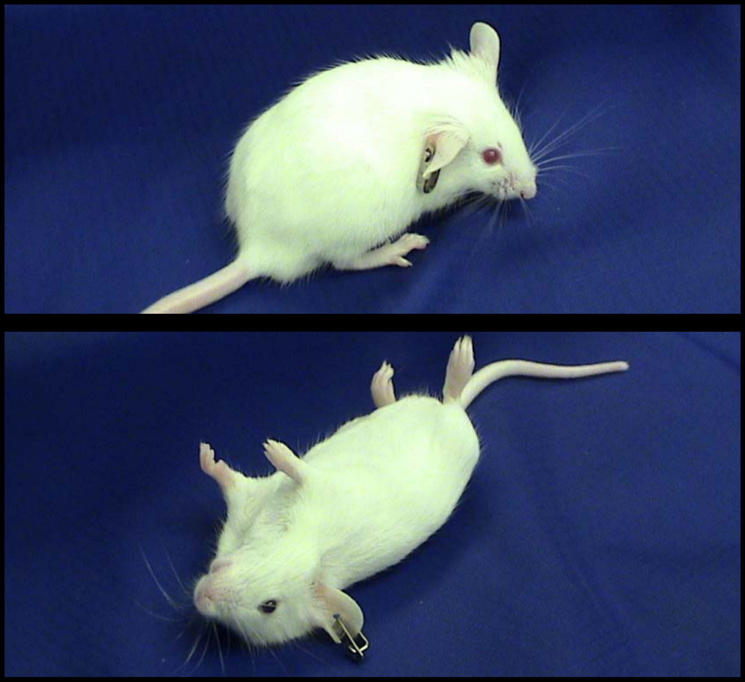
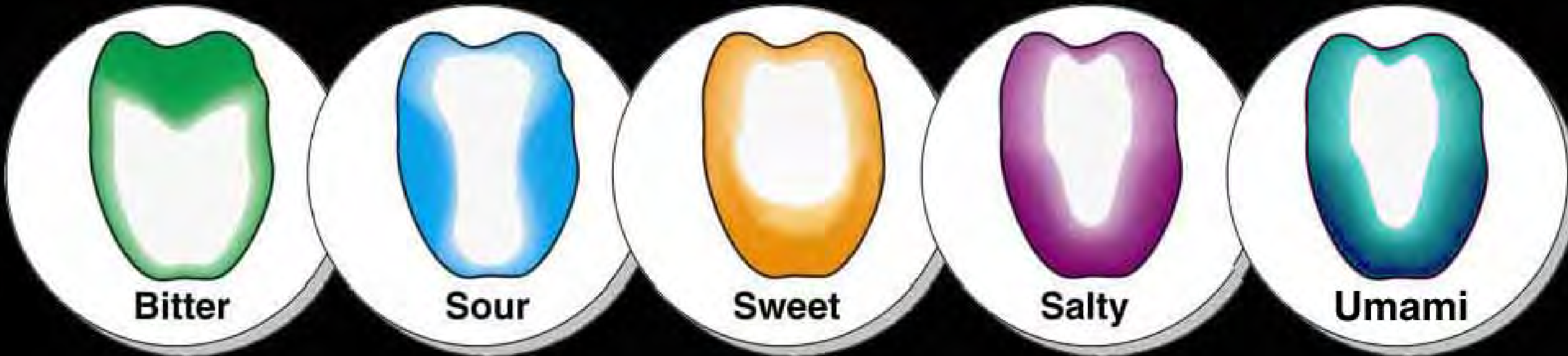
Taste: from detection to perception

- demystifying medicine?
- most “taste” problems in fact have an olfactory basis
- close inter-relation of these two chemical senses

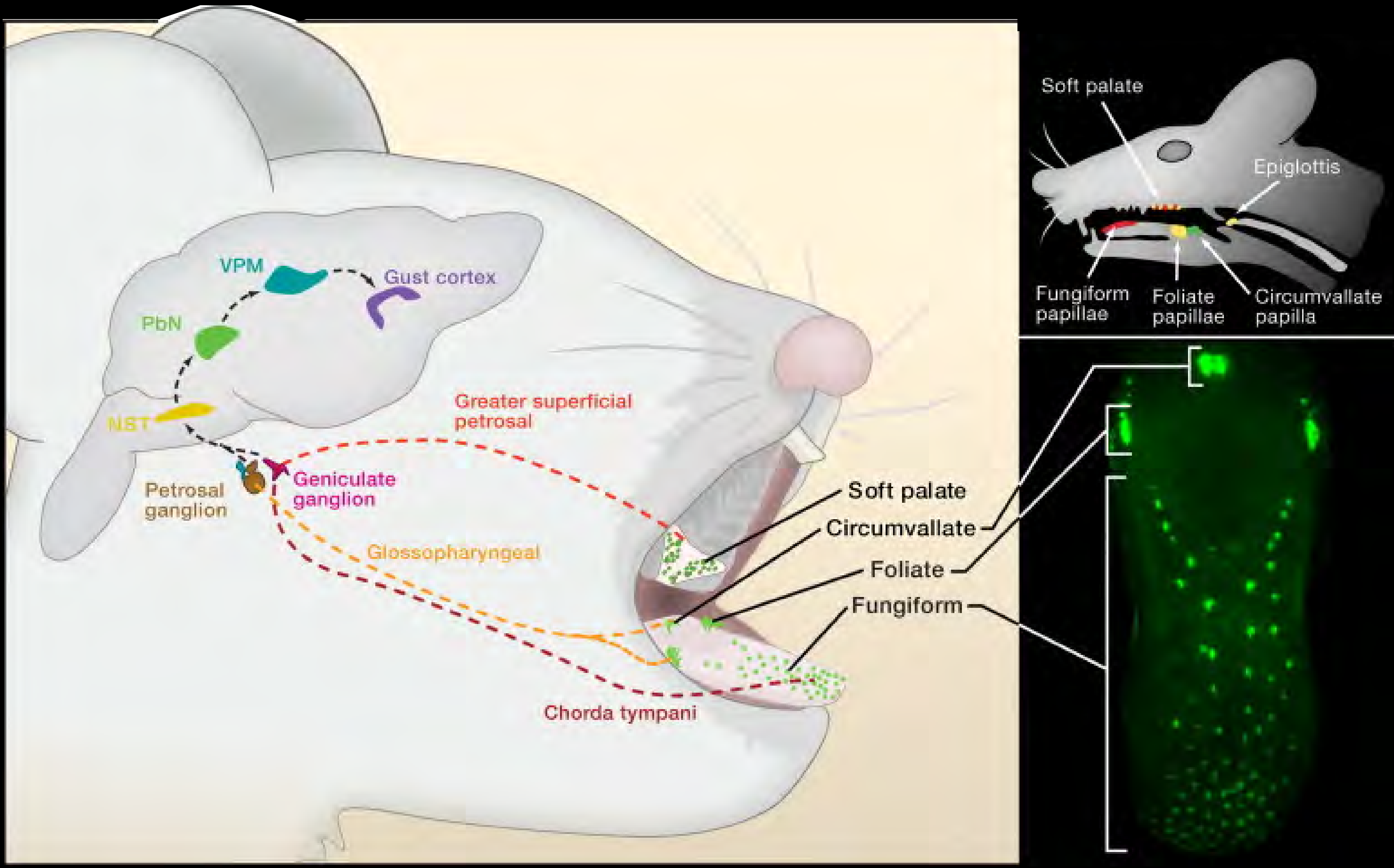
Taste evolved as an arbiter for consumption



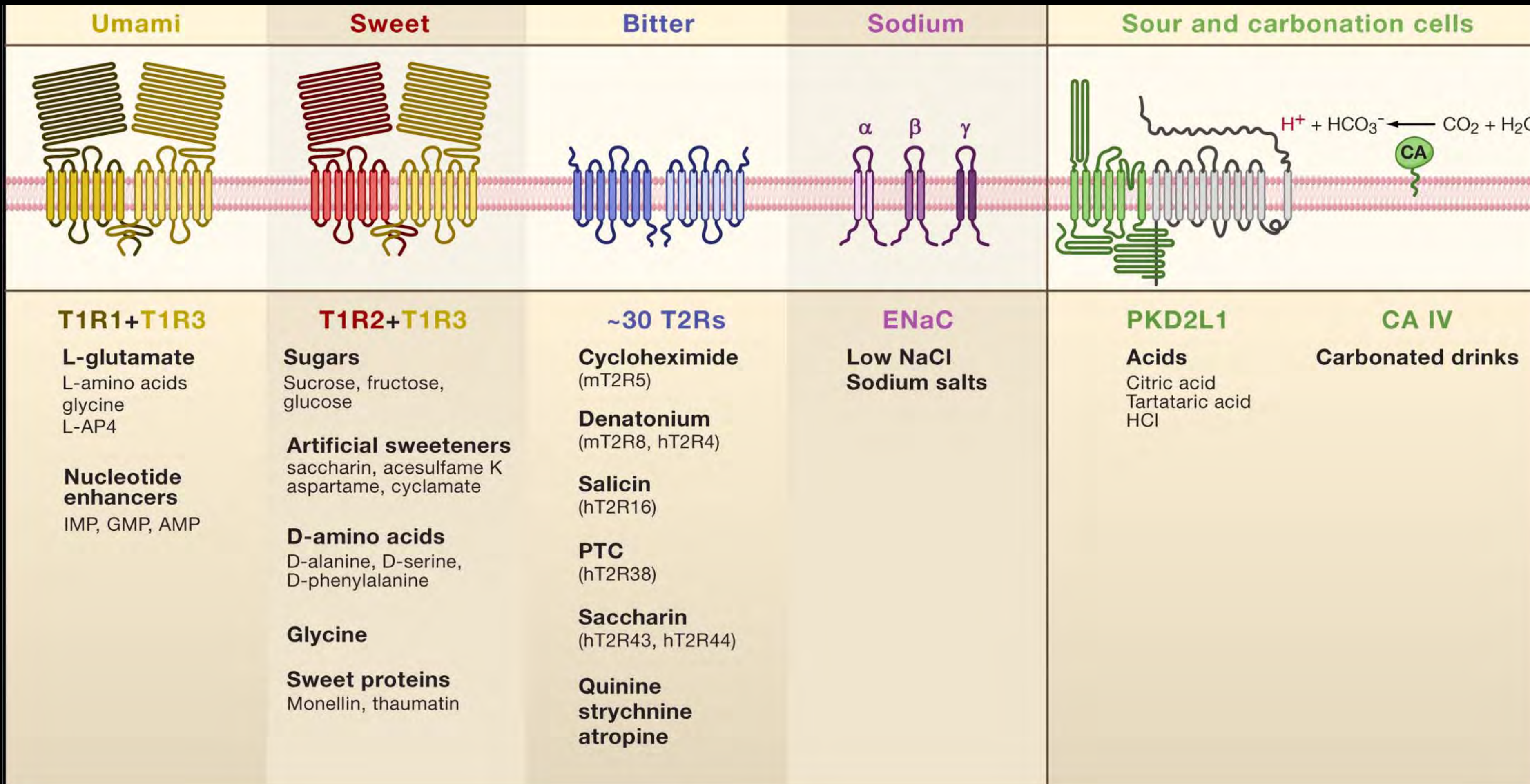

Bitter
Sour
Sweet
Salty
Umami


Bitter

The anatomy and pathways of taste perception



Mammalian Taste Receptors



necessary and sufficient for detection

reflect the evolutionary pressure on an organism

responsible for differential responses within and across species

provide a logic for the encoding of taste quality

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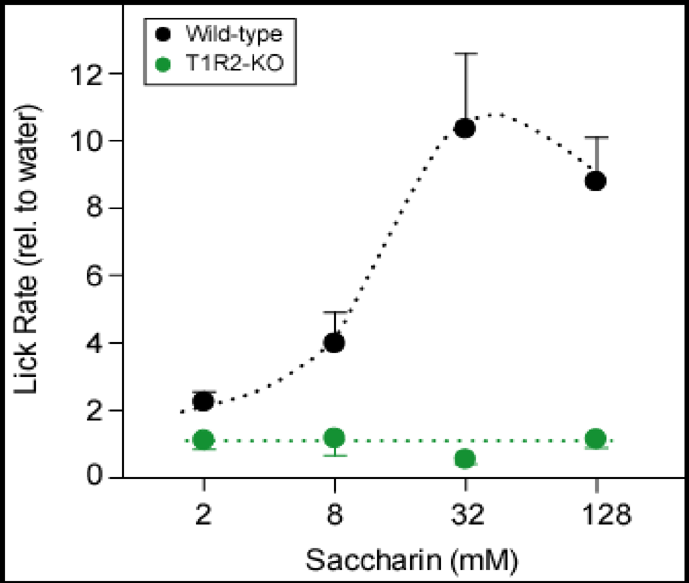
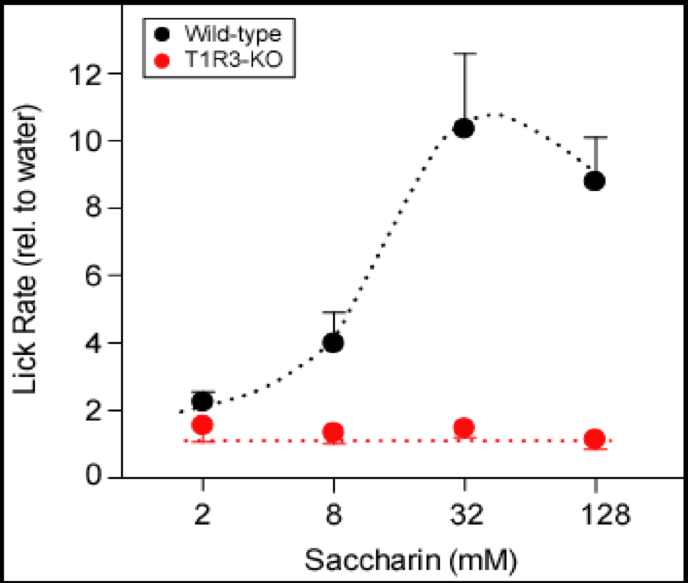
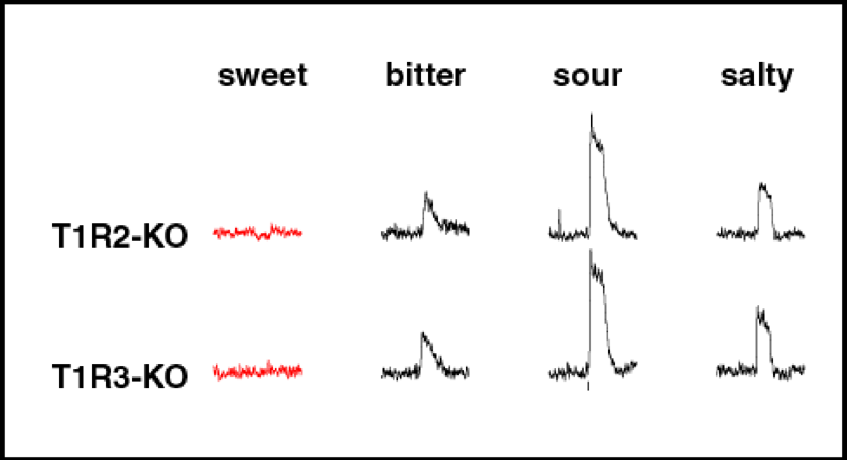
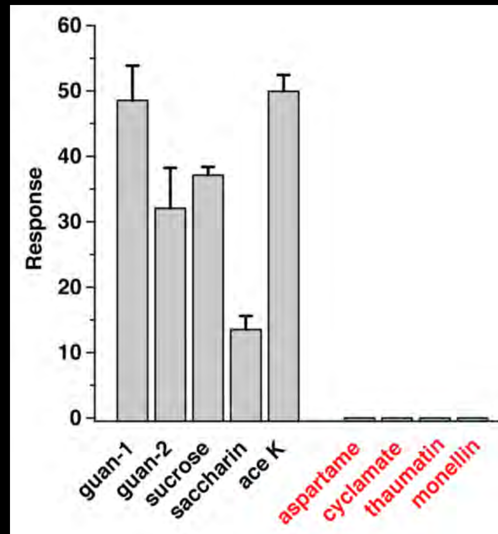
Sweet taste depends on T1R2 and T1R3



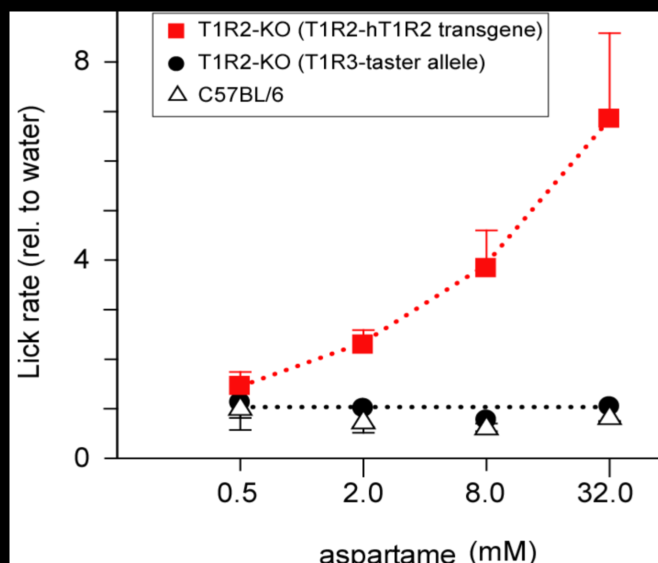




Sweet-spectrum is determined by T1Rs

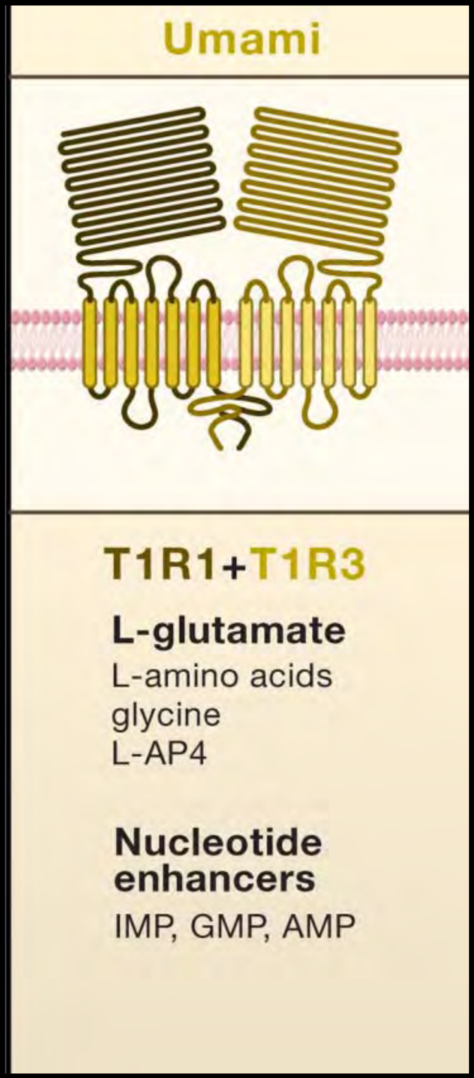


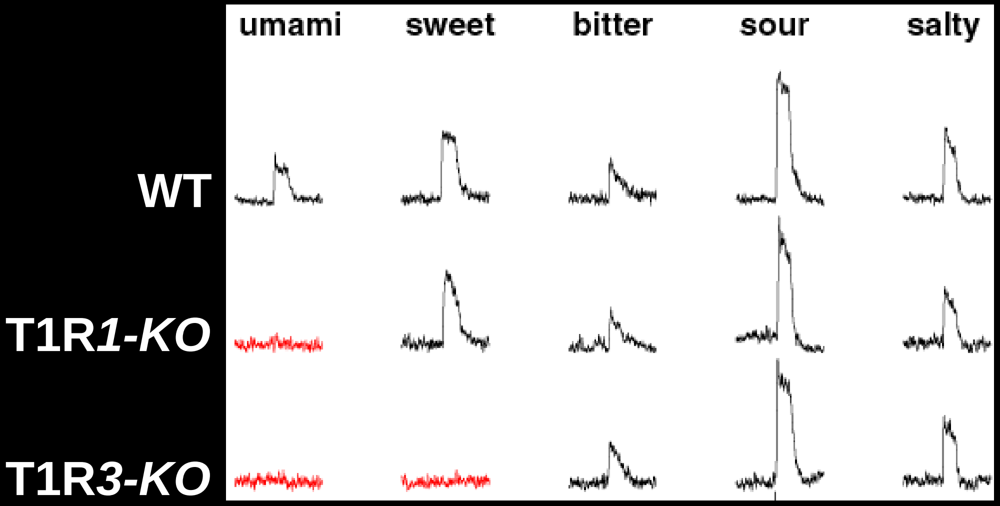
Neither mice nor mouse receptors normally detect a range of artificial sweeteners



Transgenic expression of hT1R2 “humanizes” the sweet preference of mice

The savory taste umami provides a taste for protein

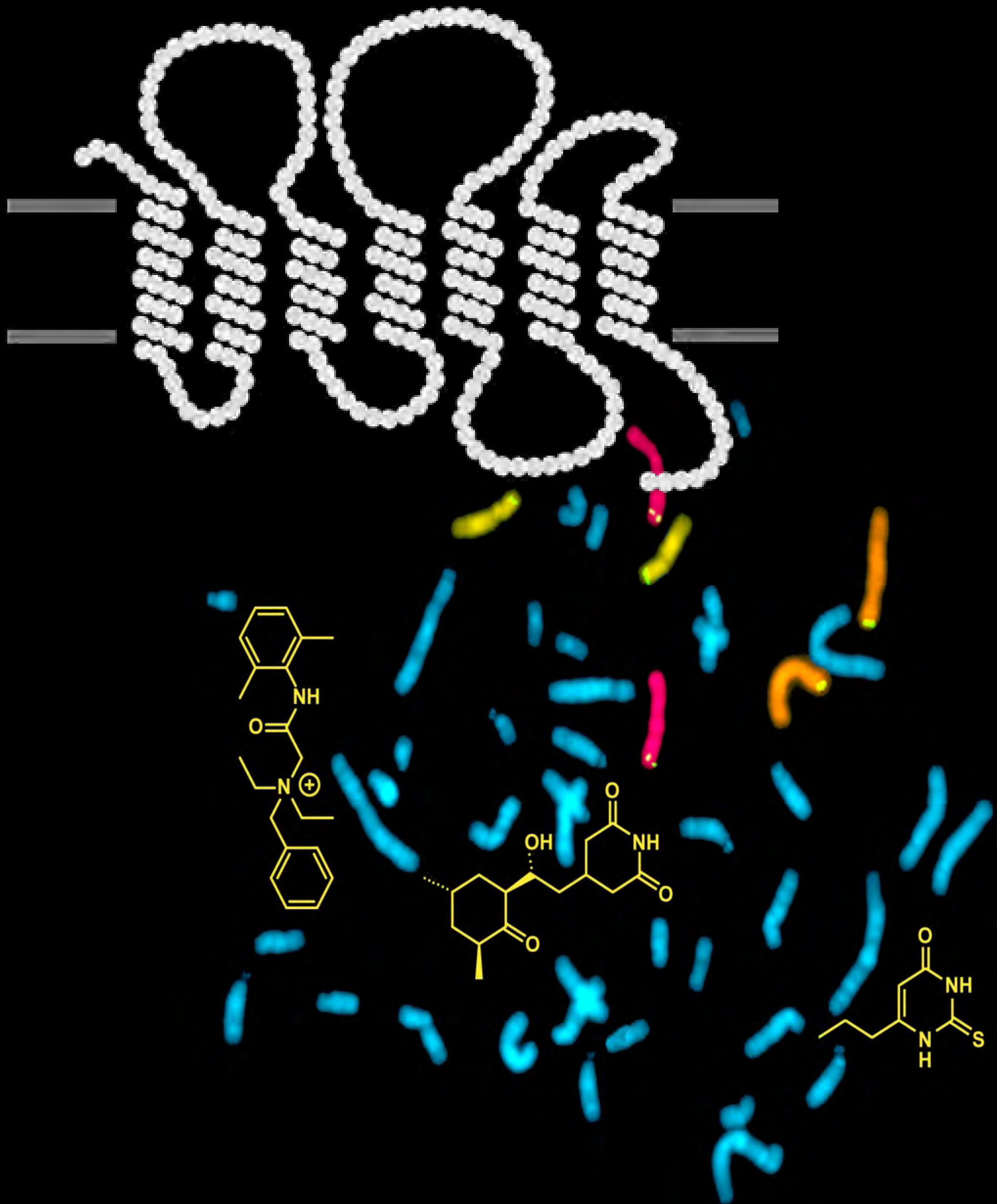




Human and mouse T1R1+3 have very different selectivity

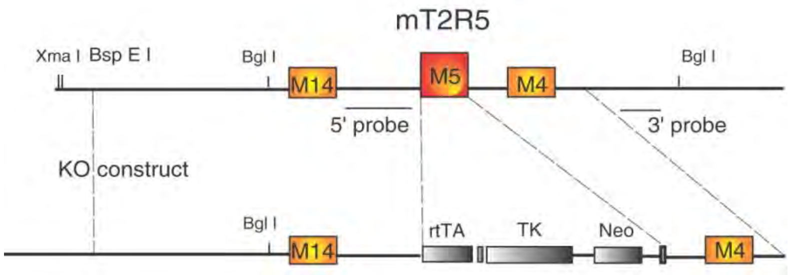
Giant pandas lost T1R1-activity when they switch diet

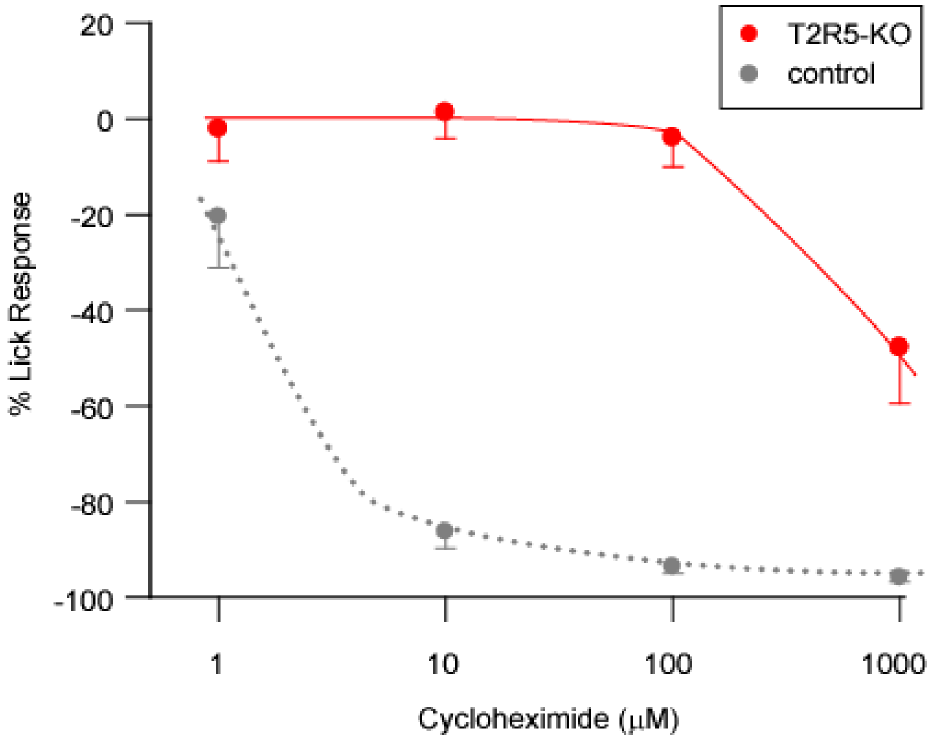
T2Rs- a very diverse family of about 30 receptors

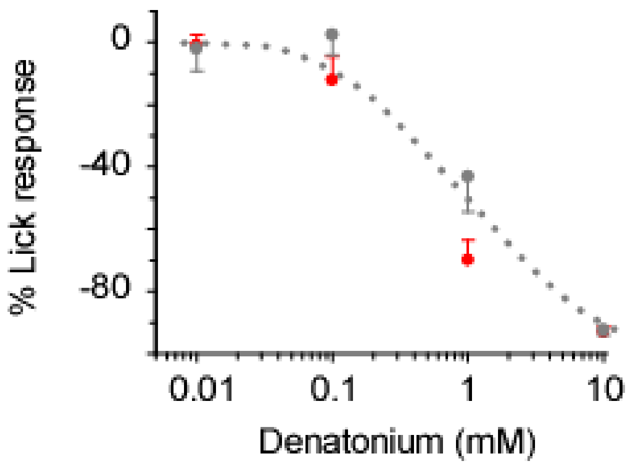


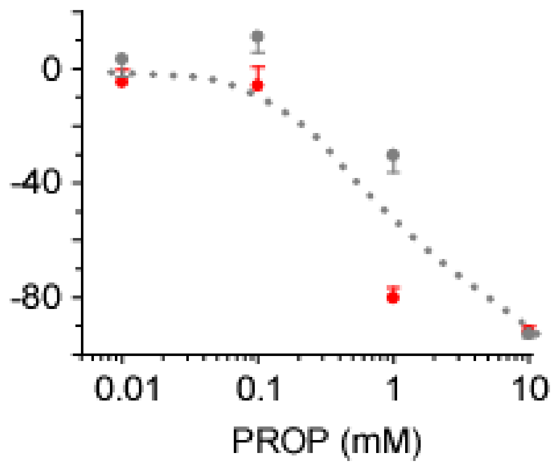
genes all map to bitter taste loci

selectively expressed in TRCs





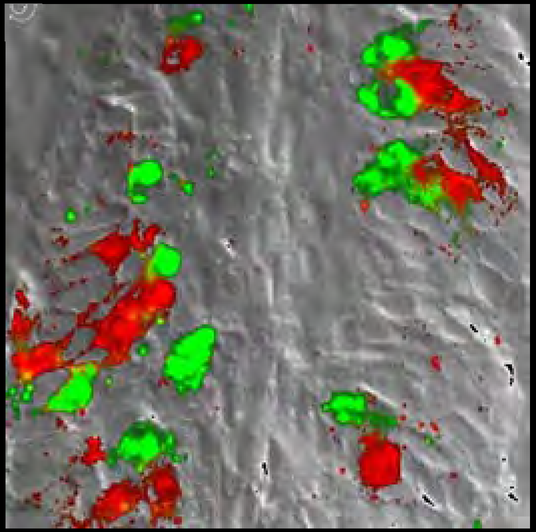




Ken Mueller
Mark Hoon

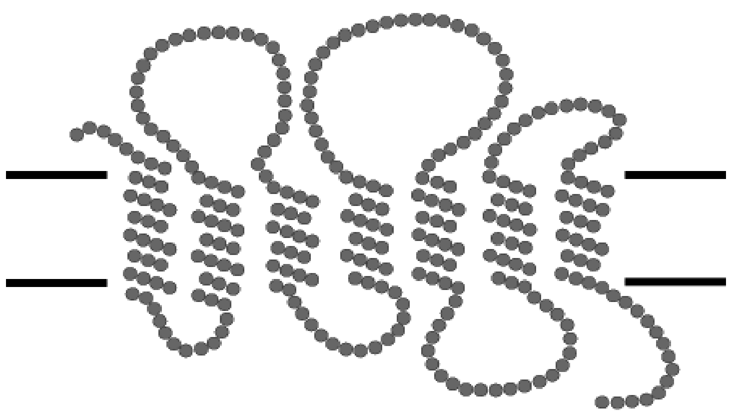
How is taste coded at the periphery?

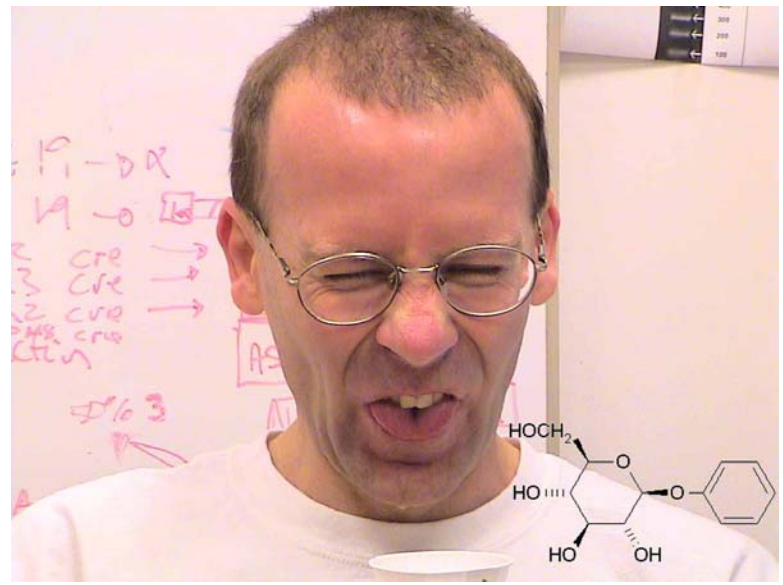
Probe: **T2R7** **mix of 10 T2Rs** **T2Rs + T1Rs**



suggests cells are responsible for encoding taste quality

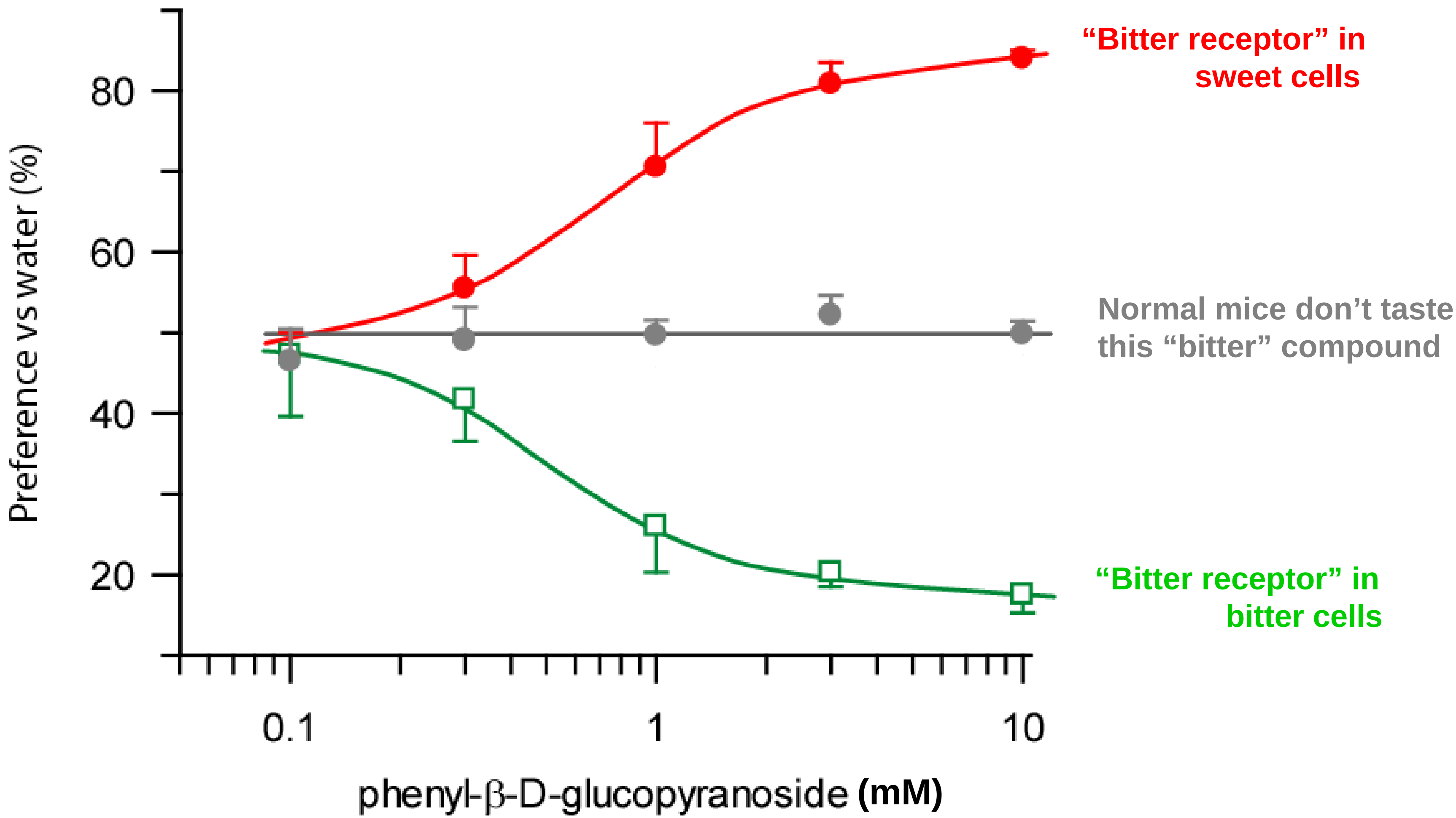
Attractive (sweet) and aversive (bitter) taste behaviors are mediated by dedicated cells <u>hardwired</u> to trigger stereotypic responses





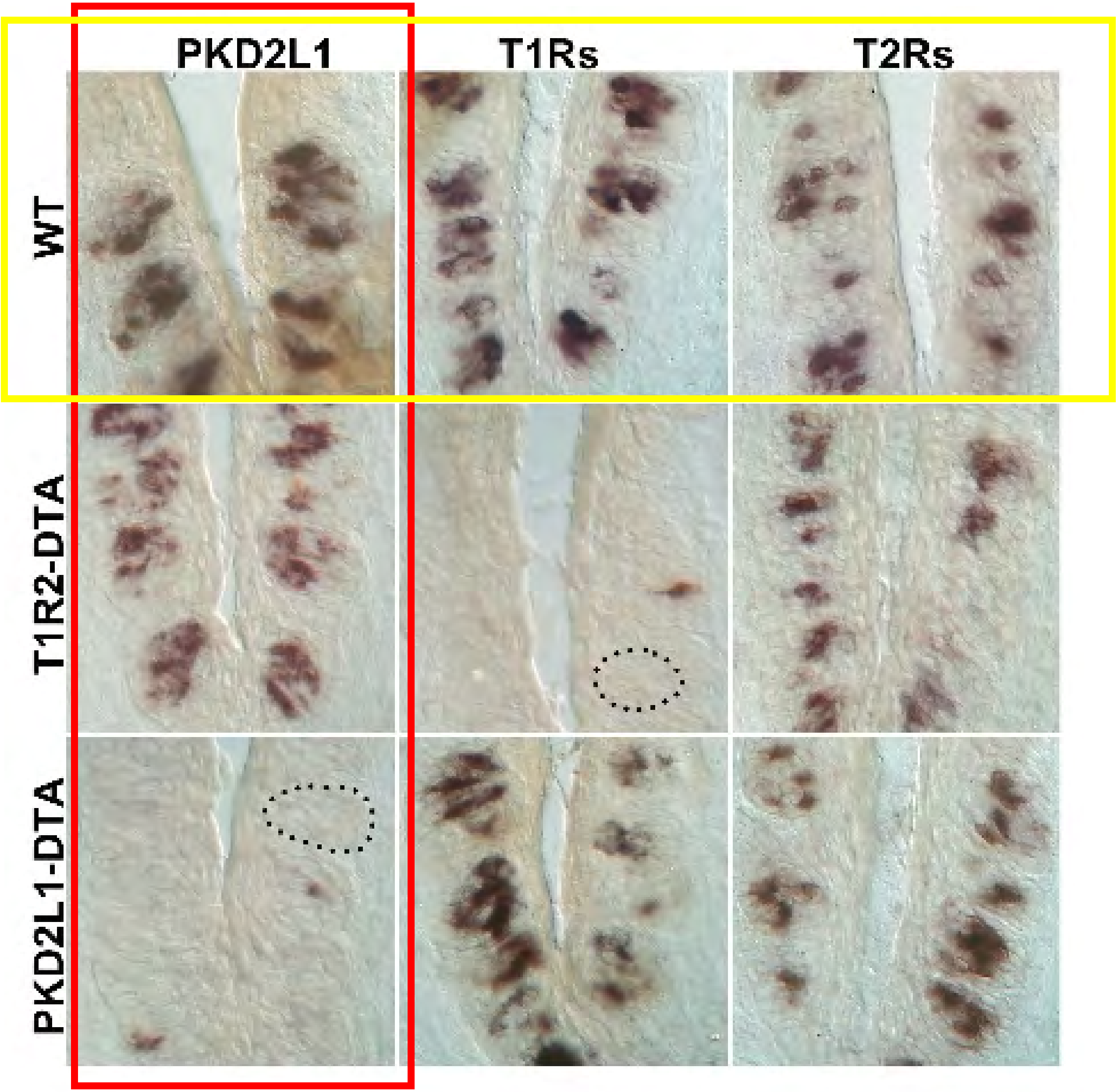
hT2R16 stimulated by phenyl β-D-glucopyranoside, which tastes very bitter to a human

BUT …

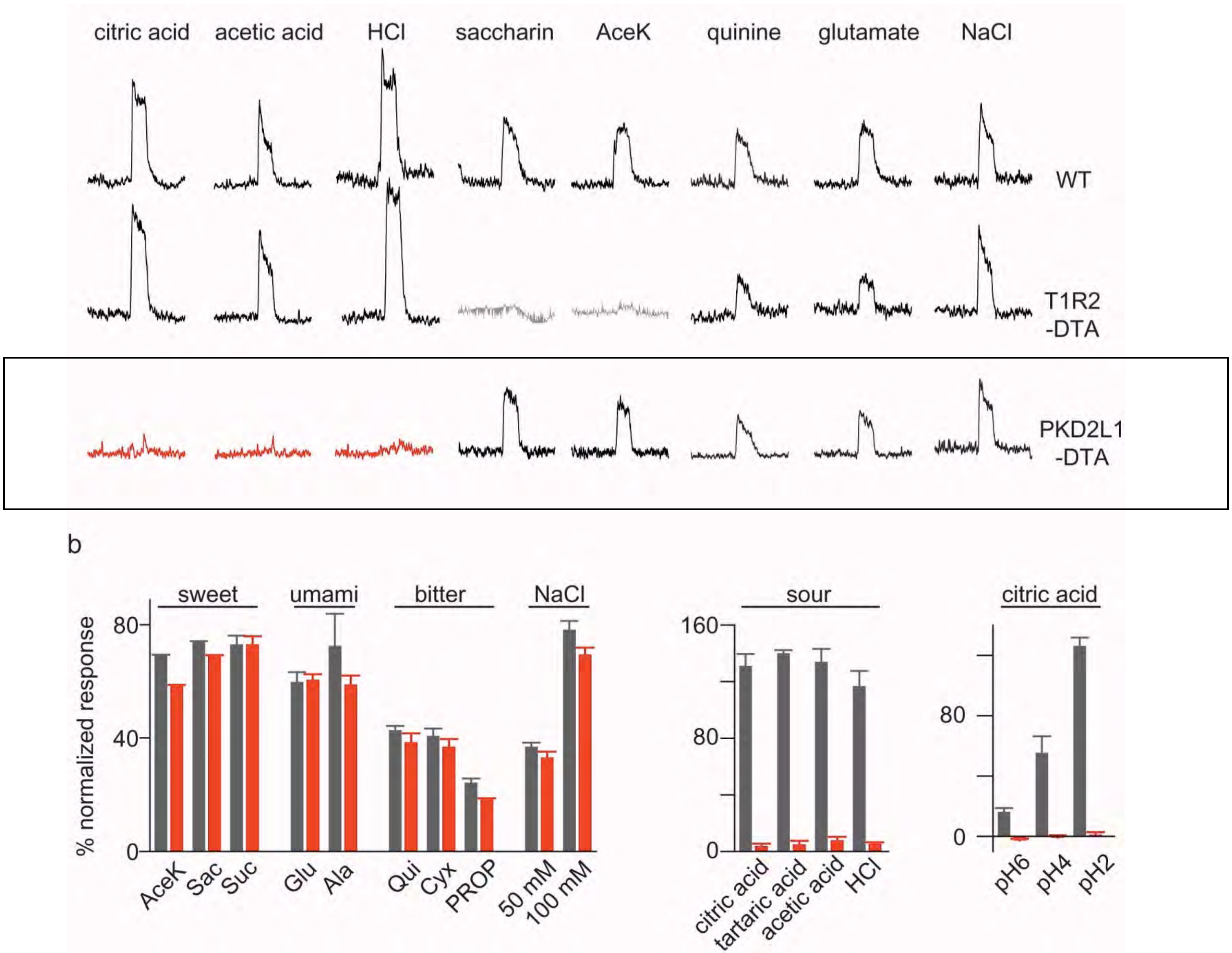


Preference vs water (%)
20
40
60
80
0.1
1
10
phenyl-β-D-glucopyranoside (mM)
“Bitter receptor” in sweet cells
Normal mice don’t taste this “bitter” compound
“Bitter receptor” in bitter cells

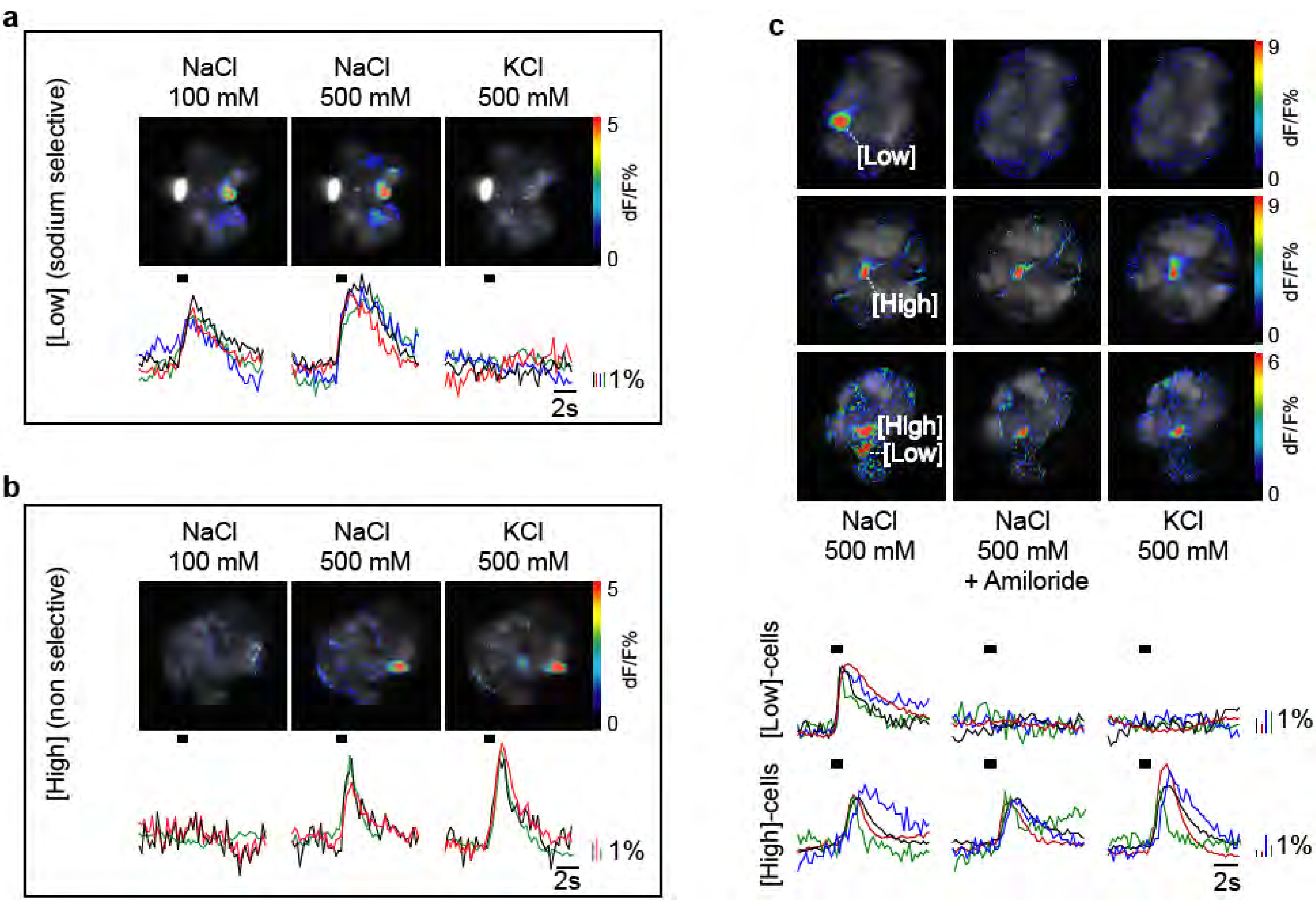
Targeted genetic ablation of TRCs (diphtheria toxin)



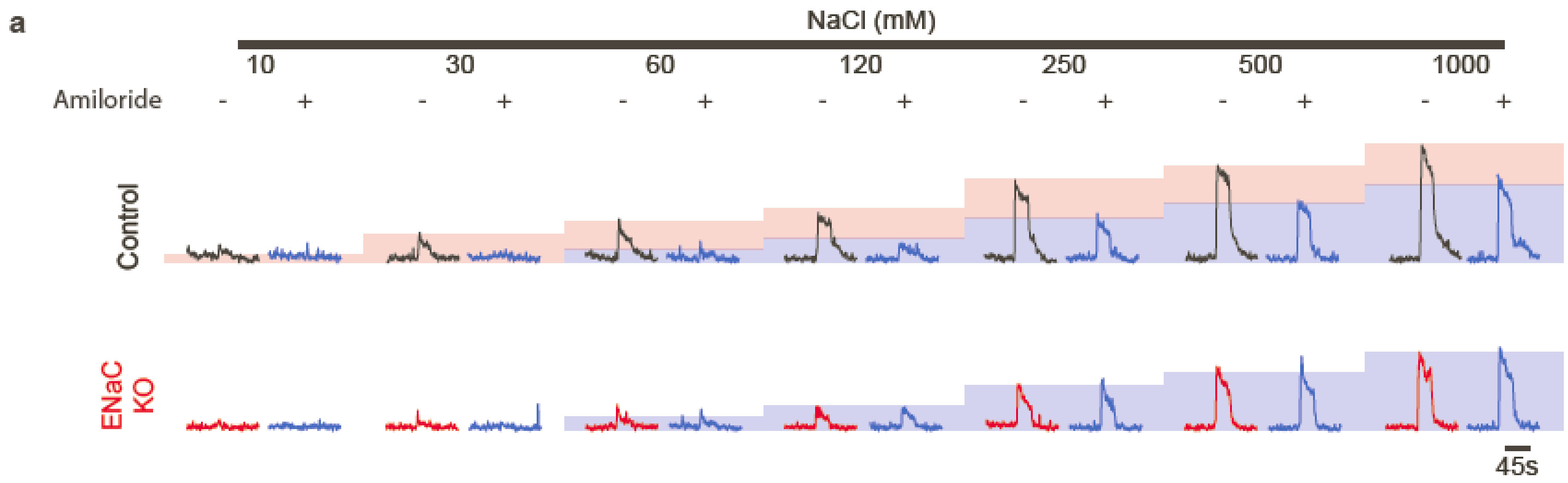
PKD2L1-expressing cells are the Sour Sensors

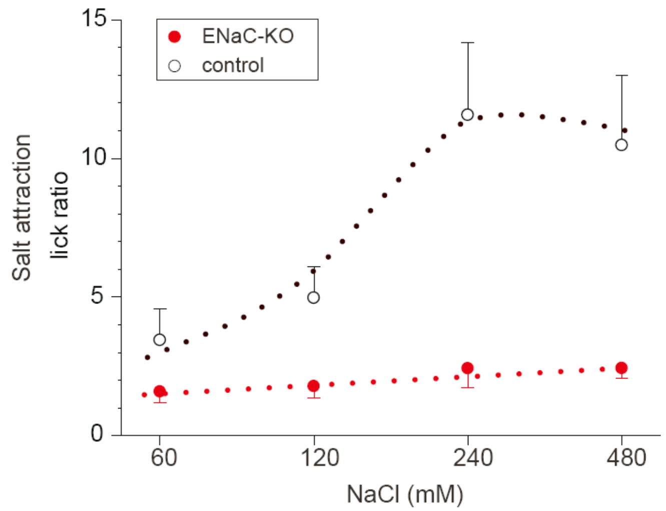


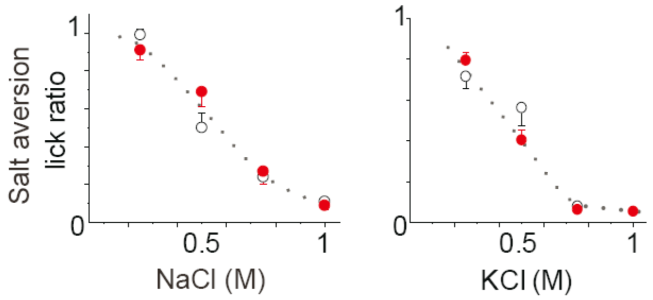
Salt taste is mediated by multiple mechanisms and cell types



Taste cell KO of ENaC abolishes sodium selective taste responses

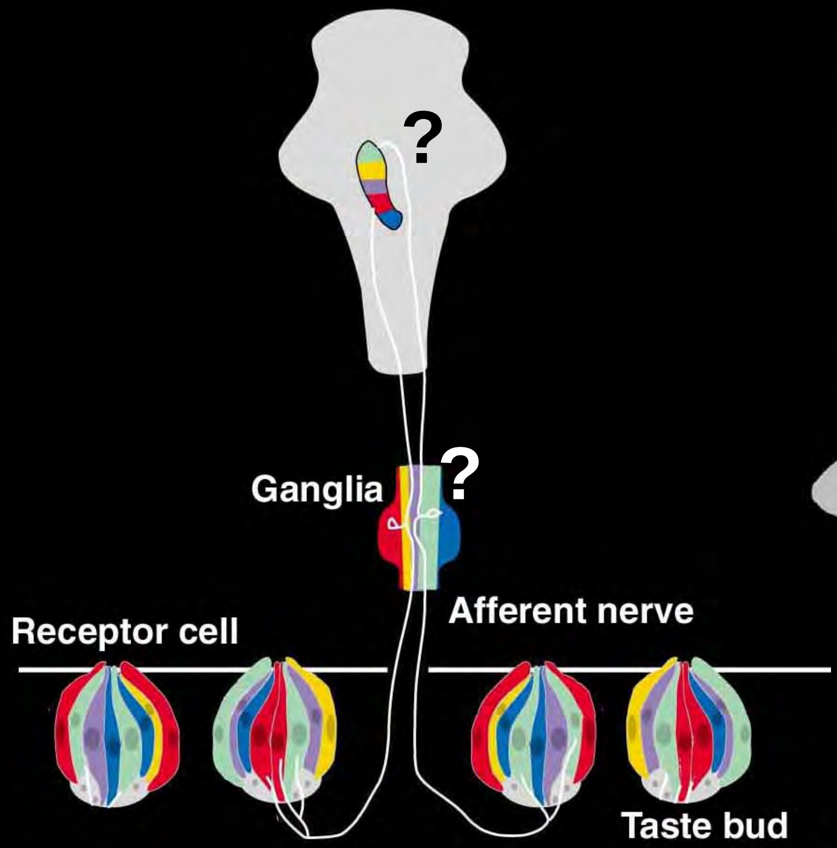


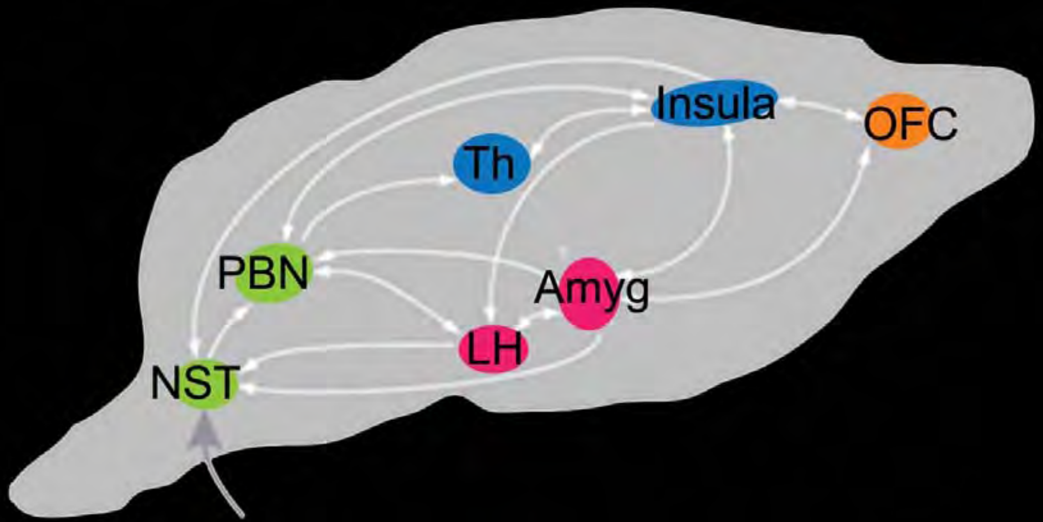




and salt attraction but not aversion

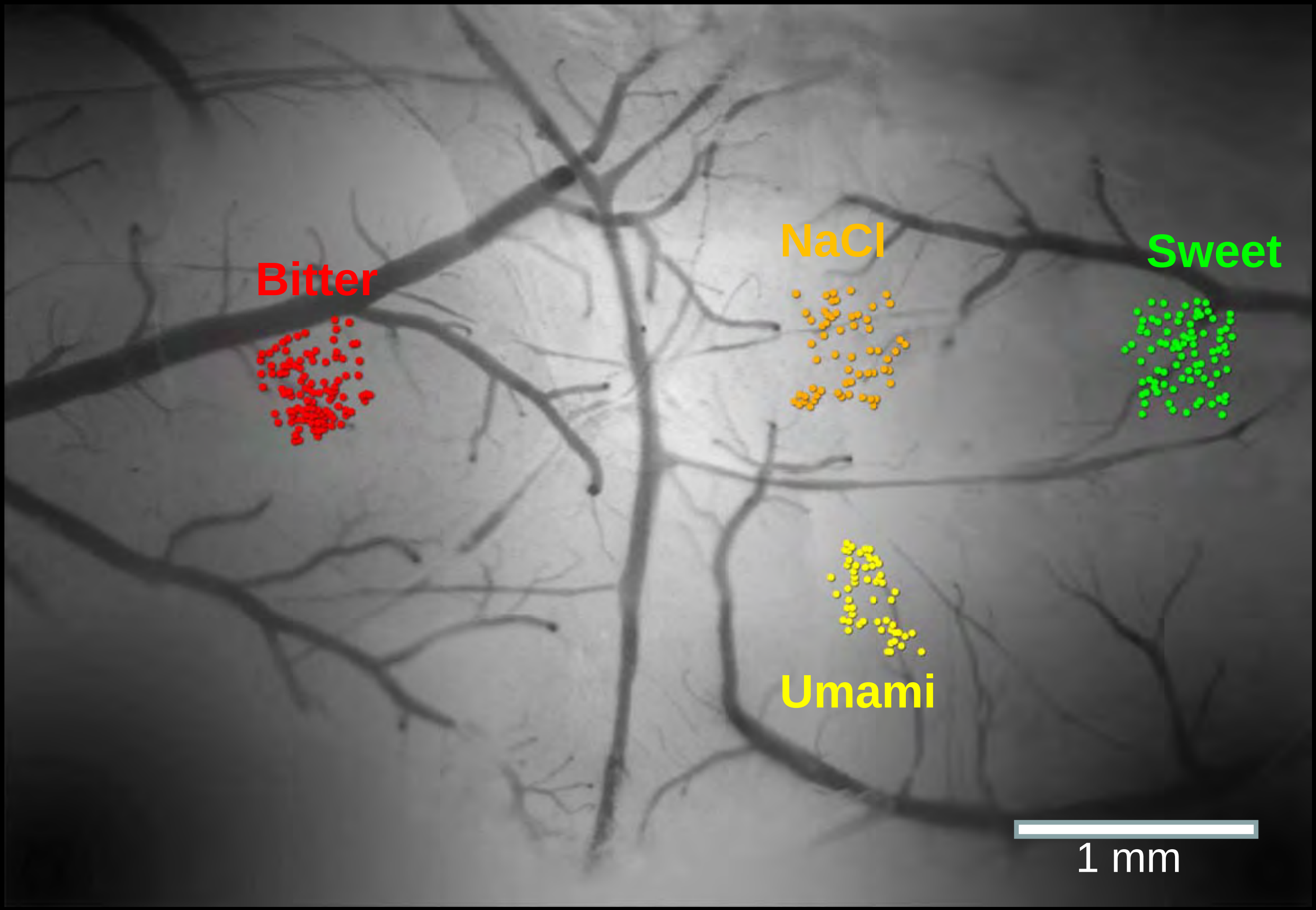
How is taste quality represented in the brain?





Peripheral coding of taste characterized by elegant simplicity

A substrate for taste quality in the brain



stereotyped spatially distinct fields for the primary tastes in insula