	9.09J/7.29J - Cellular Neurobiology, Spring 2005 Massachusetts Institute of Technology Department of Brain and Cognitive Sciences, Department of Biology Instructors: Professors William Quinn and Troy Littleton Lecture notes courtesy of Wyan-Ching Mimi Lee. Used with permission. 4/26/04
Landau II Ding with a start of Party	1. neurotrophin hypothesis: synaptic connections need strong activity (postsynaptic releases
	retrograde signals) so connections can thrive (eg BDNF retrograde signal)
- JANNESS MICHTORES - 11-111	- if oversupply these molecules or knock att tricks, don't get columns
1. 1.175. 1115. (address) - 499-975.	2. LTP hypothesis: LTD (inhibits synapses); implicates NMDARs (Ca2+influx, triggers LTD)
and the second	- if synapse very active, Mg2+ block removed
	- often postsynaptic cell get lots of inputs from same eye (get LTP), synapses grow
-	- if several long pulser, no UTP, remover AMPARs (low Ca2+), synapser retract
	4 low frequency, asynchronous ? (activates phosphatases)
	-w/ monocular deprivation, before structural changes, synapses silenced within hows (may
	be LTD)
1997 - 1997 -	veen
12. data da	- critical period varies between organisms
an in the second second second second	
tana Tarana Manganatan katika dal	- LTD much less robust in mature animal (less plasticity)
All on Pull solutions	- neurons that fire together wire together
	newons that fire out of sync lose their link
,	Trade month of sync tose men non
* <u>.</u>	receptive field:
ntro d'hand od hiyan të	- only small number of triggers allow neuron to fire
an mainte da construit de la construit d'anna a	Uning smoli normals hamber of thigges blive hearth to the
a name of the transmission of the transmission of	- visual system has incredible ability to adapt to variety of stimuli
enano konanya, 1) saldate daga	- can detect 1 - 10° photons/sec: very sensitive
au 1997 - 19 19 19 19 19 19 19 19 19 19 19 19 19	
acondences of a conversion the	visual system properties:
un constantine	1. sensitivity
	2. receptive field (what required to activate neuron you're recording from)
and a statement of the statement	- hierarchy: neurons begin to integrate more & more complex information
	3. lateral inhibition : contrast (neurons like to see bandaries)
and the second	
and warmen of the state of the	1930's: Hartline studied horseshoe crab (Limulus): have many ommatidia, each sends
1222279-2223-274-70789	one axon to optic neve
	- normally active, shining light makes very active ; if shine on one area, area next

- normally active, shining light makes very active : if shine on one area, area next

to it (neighboring photoreceptors) shut off 3 types of contrast: 1. spatial contrast : boundaries 2. temporal contrast : if slavly increase light intensity, hard to detect, but if fast, very detectable 3. motion : spatial & temporal vitreous humor pigment epithelial cells (light sensitive background, absorb random light) comea forea Chighest visual acuity) lens - optic cup (blind spot) ( optic nerve -) thalamur chamber ſ - cillary muscles (hold eye in place) iris (muscle that contracts) C (this connection always fires in dark: light makes it stop fining) photoreceptor neceives light -> bipolar neuron -> ganglion cell -> LGN -> Layer IIZ Coptic nerve from don't fire APS: these axons) use graded potentials - as progress through visual system, receptive fields get bigger -retina 1 pt, bipolar neurons receive inputs from more than one photoreceptor, etc - in cortex, PC: face detection (extract information you want, ignore all-else) MT: motion horizontal cells mediate anatomy of retina: crystalline. lateral inhibition back light must travel through all these photoreceptor cell types: in fores, everything harizantal (GABA shifts so photoreceptors directly bipolar cell 0000 6 photoreceptor exposed. - Swarine 20 ell (thought to contribute 9 to lateral inhibition) ganglioncell (, front + optic nerve

2 types of photoreceptos: - rods outnumber cones 20:1 rods cones 20:1 number night vision (| photon) daytime (10's - 100's photons) convergence talk to bipolar cells to cauple input on one oipolar 108 photopigment/cell good at acuity (b)c less convergence) forea has only coner only one form of opsin (achromatic) 3 different opsins (color vision) ~ 100ms (long signal processing time) detect 12 Hz flicker detect S5 Hz flicter (back) rod cone outer pigment - filled not pinched off intracellular organeller (pinch off membrane) nitochondria synaptic terminals pigment epithelium Il-cis 211- +/2nj lys 296 in TM domain directly connects to 11-cis retinal - rhodopsin (w/light, becomes trans) - retinal (in 7th w/o light) TM domain) trans switches to active opsin conformation different opsins hold So c-terminus can interact retinal in slightly different w/ downstream proteins conformations, so different all-trans retinal transported art of cell to pigment epithelium, As change doublez band back to cis, back to photoreceptors

-11-cisrctinal from vitamin A Clack -> night blindness, photoreceptor degeneration) - rhodopsin is 6 protein-coupled receptor - when modopsin activated, recruits transducin. transducin (+ransducin-6TP active) photoreceptors have no voltage - gated CGMP phosphodiesterale Natchannel, but have cGMP-gated S' GMP Nat channel (in dark, constantly fluxing Nat in) Nat EK=-70 mV when Nat channels closed, { w/ light hyperpolarize to -70 mV, no more synaptic transmission (indark, Vm = -40mV) 000000 (voltage-gated) -40-1-70 = dynamic Ange of vision amplification:

- one activated rhodopsin can bind hundreds of transducins, 1:1 phosphodiesterase, but phosphodiesterase can convert 103 cGMPs
  - 10.5 amplification (can get dramatic response blc of this)

rhodopsin = opsin + 11-cis refinal

