動物生理学 III　Handout No. 9

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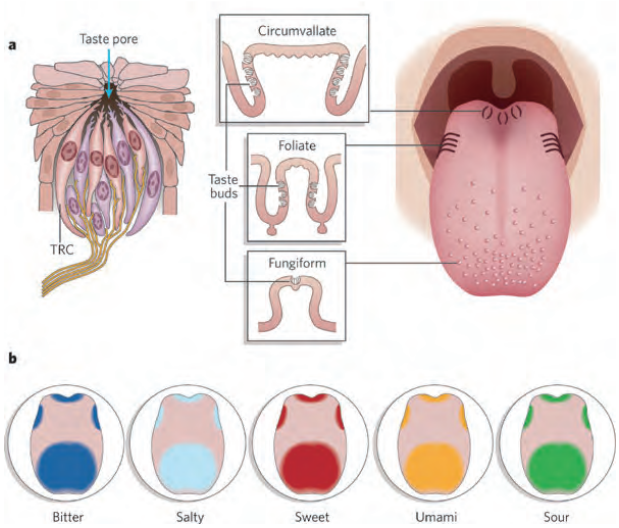

Figure 1: **Taste-receptor cells, buds and papillae.**
a, Taste buds (left) are composed of 50–150 TRCs (depending on the species), distributed across different papillae. Circumvallate papillae are found at the very back of the tongue and contain hundreds (mice) to thousands (human) of taste buds. Foliate papillae are present at the posterior lateral edge of the tongue and contain a dozen to hundreds of taste buds. Fungiform papillae contain one or a few taste buds and are found in the anterior two-thirds of the tongue. TRCs project microvillae to the apical surface of the taste bud, where they form the 'taste pore'; this is the site of interaction with tastants. b, Recent molecular and functional data have revealed that, contrary to popular belief, there is no tongue 'map': responsiveness to the five basic modalities — bitter, sour, sweet, salty and umami — is present in all areas of the tongue

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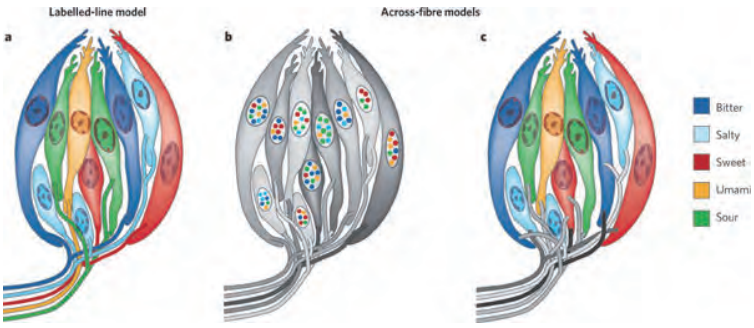

Figure 2: **Encoding of taste qualities at the periphery**
There are two opposing views of how taste qualities are encoded in the periphery. a, In the labelled-line model, receptor cells are tuned to respond to single taste modalities — sweet, bitter, sour, salty or umami — and are innervated by individually tuned nerve fibres. In this case, each taste quality is specified by the activity of non-overlapping cells and fibres. b, c, Two contrasting models of what is known as the 'across-fibre pattern'. This states that either individual TRCs are tuned to multiple taste qualities (indicated by various tones of grey and multicoloured stippled nuclei), and consequently the same afferent fibre carries information for more than one taste modality (b), or that TRCs are still tuned to single taste qualities but the same afferent fibre carries information for more than one taste modality (c). In these two models, the specification of any one taste quality is embedded in a complex pattern of activity across various lines. Recent molecular and functional studies in mice have demonstrated that different TRCs define the different taste modalities, and that activation of a single type of TRC is sufficient to encode taste quality, strongly supporting the labelled-line model.

①〜③の出典：Nature 444:288–294（Nature のウェブサイトからオンラインで全文を読むことができます（学内からのみ）。）

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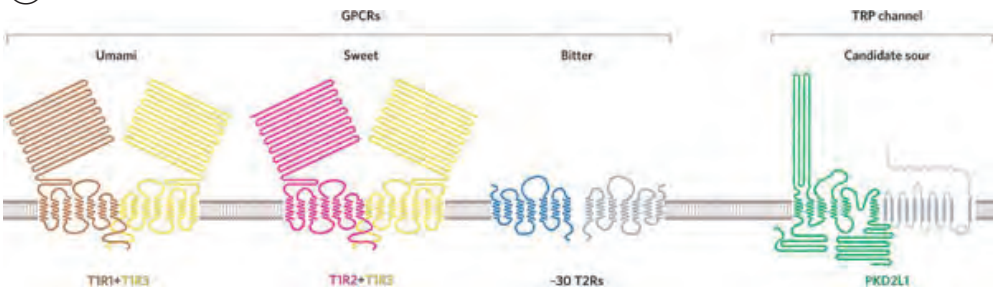

Figure 4: **Summary of receptors for umami, sweet, bitter and sour tastes**
Schematic representation of taste receptors (and candidate receptors) mediating four of the five basic taste modalities. Although not indicated in the figure, responses to high concentrations of sugars, but not other sweet tastants, are also detected by T1R3 alone15. The grey T2R receptor is designed to illustrate the possibility that T2Rs, much like T1Rs, may function as heteromeric complexes. Similarly, the grey receptor next to PKD2L1 depicts a PKD1-family member as a candidate partner

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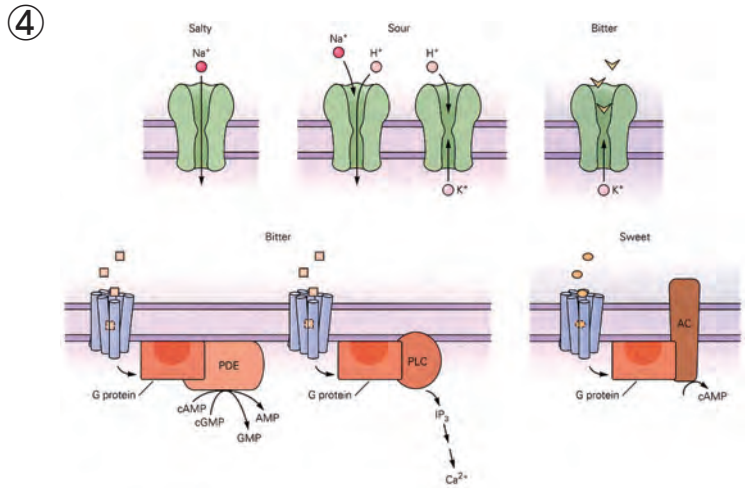

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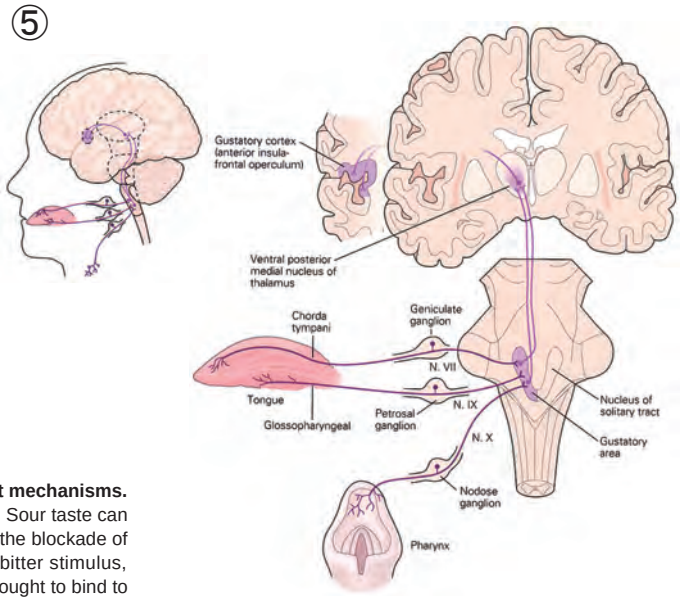

Figure 32-14 **Four basic taste stimuli are transduced into electrical signals by different mechanisms.** Salty. Salty taste is mediated by Na^+ influx through amiloride-sensitive Na^+ channels. Sour. Sour taste can result from either the passage of H^+ ions through amiloride-sensitive Na^+ channels or from the blockade of K^+-channels, which are normally open at resting potential. Bitter. Although at least one bitter stimulus, quinine, may depolarize taste cells by blocking apical K^+ channels, most bitter stimuli are thought to bind to G protein-coupled receptors. There is evidence for two different pathways of bitter taste transduction that involve G proteins. In one the G protein stimulates phospholipase C (PLC) to increase production of inositol 1,4,5-trisphosphate (IP_3), which then causes the release of Ca^{2+} from intracellular stores. In the other pathway the G protein gustducin activates a phosphodiesterase (PDE) that may reduce intracellular levels of both cAMP and cGMP. Sweet. Some sweet tastants are also thought to bind to receptors that couple to gustducin or a G protein that stimulates IP_3 production. However, other sweet receptors may couple to a G protein that interacts with adenylyl cyclase, causing an increase in cAMP that leads to the phosphorylation of K^+ channels by protein kinase A.

Figure 32-17　Taste information is transmitted from the taste buds to the cerebral cortex via synapses in the brain stem and thalamus. Signals carried by fibers that innervate the taste buds travel through several different nerves to the gustatory area of the nucleus of the solitary tract, which relays information to the thalamus. The thalamus transmits taste information to the gustatory cortex.