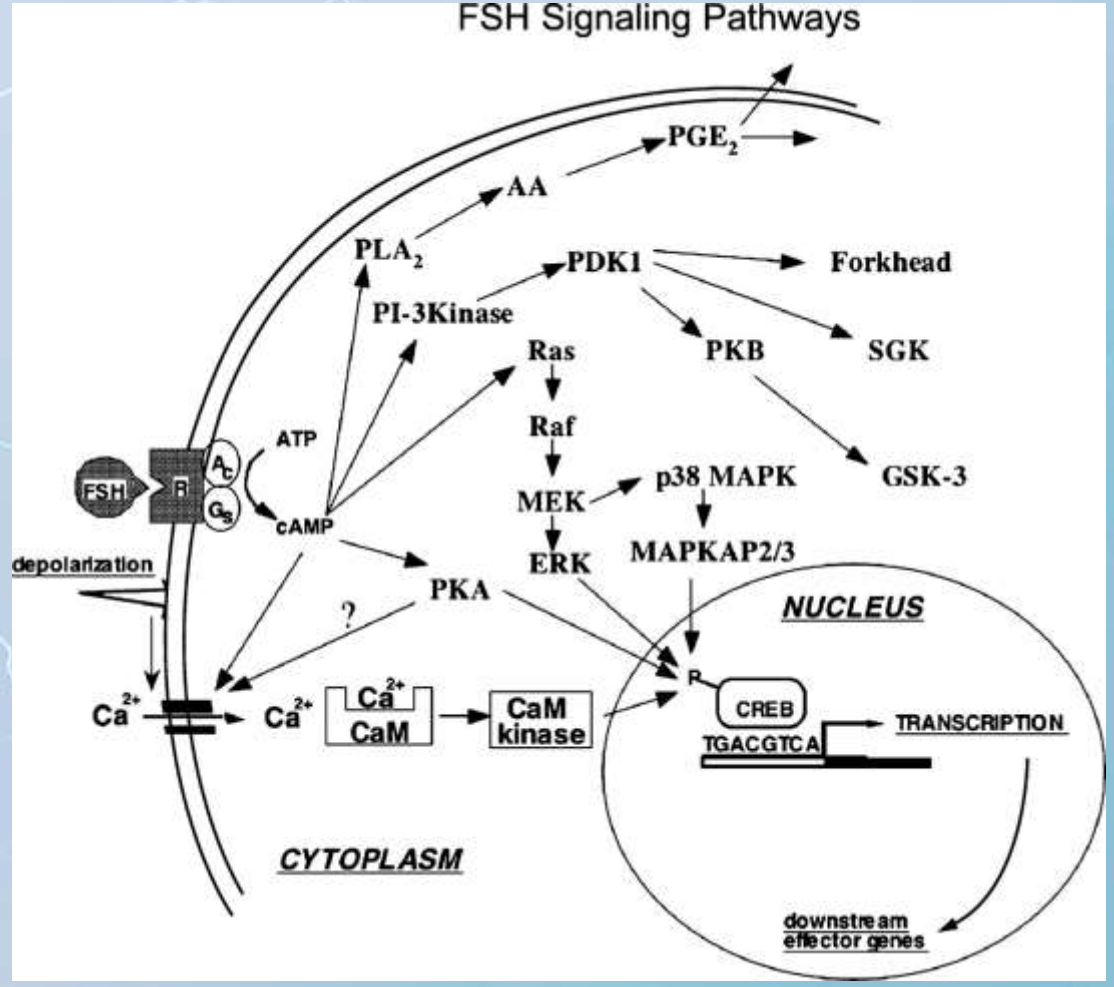
Чоловіча статева система



Almeida RdN, Braz-de-Melo HA, Santos IdO, Corrêa R, Kobinger GP, Magalhaes KG. The Cellular Impact of the ZIKA Virus on Male Reproductive Tract Immunology and Physiology. *Cells*. 2020; 9(4):1006. https://doi.org/10.3390/cells9041006

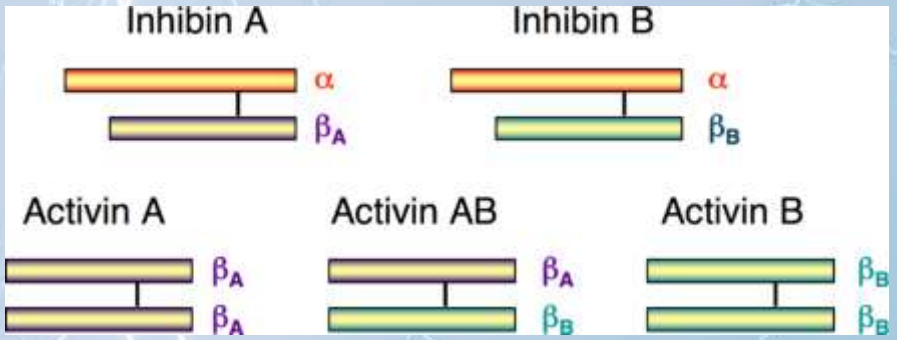
Figure 1

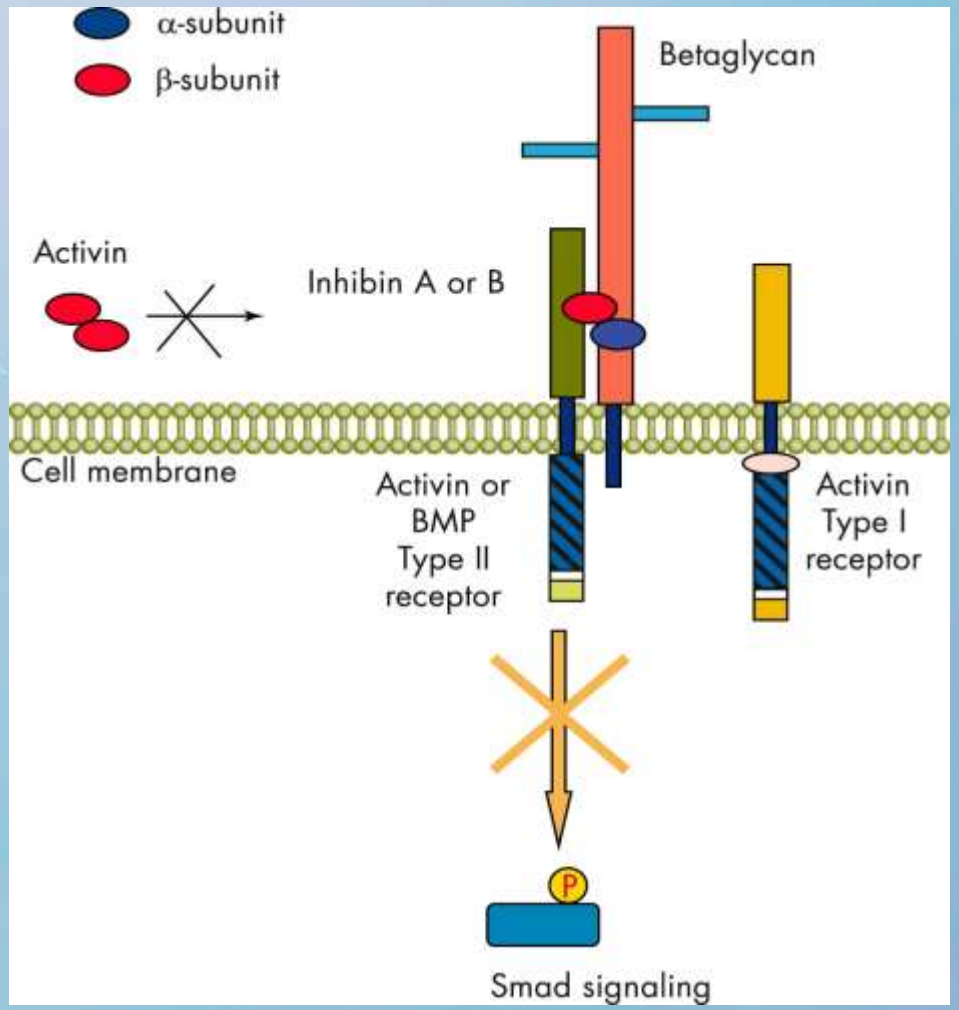
ФСГ у клітинах Сертолі



Signaling pathways activated by FSH are displayed. Initially FSH binding to the FSH receptor causes receptor coupled G proteins to activate adenylate cyclase (AC) and increase intracellular cAMP levels. Multiple factors can be activated by cAMP in Sertoli cells including PKA that can phosphorylate a number of proteins in the cell and also regulate the expression and activity of numerous transcription factors including CREB. FSH also causes Ca2+ influx into Sertoli cells that is mediated by cAMP and perhaps PKA modification of surface Ca2+ channels. Depolarization of the cell is also involved in Ca2+ influx. Elevated Ca2+ levels can activate calmodulin and CaM kinases that have multiple potential downstream effects including the phosphorylation of CREB. During puberty, FSH activates the MAP kinase cascade and ERK kinase in Sertoli cells most likely via cAMP interactions with guanine nucleotide exchange factors (GEFs) and activation of Ras-like G proteins. ERK is capable of activating transcription factors including SRF, c-jun and CREB. In granulosa cells, FSH also activates the p38 MAP kinase. FSH and cAMP also likely act through GEFs to activate PI3-K and then phosphoinositide dependant protein kinase (PDK1) and PKB in Sertoli cells. Studies of granulosa cells identified Forkhead transcription factor (Forkhead), SGK (glucocorticoid-induced kinase) and GSK-3 (glycogen synthase kinase-3) as additional downstream targets of the PI3-K pathway. FSH also mediates the induction of PLA2 and the subsequent release of arachadonic acid

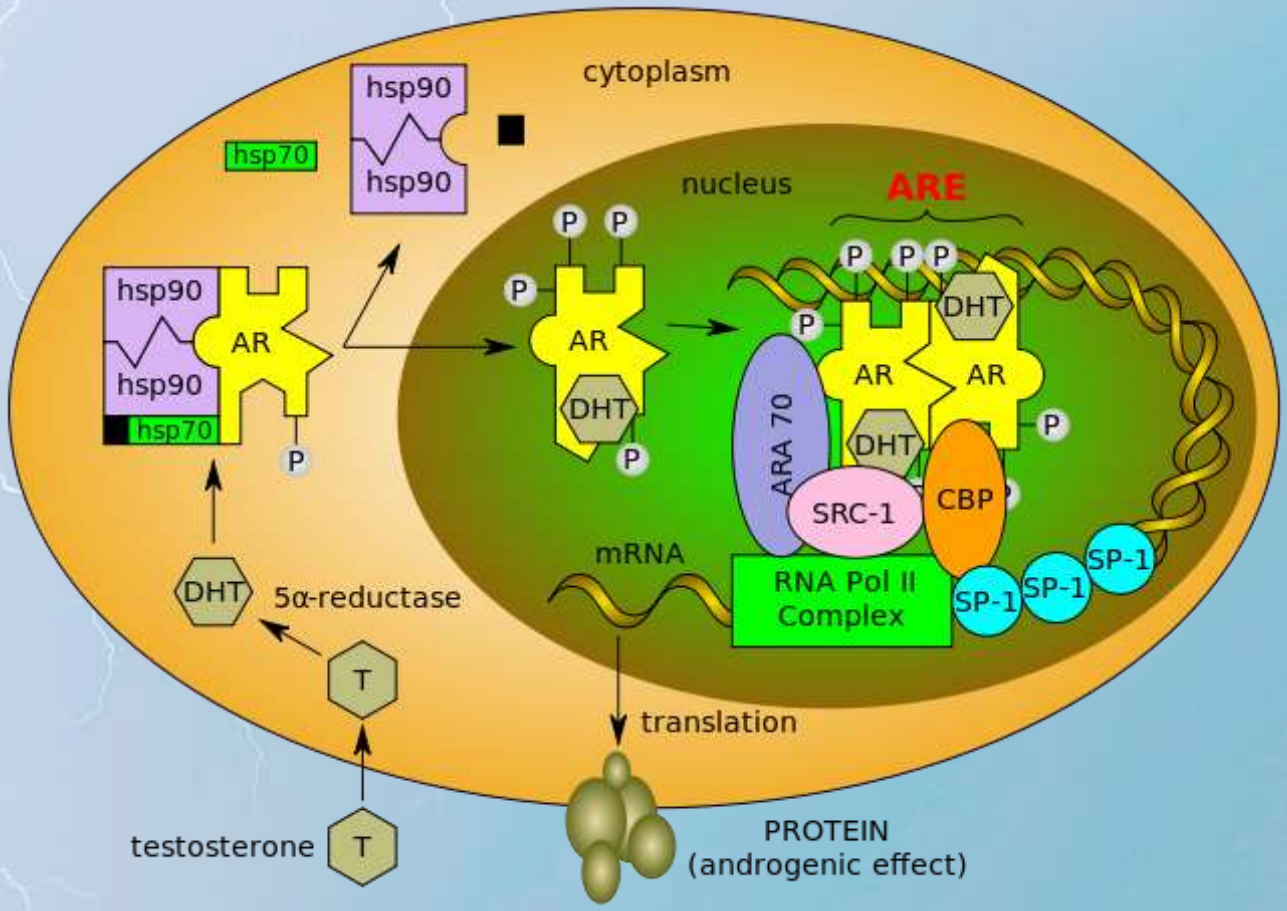
Інгібін та активін





Endocr Rev, Volume 35, Issue 5, 1 October 2014, Pages 747–794, https://doi.org/10.1210/er.2014-1003

Статеві гормони й рецептори



Окситоцин

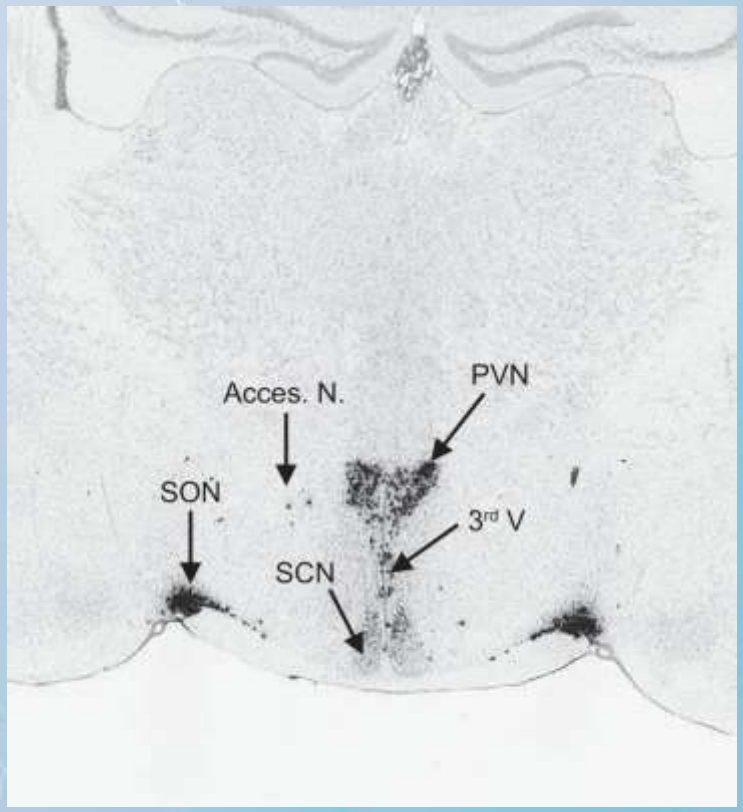


FIGURE 3. Coronal section of an adult mouse brain showing prominent OXT mRNA expression in the hypothalamic paraventricular nucleus (PVN) and supraoptic nucleus (SON), and weaker expression along the walls of the third ventricle and the accessory nuclei, as revealed by in situ hybridization. The weak signal detected in the suprachiasmatic nucleus (SCN) is likely to be unspecific and could not be confirmed by immunostaining. Image credit: Allen Institute.

DOI: (10.1152/physrev.00031.2017)

Вплив окситоцину на міометрій

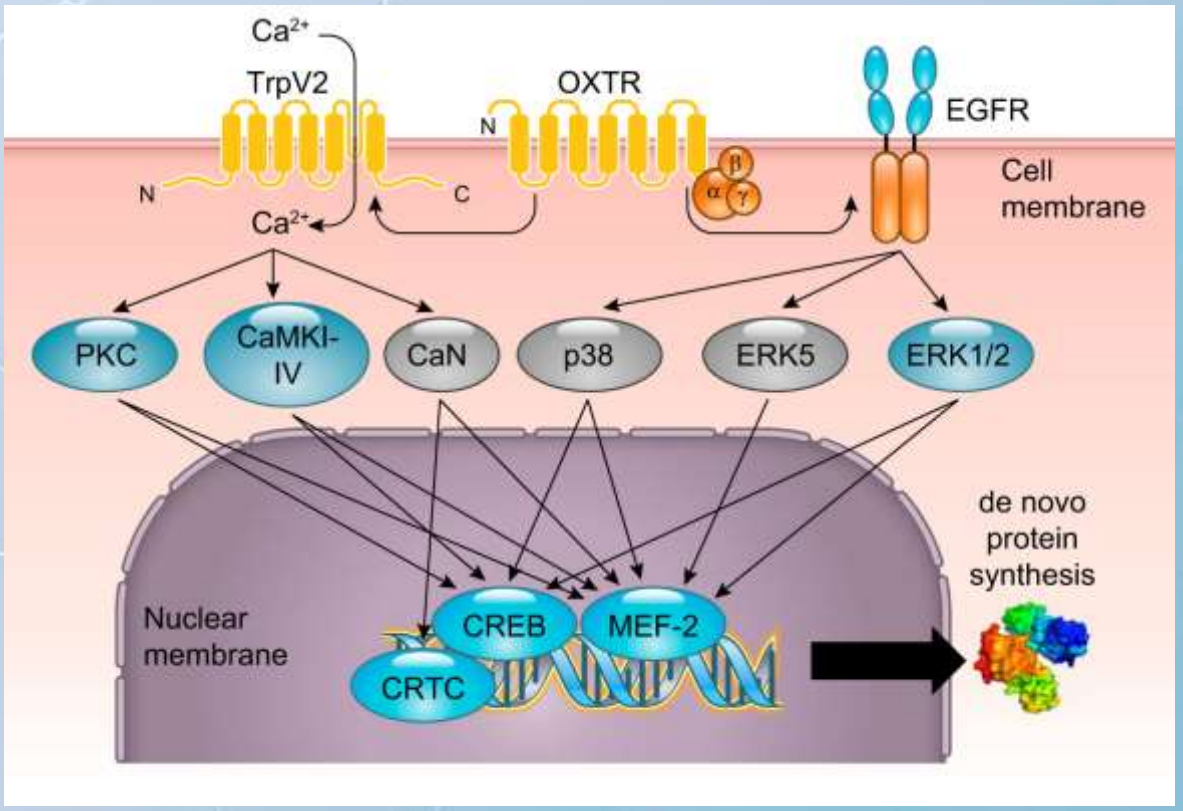
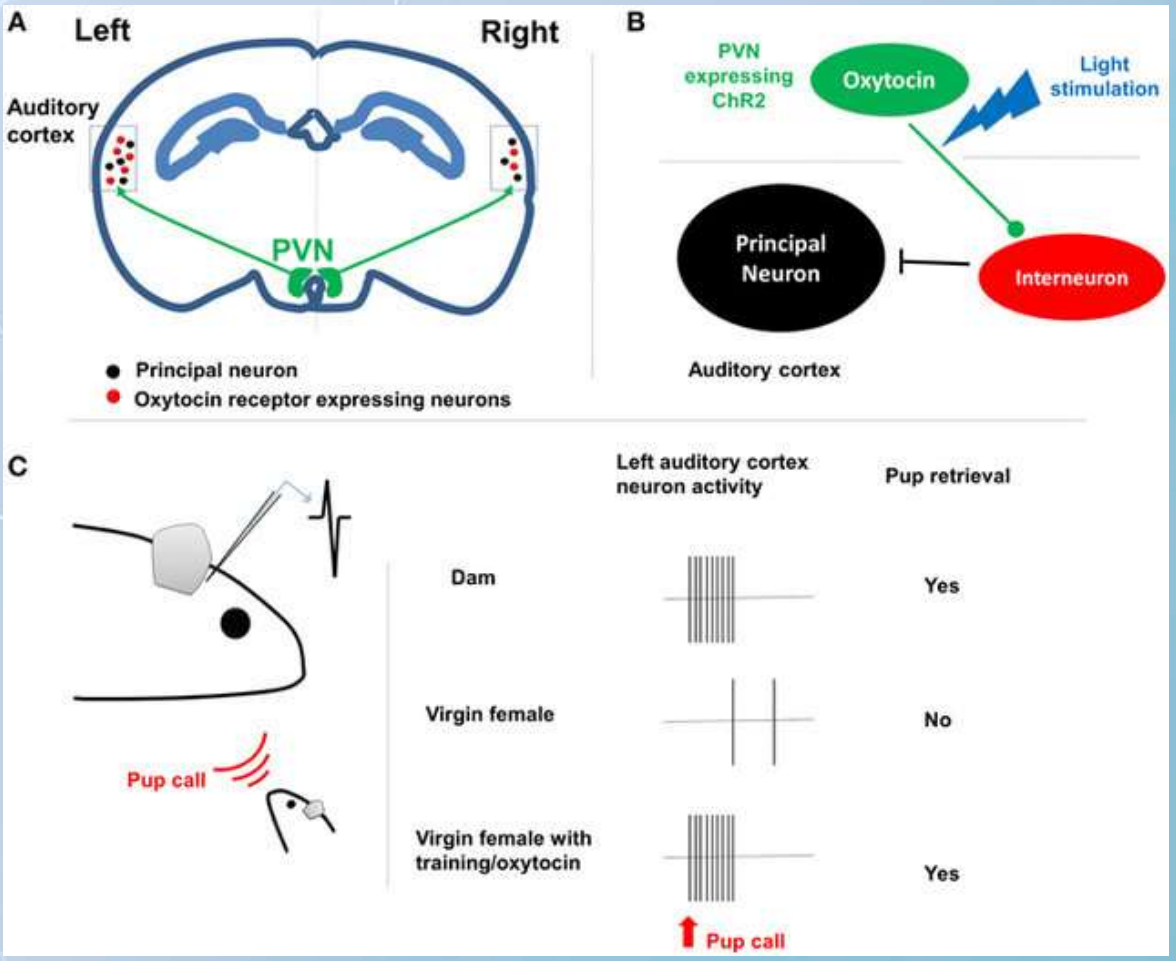


FIGURE 9. Representative scheme of neuronal OXTR-coupled signaling cascades. OXT binding to its receptor induces incorporation of TrpV2 channels into the cellular membrane and subsequent activation of Ca2+-dependent cascades (PKC, CaMKI, II, IV, and CaN). OXT binding also induces transactivation of the EGFR and subsequent MAPK activation (ERK1/2, ERK5, p38). When direct evidence for coupling to OXTR in neurons is available, kinases are in blue circles. When indirect evidence is available or direct evidence from other cell types, kinases are in gray circles. All of the described cascades converge on the CREB-CRTC/MEF-2 transcription factor complex, leading to increased transcription of target genes. TrpV2, transient receptor potential vanilloid type 2; PKC, protein kinase C; CaMK, calcium/calmodulin-dependent kinase; CaN, calcinueurin; EGFR, epidermal growth factor receptor; MAPK, mitogen activated protein kinase; ERK1/2, extracellular signal regulated kinase 1/2; CREB, cyclic AMP responsive element binding protein; CRTC, cyclic-AMP-regulated transcriptional co-activators; MEF-2, myocyte enhancer factor 2.

DOI: (10.1152/physrev.00031.2017)

Окситоцин і материнська поведінка



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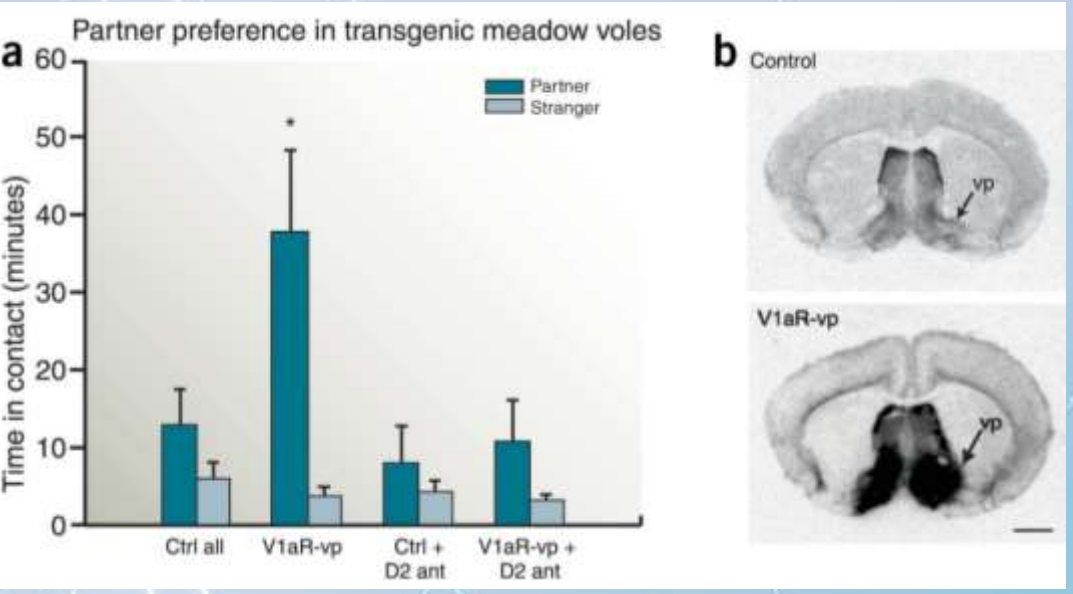
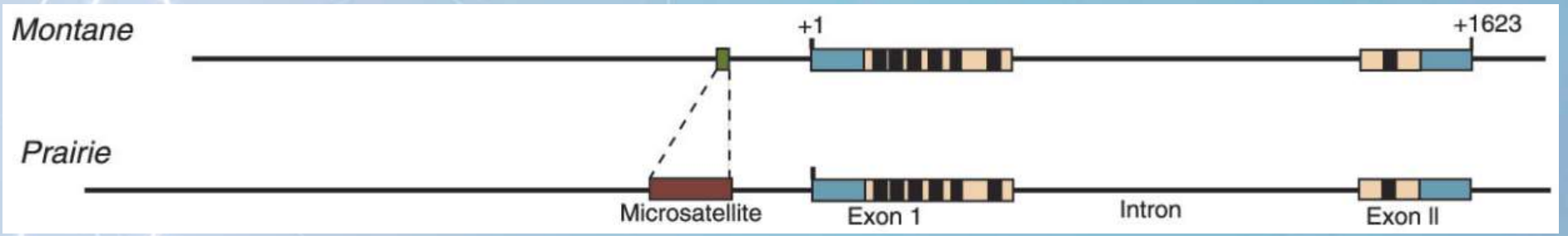
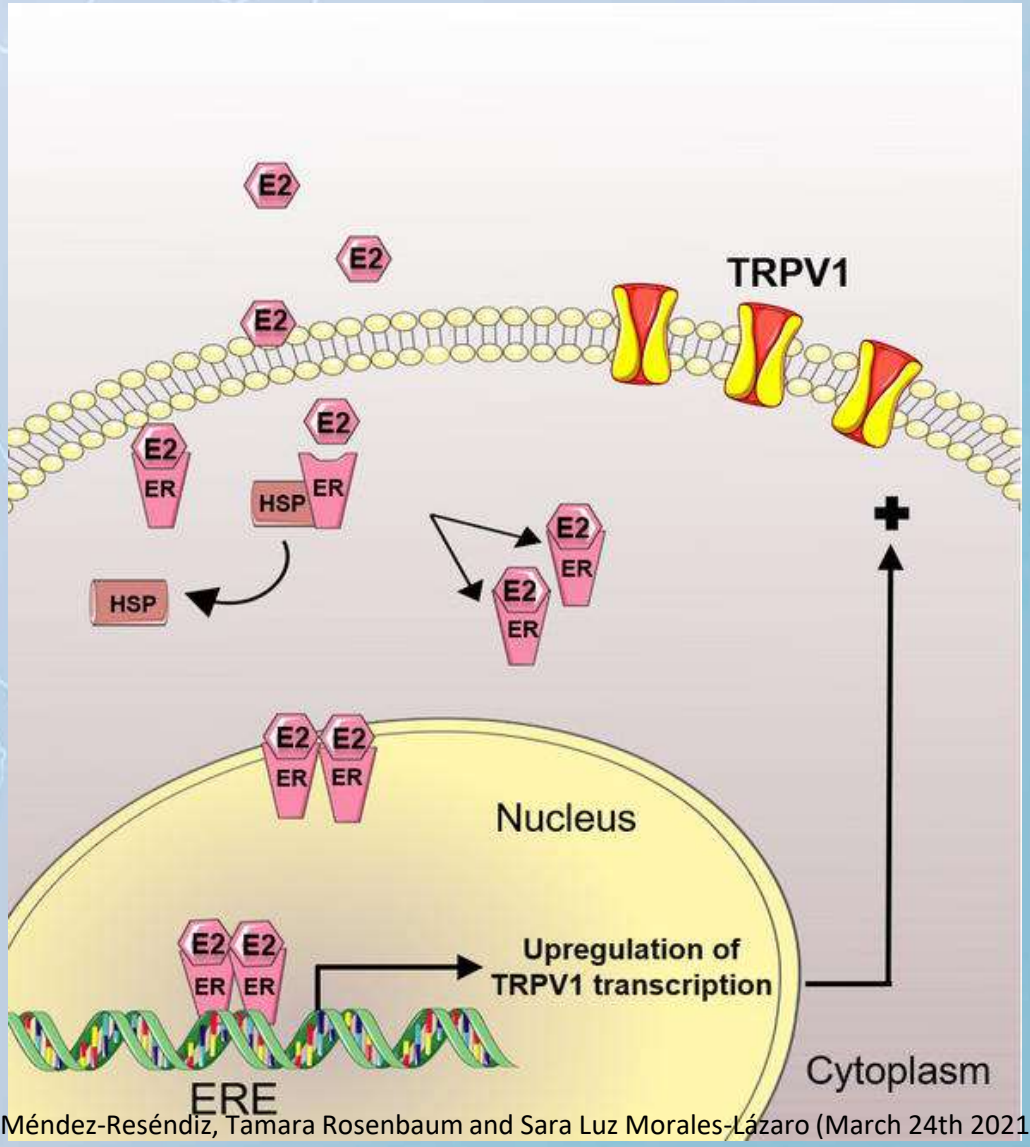
Вазопресин впливає на пошук партнера





Ларрі Янг: Прерійна полівка *Microtus ochrogaster* і гірська полівка *Microtus montanus*

Жінкам не боляче?



Óscar Enciso-Pablo, Karina Angélica Méndez-Reséndiz, Tamara Rosenbaum and Sara Luz Morales-Lázaro (March 24th 2021). Nociceptive TRP Channels and Sex Steroids, Reproductive Hormones, Courtney Marsh, IntechOpen, DOI: 10.5772/intechopen.95552. CC-BY 3.0

Чоловіки не мерзнуть?