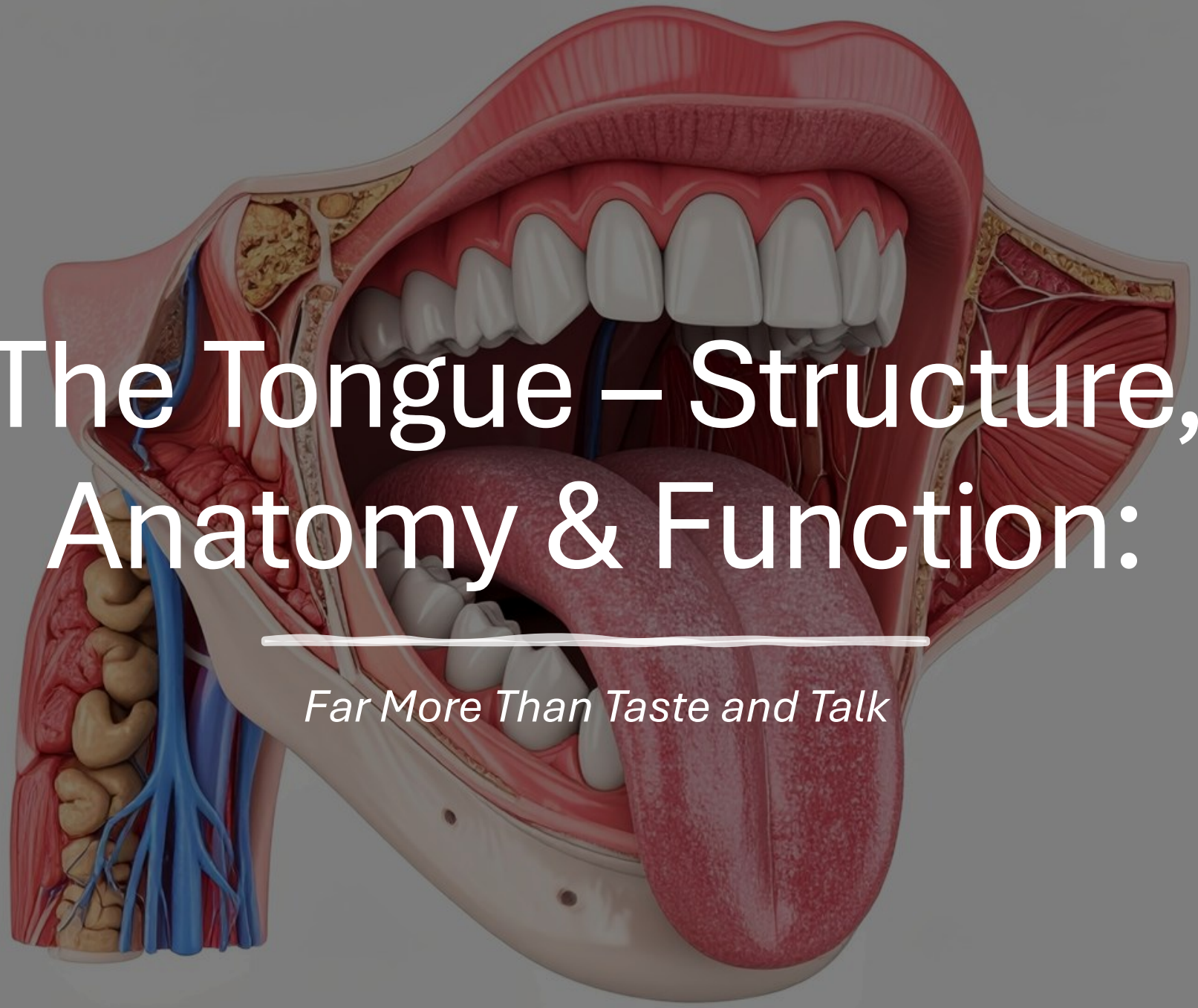
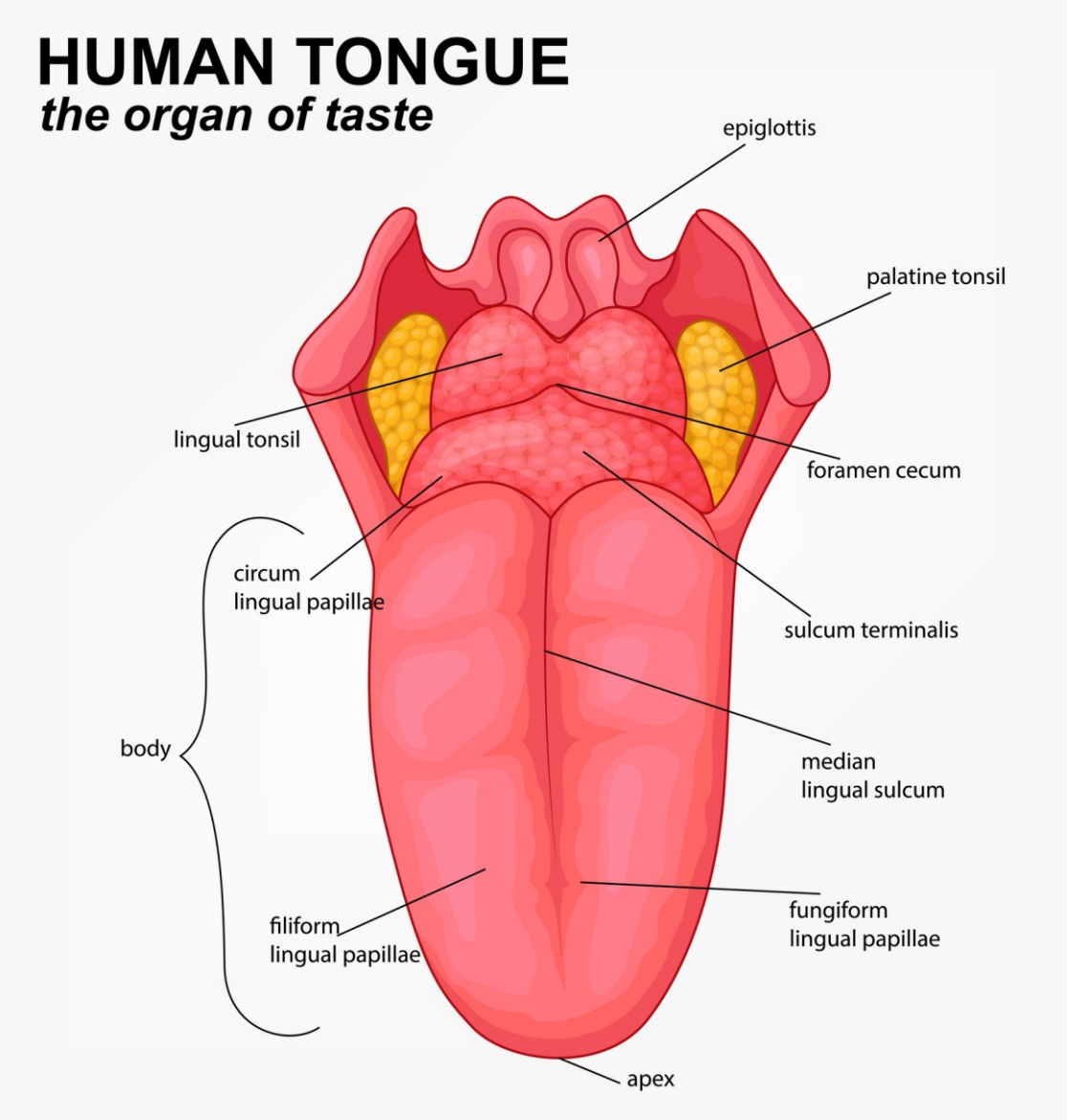


The Tongue – Structure, Anatomy & Function:

Far More Than Taste and Talk



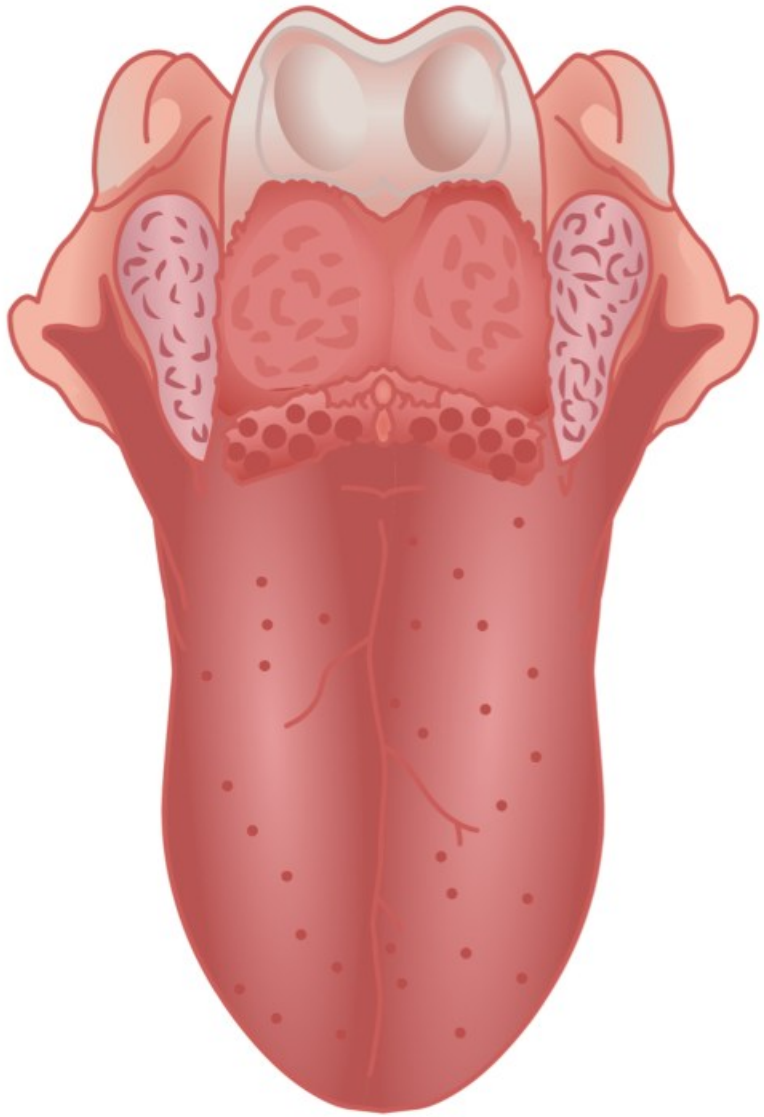
The Tongue

The tongue is a highly specialized muscular organ that sits on the floor of the mouth and plays a central role in everyday functions we often take for granted. It is composed of interlacing muscles covered by a unique mucosal surface and is richly supplied with nerves and blood vessels. The tongue helps manipulate food for chewing and swallowing, contains receptors for taste, and works in coordination with the lips, teeth, and palate to produce speech. More than just a structure for tasting, it serves as a dynamic interface between the body and the outside world—both receiving sensory information and enabling expression.

Most people think the tongue = taste

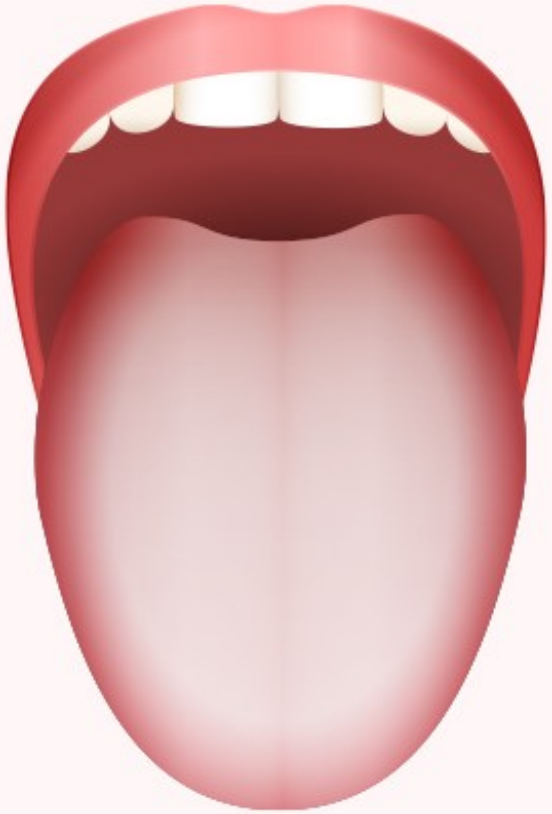
But it also:

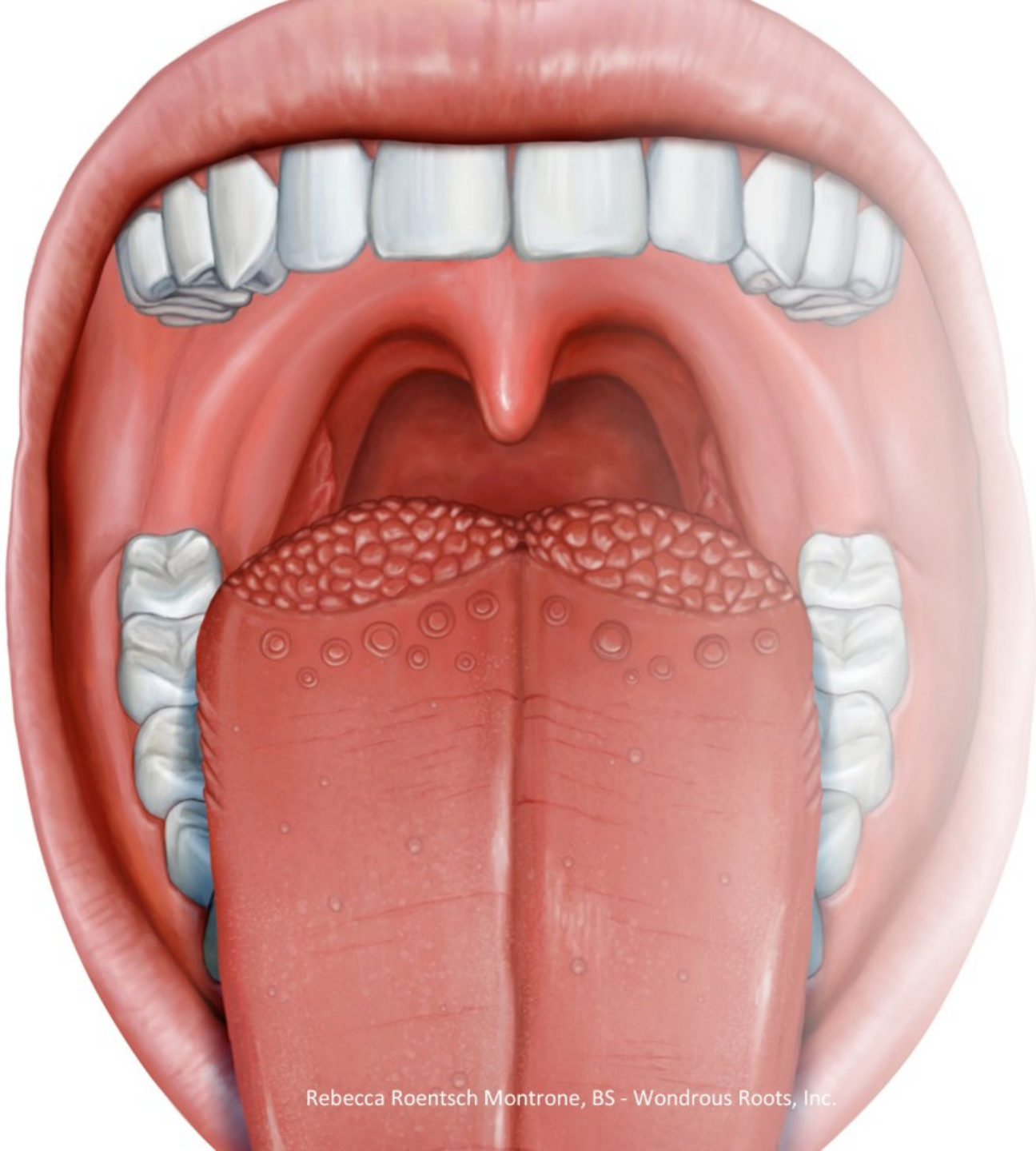
- Shapes speech
- Initiates digestion
- Influences perception
- Expresses thought



Function Of Tongue

- There are many functions of the tongue such as mastication and deglutition of food.
- It also helps in speech production.
- Tongue keeps the path of air open, which helps in proper breathing.





The Tongue & Oral Cavity

“The Gatekeeper of Nourishment and Discernment”

The Tongue: Structure & Position

The tongue is not just a muscle—it's a **highly specialized, multi-layered organ** designed for movement, sensation, immune defense, and taste.

- **Where it sits**
- Occupies the **floor of the oral cavity**
- Anchored at the back to the **hyoid bone** (a floating bone—unique in the body)
- Attached underneath by the **lingual frenulum**
- Surrounded by the teeth, palate, and cheeks

The Hyoid Bone

- The only bone that does not articulate with another bone
- Serves as a moveable base for the tongue

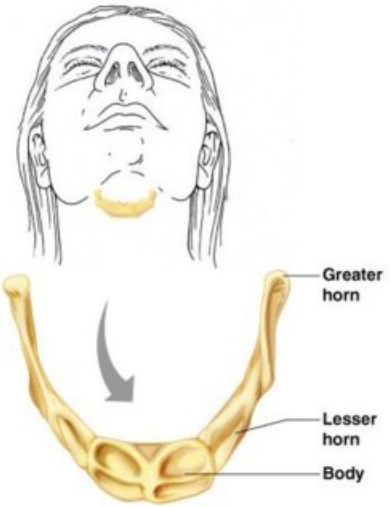
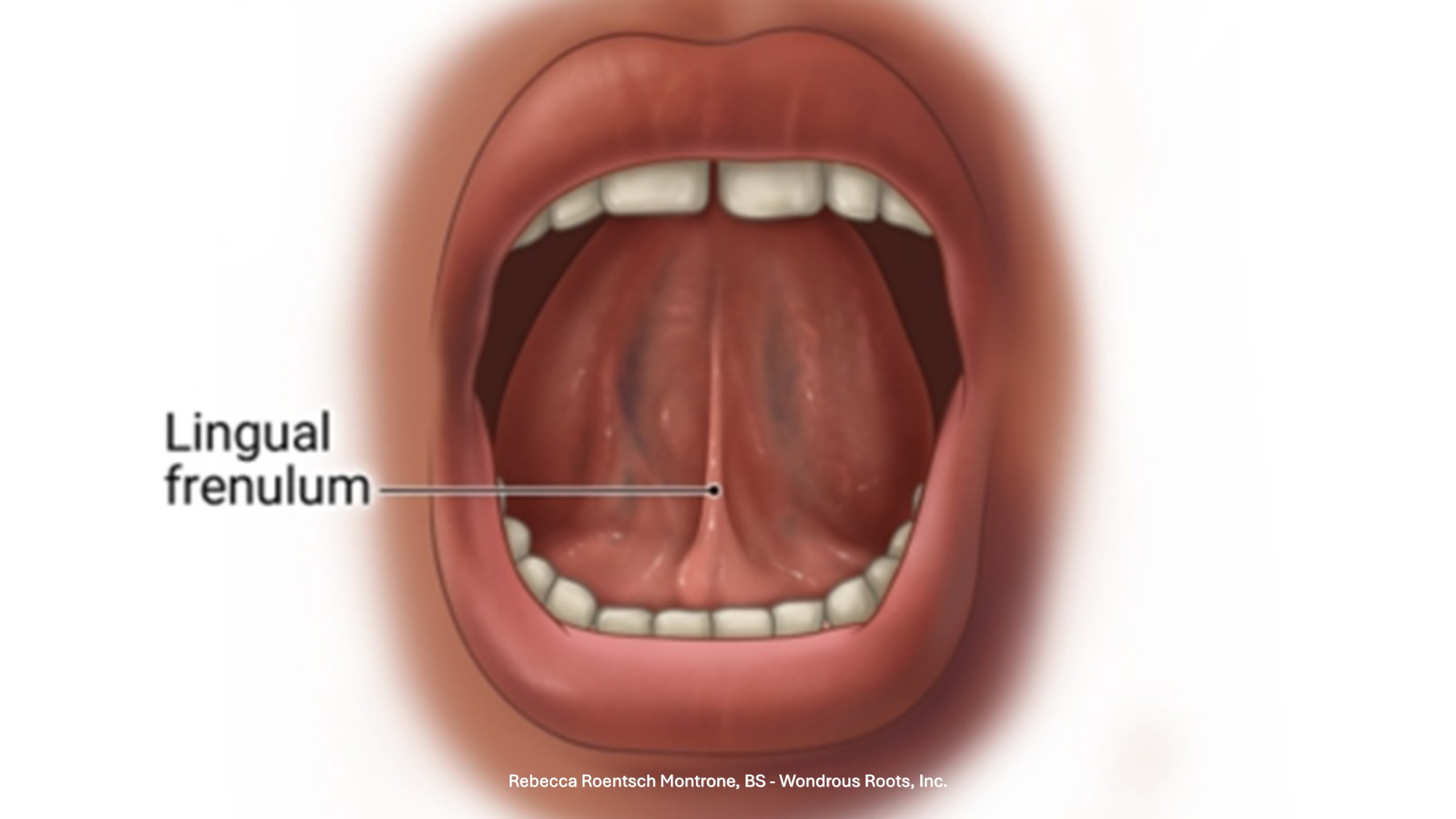


Figure 5.12



🔷 Muscle architecture

The tongue is made of:

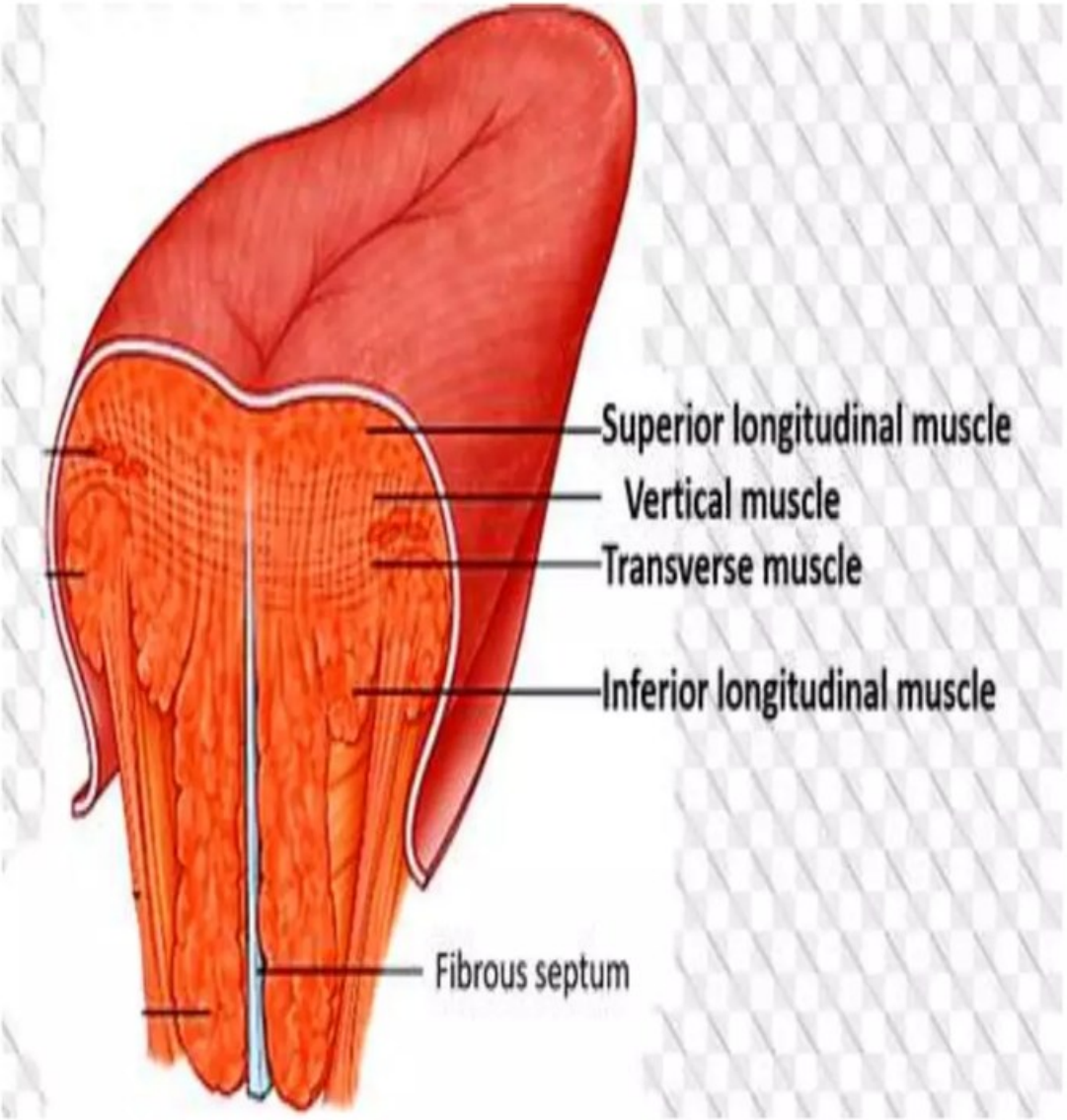
- **Intrinsic muscles** → shape (curling, flattening, precision)
- **Extrinsic muscles** → movement (forward, backward, side-to-side)

This is what allows:

- Speech articulation
- Swallowing coordination
- Food manipulation (forming a bolus)

It's one of the most neurologically refined muscular systems in the body.

- Four paired intrinsic muscles originate & inserted within the tongue
- These muscle alter the shape of the tongue
- It is not attached to any bone
- Innervated by hypoglossal nerve



The Oral Mucosa: The Living Interface

The entire mouth is lined with **oral mucosa**—not just "skin inside the mouth," but a **dynamic, semi-permeable, immune-active tissue.**

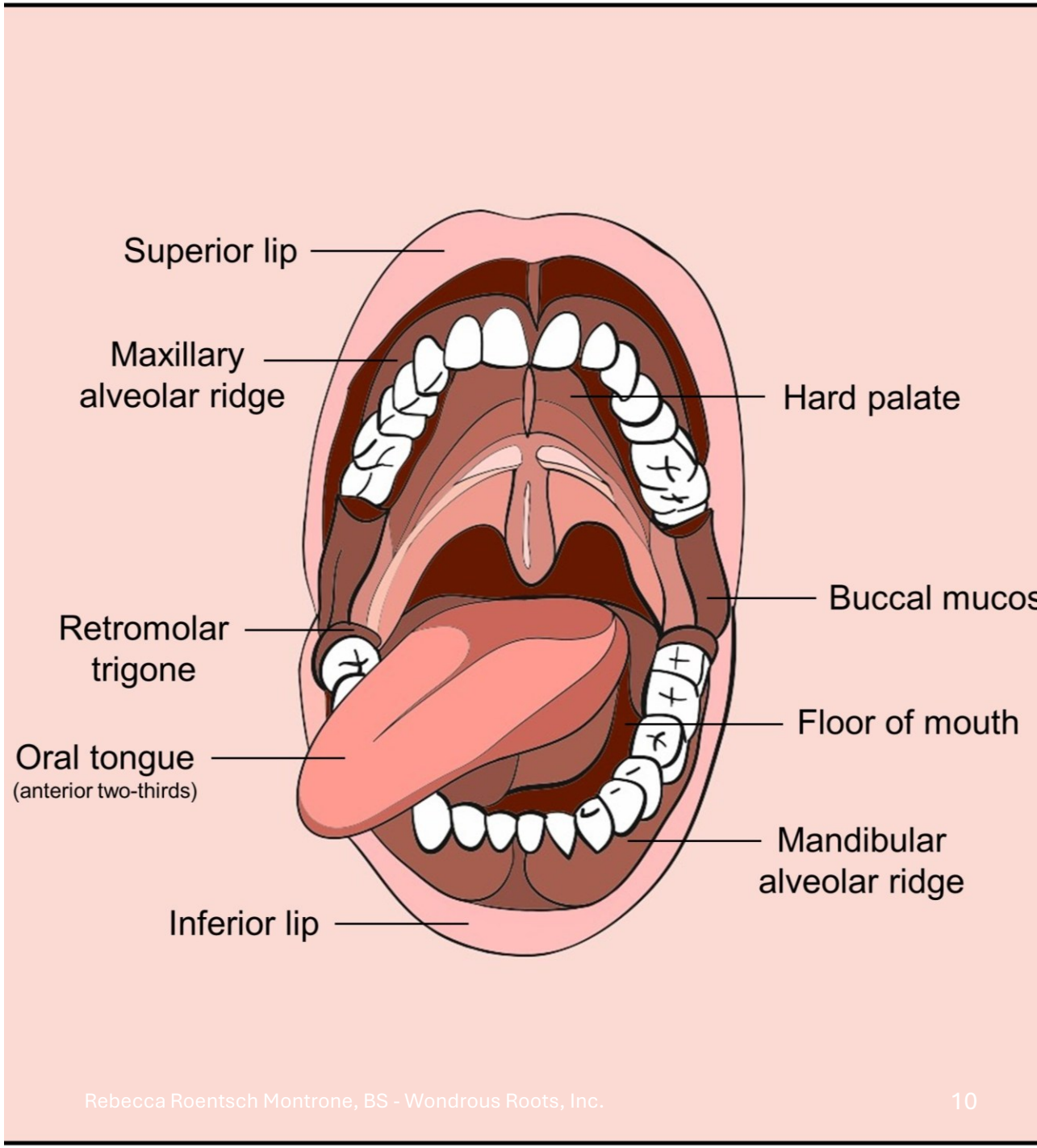
🔹 **Types of oral mucosa**

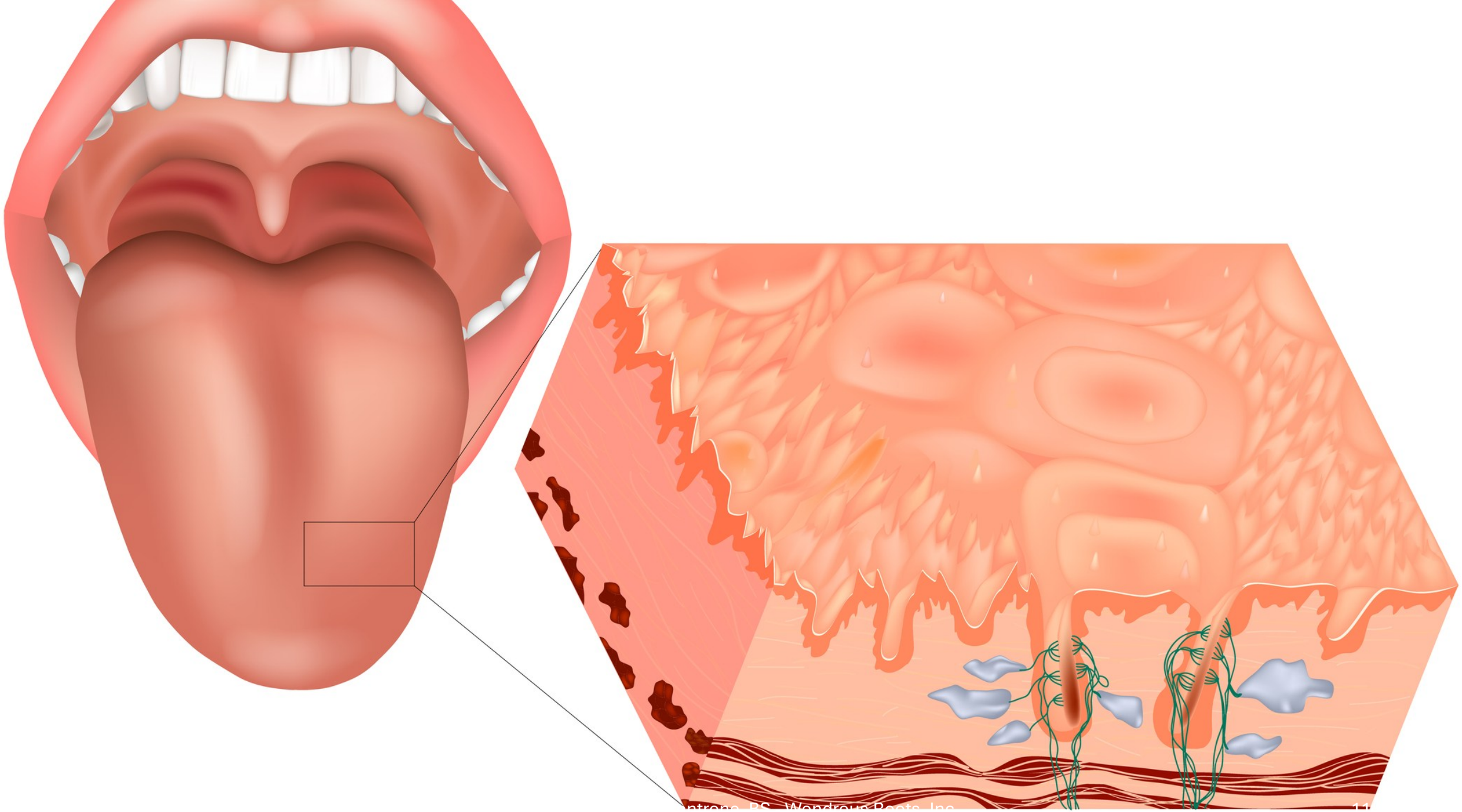
- **Masticatory** (gums, hard palate) → tougher, keratinized
- **Lining mucosa** (cheeks, floor of mouth) → softer, more permeable
- **Specialized mucosa** (tongue) → contains taste structures

🔹 **Why this matters**

- Rapid absorption → why **sublingual delivery works so well**
- Immune surveillance → part of the **first-line defense**
- Microbiome interaction → oral flora influence systemic health

👉 This is a *gateway tissue*, not just a lining.





Salivary Glands: The Unsung Heroes of Taste

Taste literally **cannot happen without saliva.**

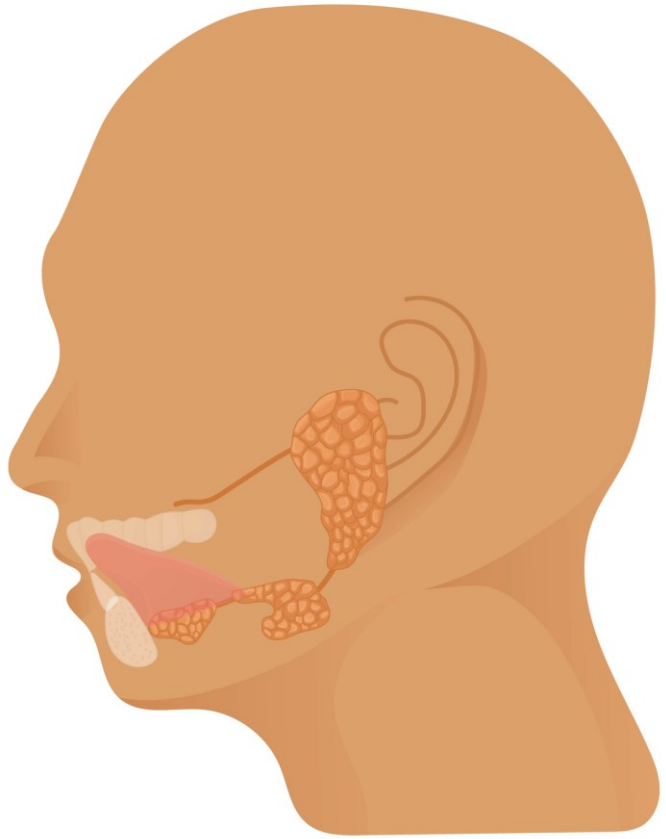
🔹 **Major glands**

- **Parotid glands** (in front of ears) → watery, enzyme-rich
- **Submandibular glands** → mixed secretion
- **Sublingual glands** → thicker, mucin-rich

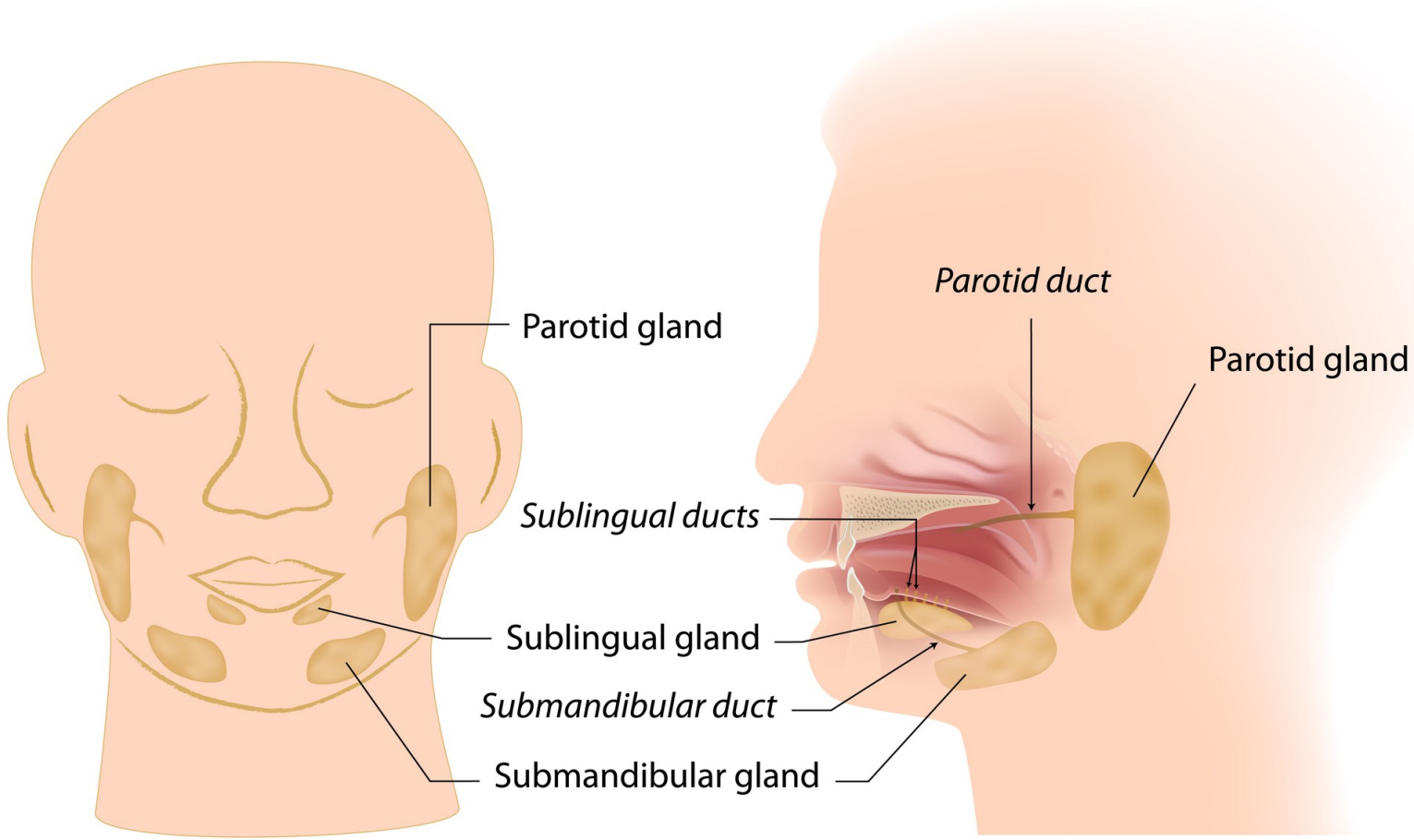
🔹 **What saliva does**

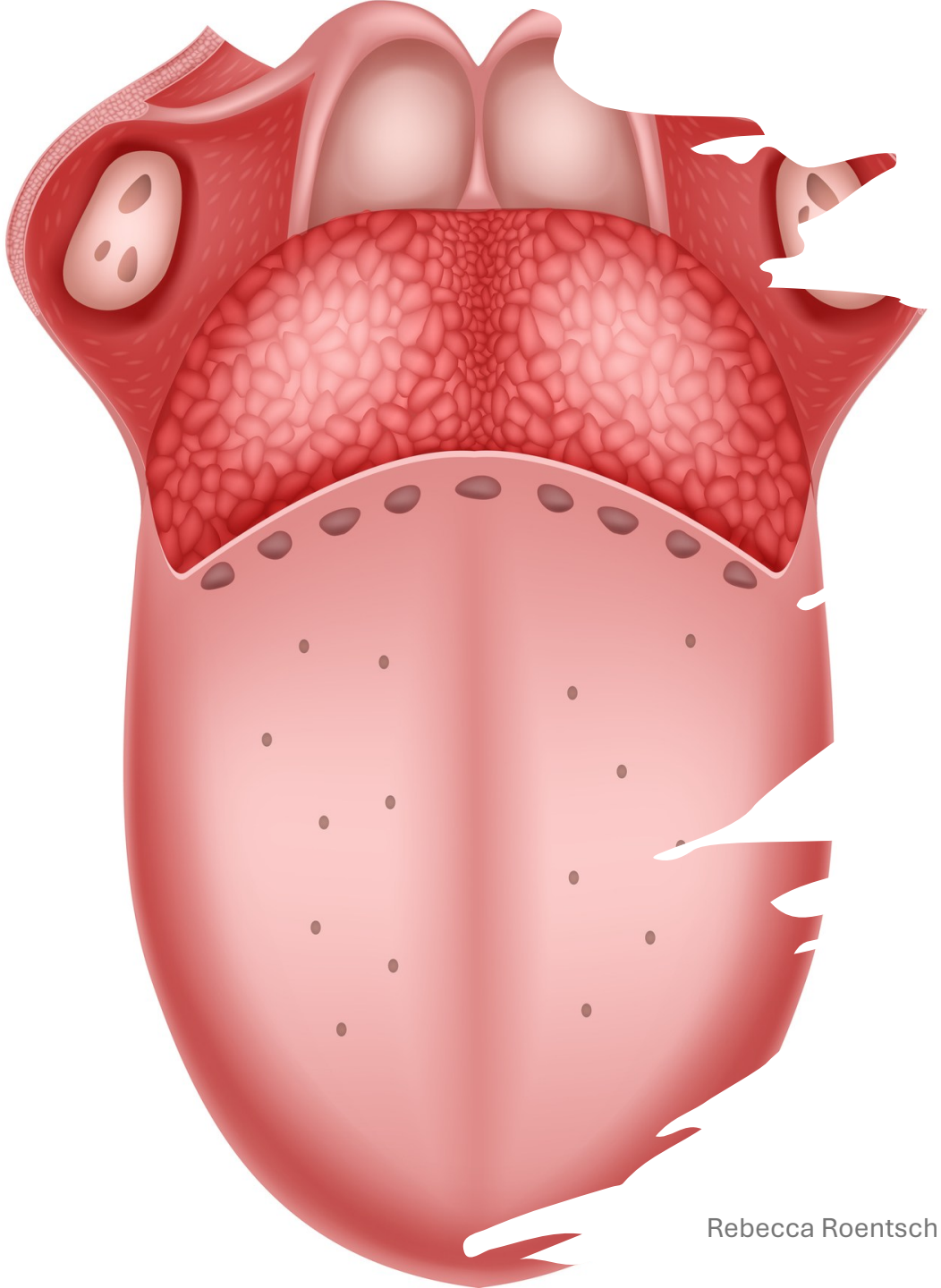
- Dissolves food → makes taste molecules detectable
- Begins digestion → **amylase for carbohydrates**
- Protects tissues → antimicrobial compounds
- Lubricates → speech + swallowing

👉 No saliva = dramatically reduced taste (and often altered perception).



The Salivary Glands



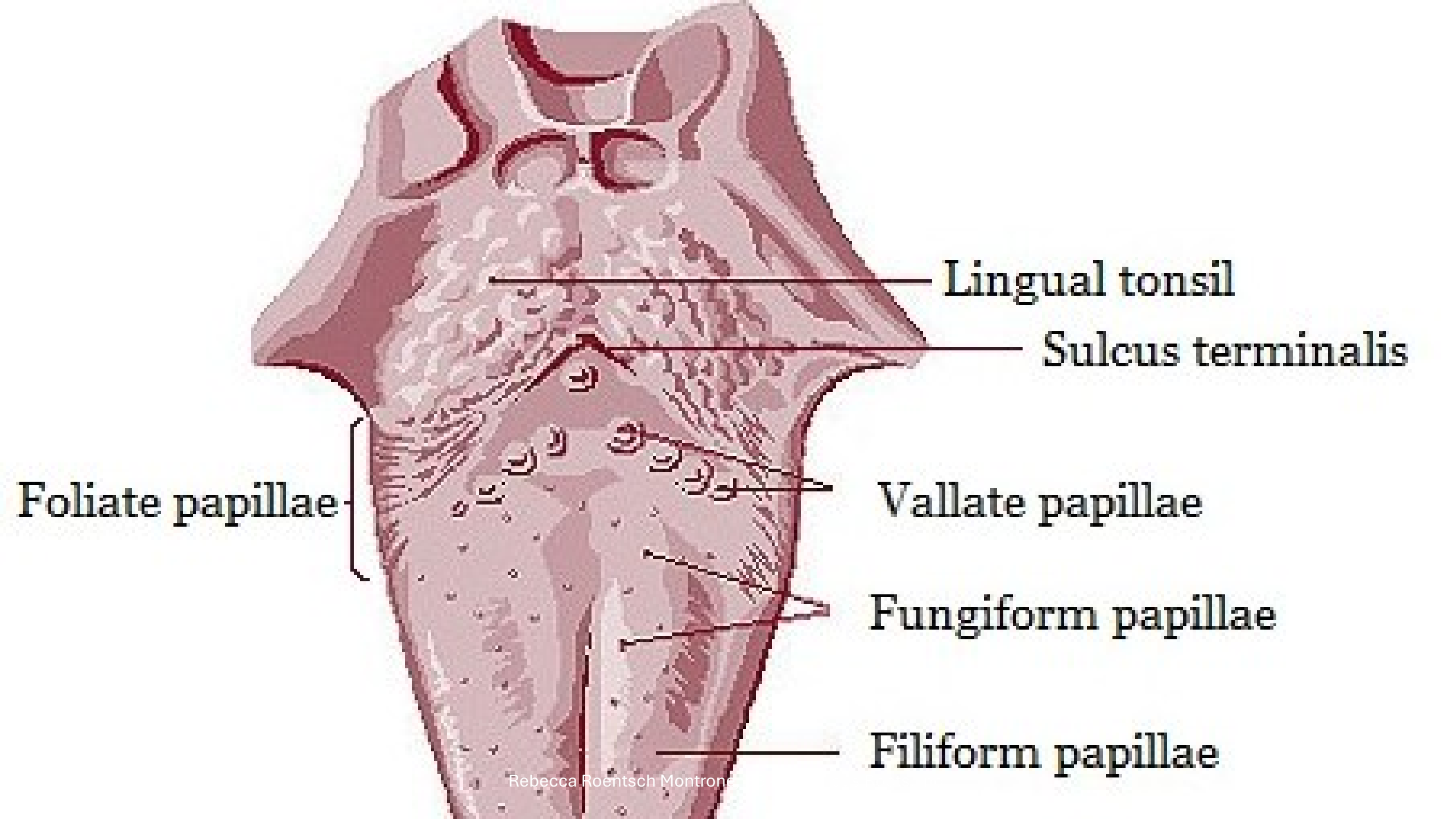


Taste Buds & Papillae: Where Taste Begins

The surface of the tongue is covered in **papillae**, but only some contain taste buds.

- **Types of papillae**

- **Fungiform** → front of tongue (sweet, salty sensitivity)
- **Circumvallate** → back (bitter detection—protective)
- **Foliate** → sides
- **Filiform** → no taste, just texture/grip

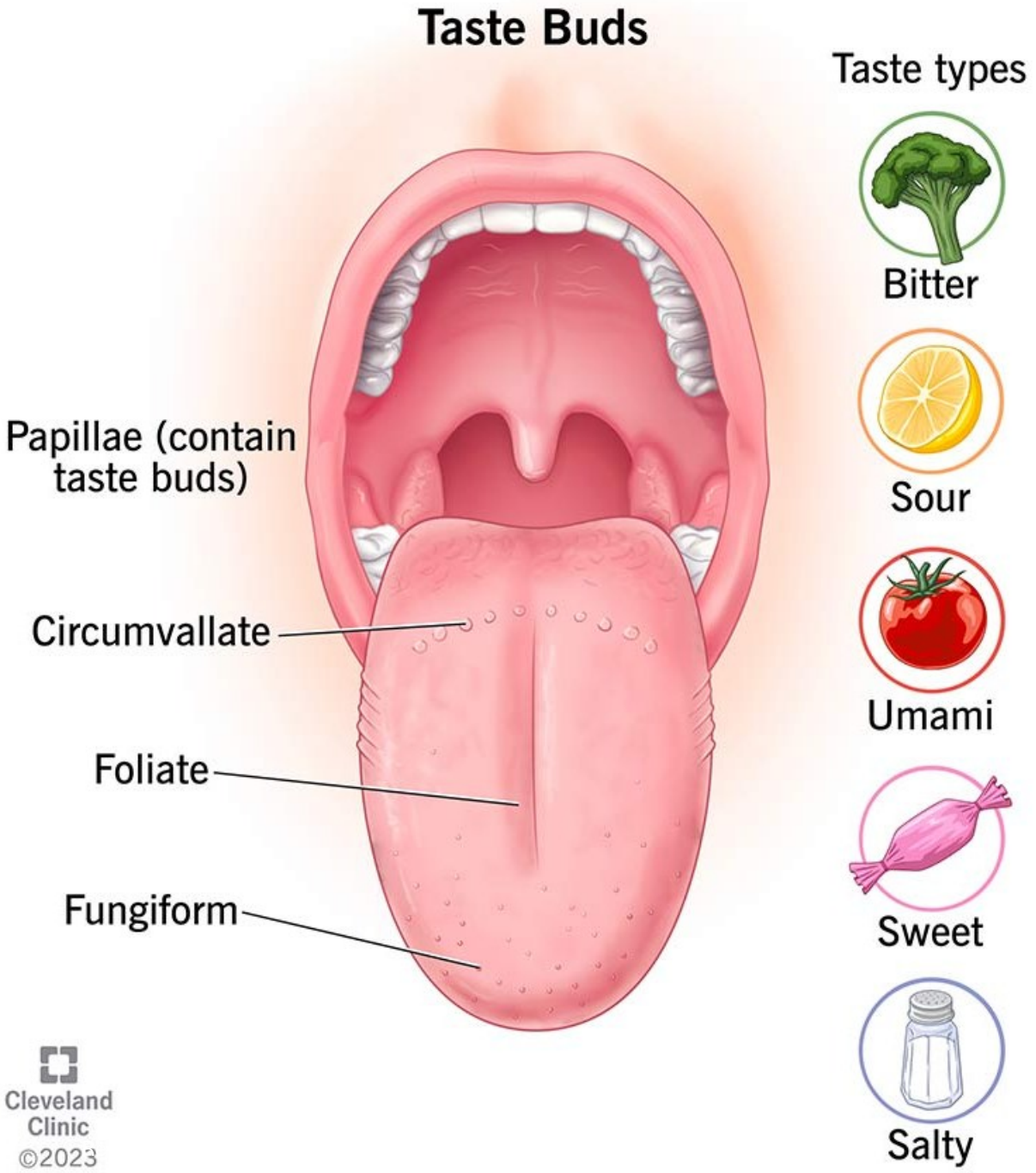

Lingual tonsil
Sulcus terminalis
Foliate papillae
Vallate papillae
Fungiform papillae
Filiform papillae

Taste Buds

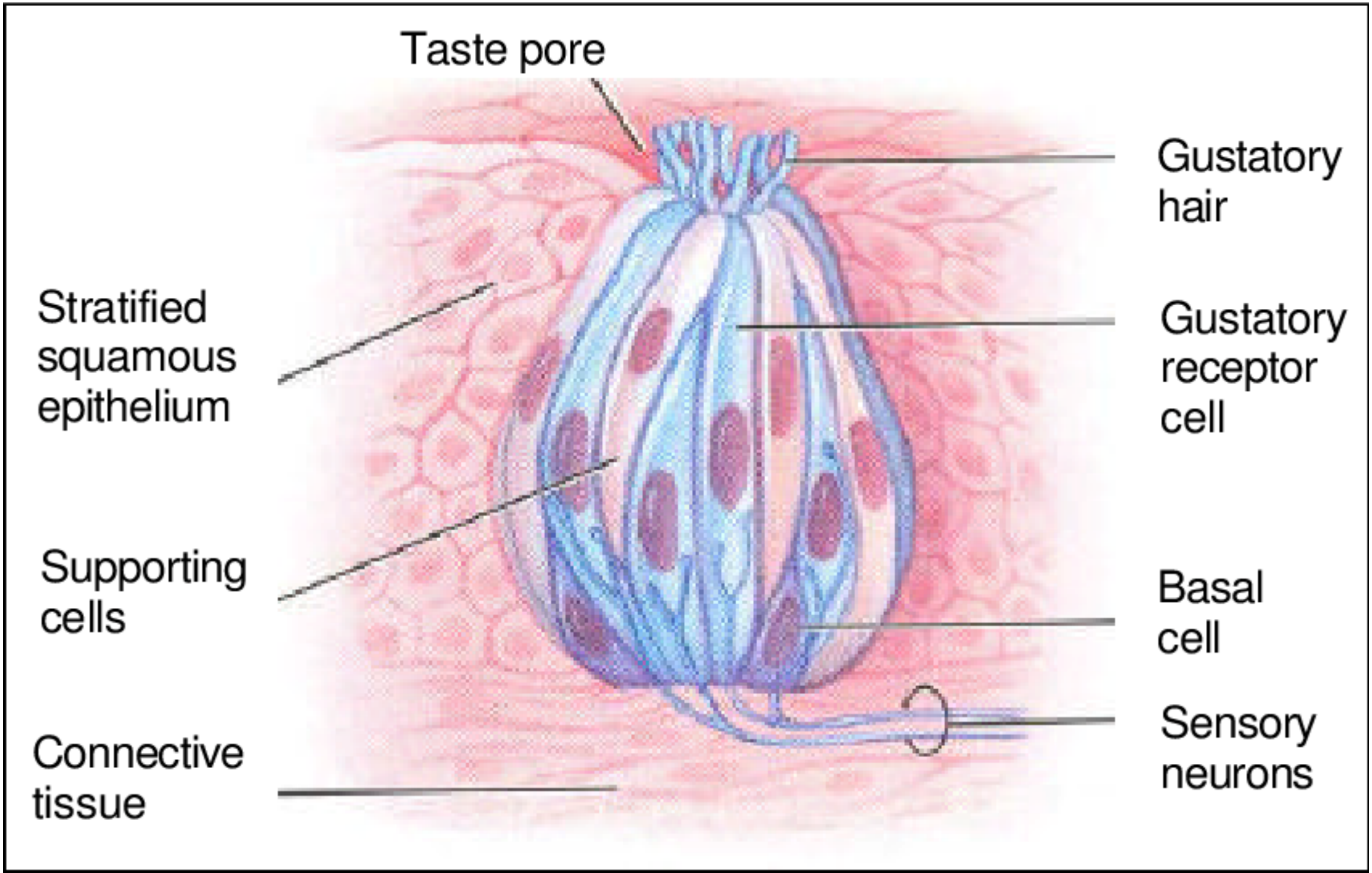
Each taste bud contains **50–100 receptor cells** that detect:

- Sweet
- Salty
- Sour
- Bitter
- Umami (savory/protein)

👉 Important correction to what is commonly thought: There is **no strict "tongue map."** All regions can detect most tastes—just with varying sensitivity.




UMAMI
SWEET
SALTY
SOUR
BITTER


Taste pore
Gustatory hair
Stratified squamous epithelium
Gustatory receptor cell
Supporting cells
Basal cell
Sensory neurons
Connective tissue

The Nose–Tongue Connection
Taste is Actually Smell + Taste Together

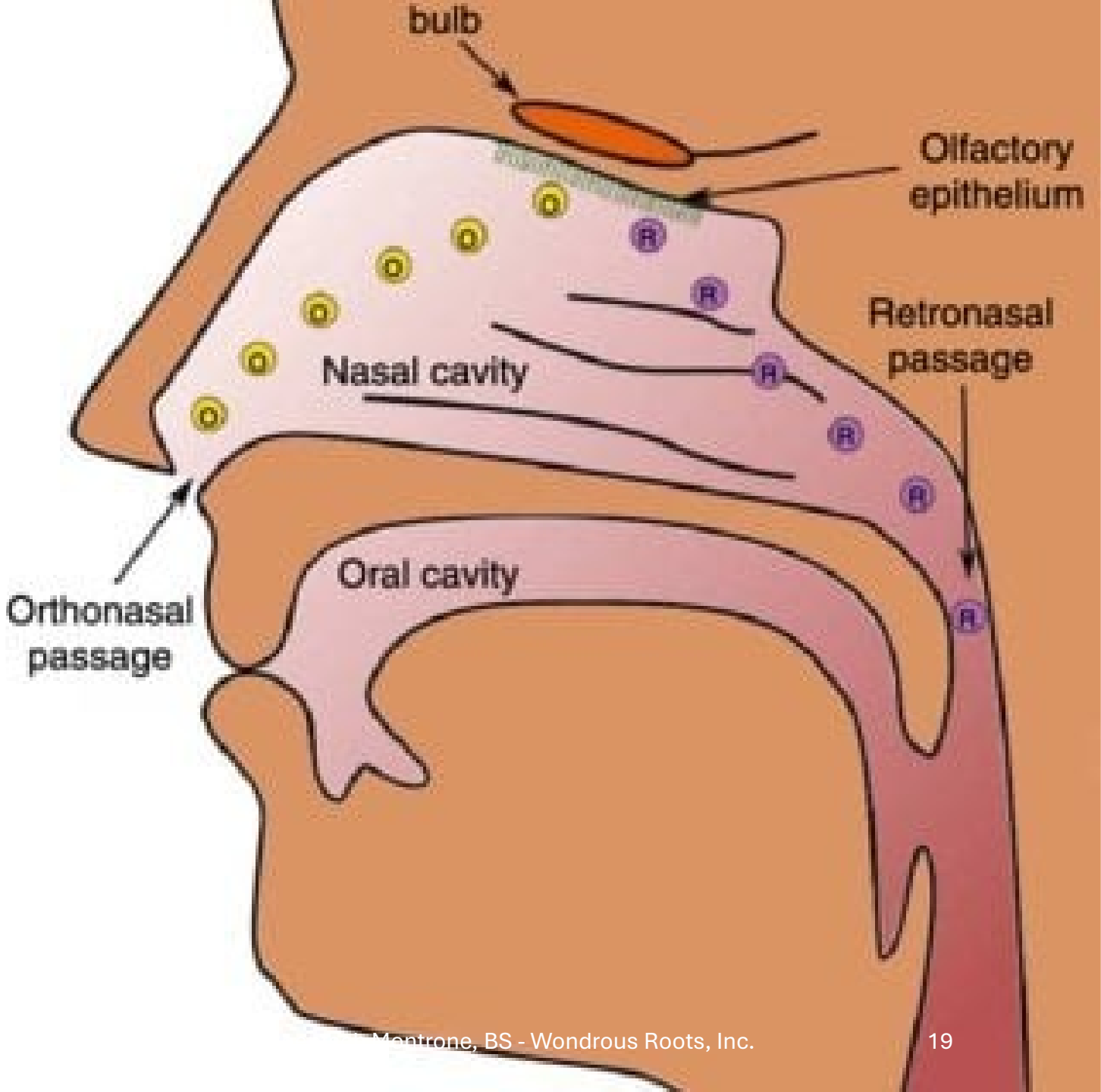
🔹 **Two pathways of smell:**

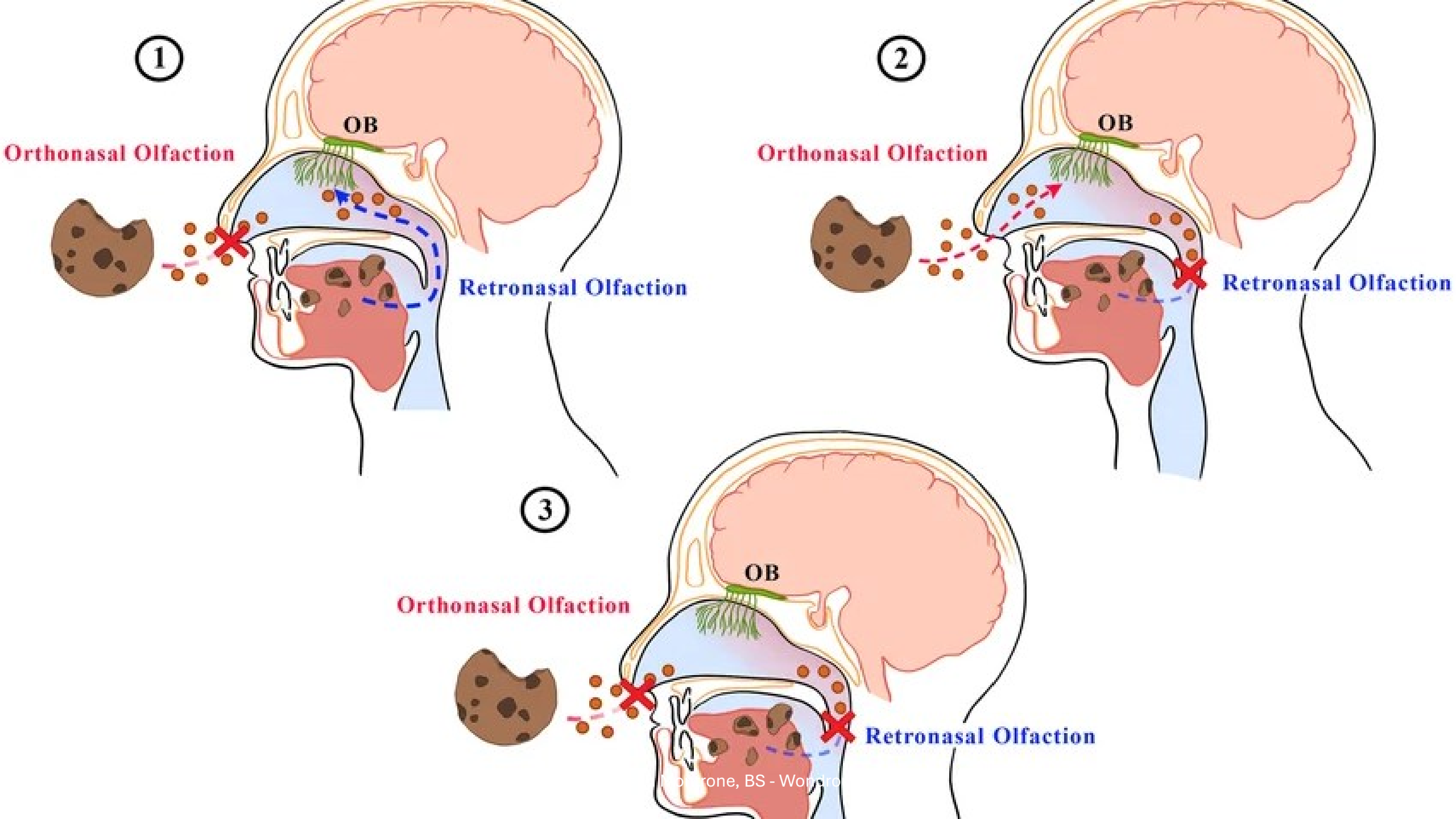
- **Orthonasal** → smelling through the nose
- **Retronasal** → aroma rising from the mouth to the nose

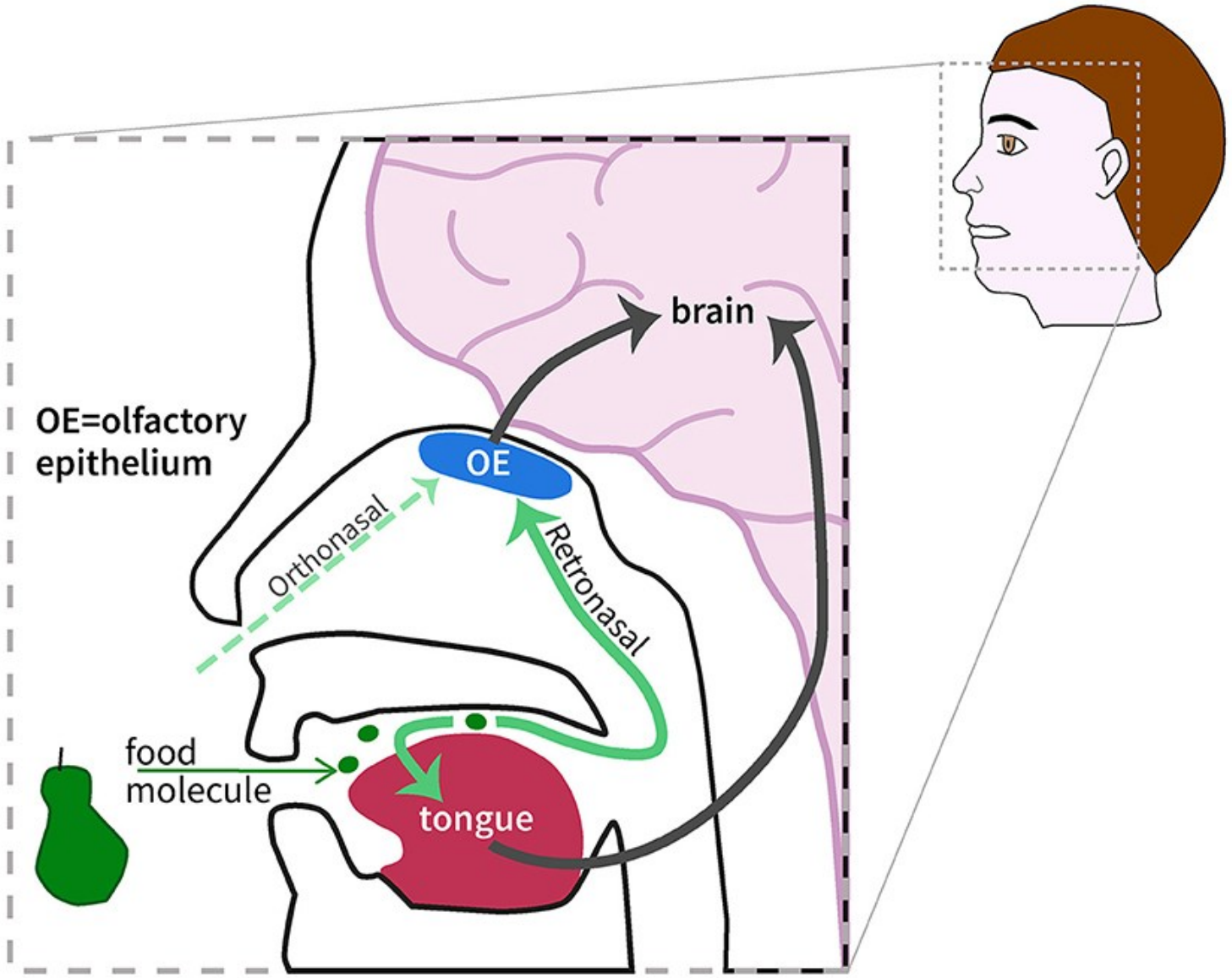
👉 When you eat, most of what you perceive as "flavor" is actually **retronasal olfaction**.

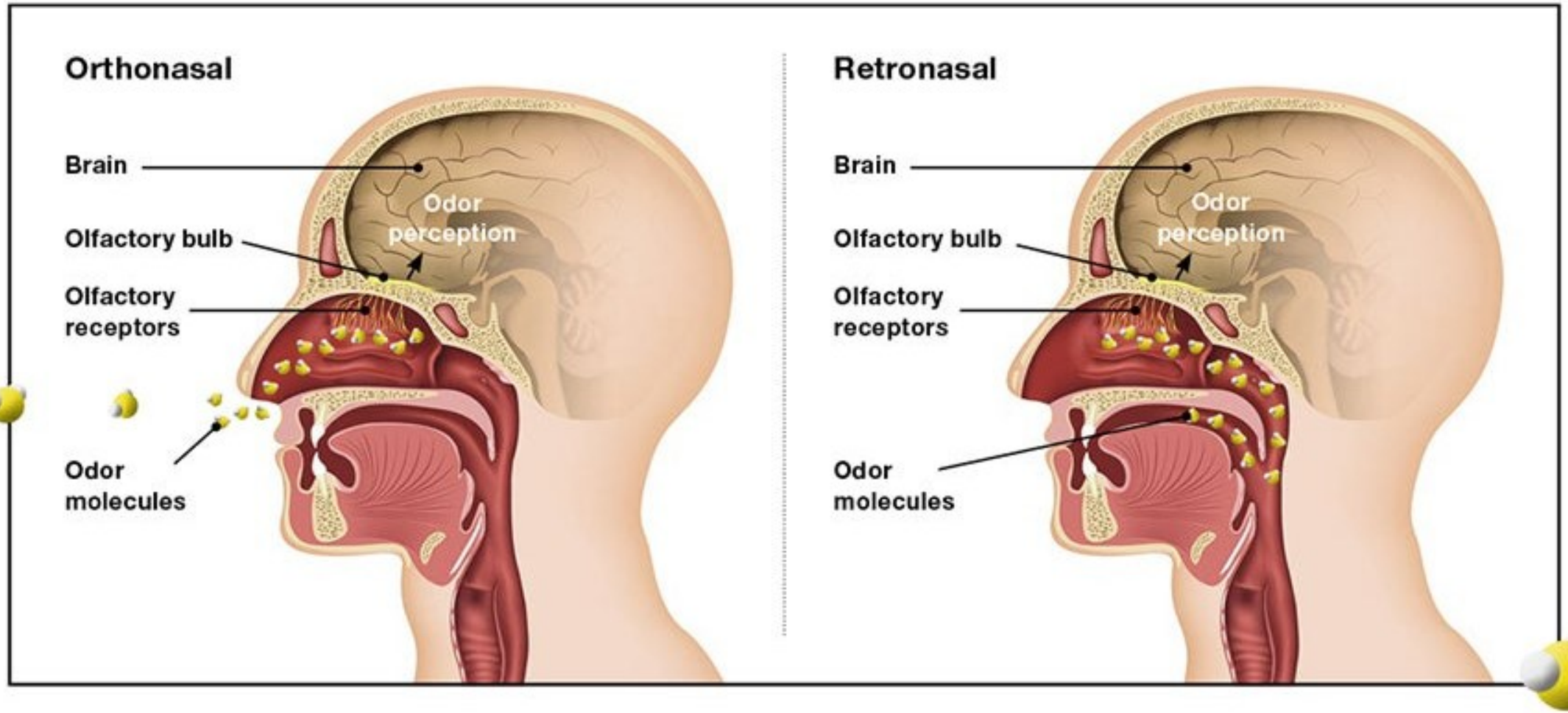
🔹 **That's why:**

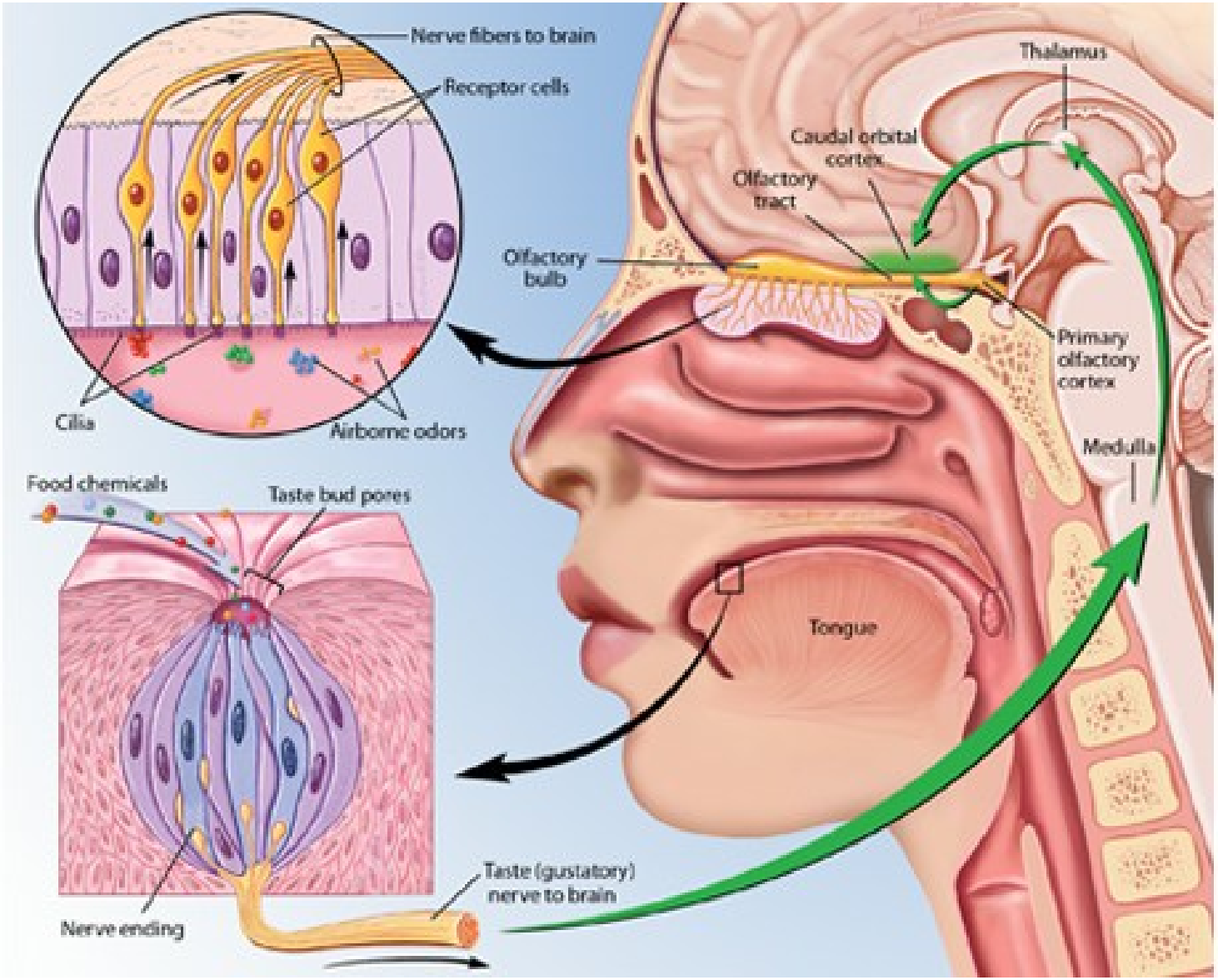
- Food tastes bland when your nose is blocked
- "Taste loss" in illness is often **smell impairment**




1
OB
Orthonasal Olfaction
Retronasal Olfaction
2
OB
Orthonasal Olfaction
Retronasal Olfaction
3
OB
Orthonasal Olfaction
Retronasal Olfaction


brain
OE=olfactory epithelium
OE
Orthonasal
Retronasal
food molecule
tongue


Orthonasal
Brain
Olfactory bulb
Olfactory receptors
Odor molecules
Odor perception
Retronasal
Brain
Olfactory bulb
Olfactory receptors
Odor molecules
Odor perception


Nerve fibers to brain
Receptor cells
Cilia
Airborne odors
Thalamus
Caudal orbital cortex
Olfactory tract
Olfactory bulb
Primary olfactory cortex
Medulla
Food chemicals
Taste bud pores
Tongue
Taste (gustatory) nerve to brain
Nerve ending

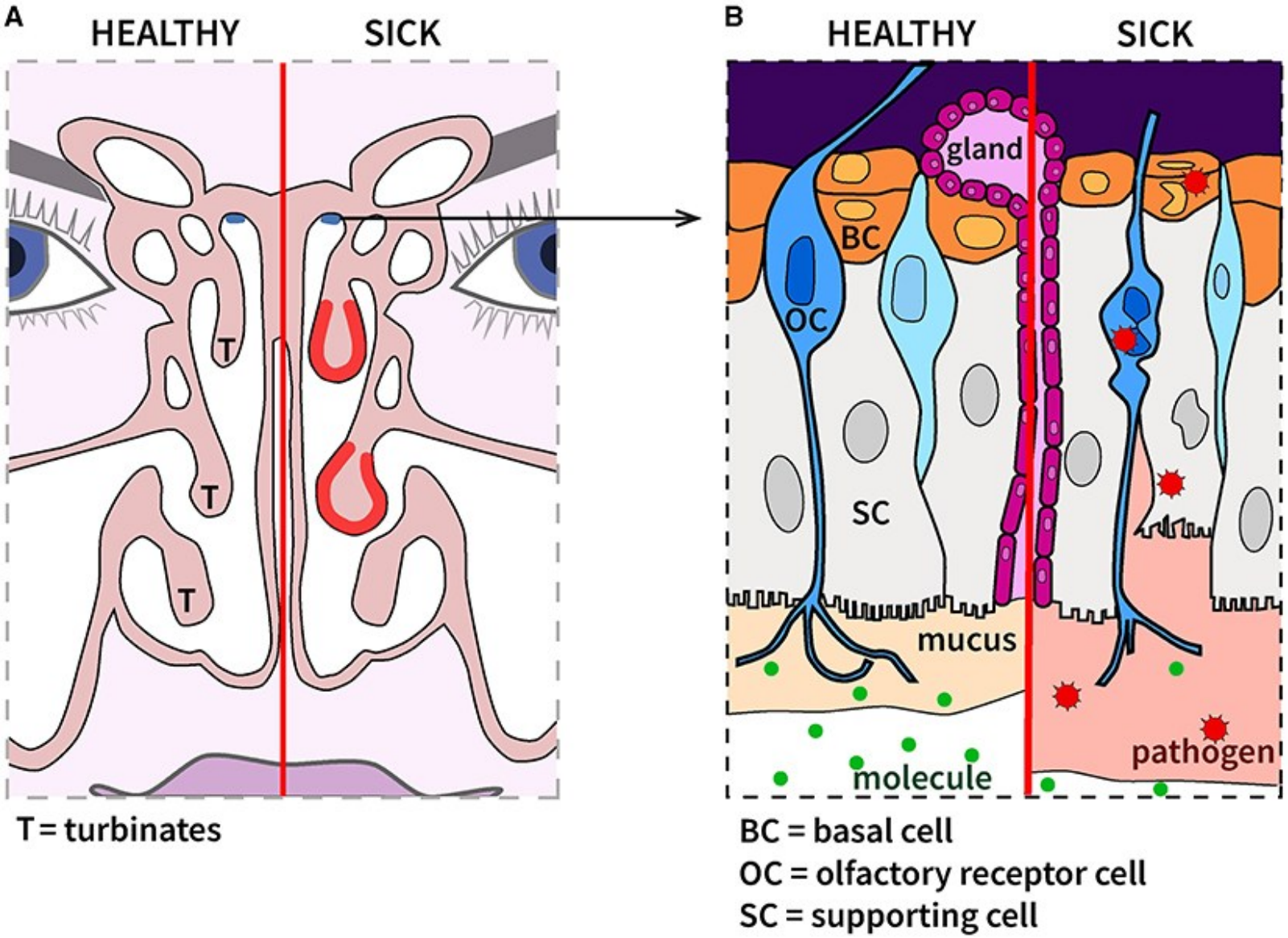
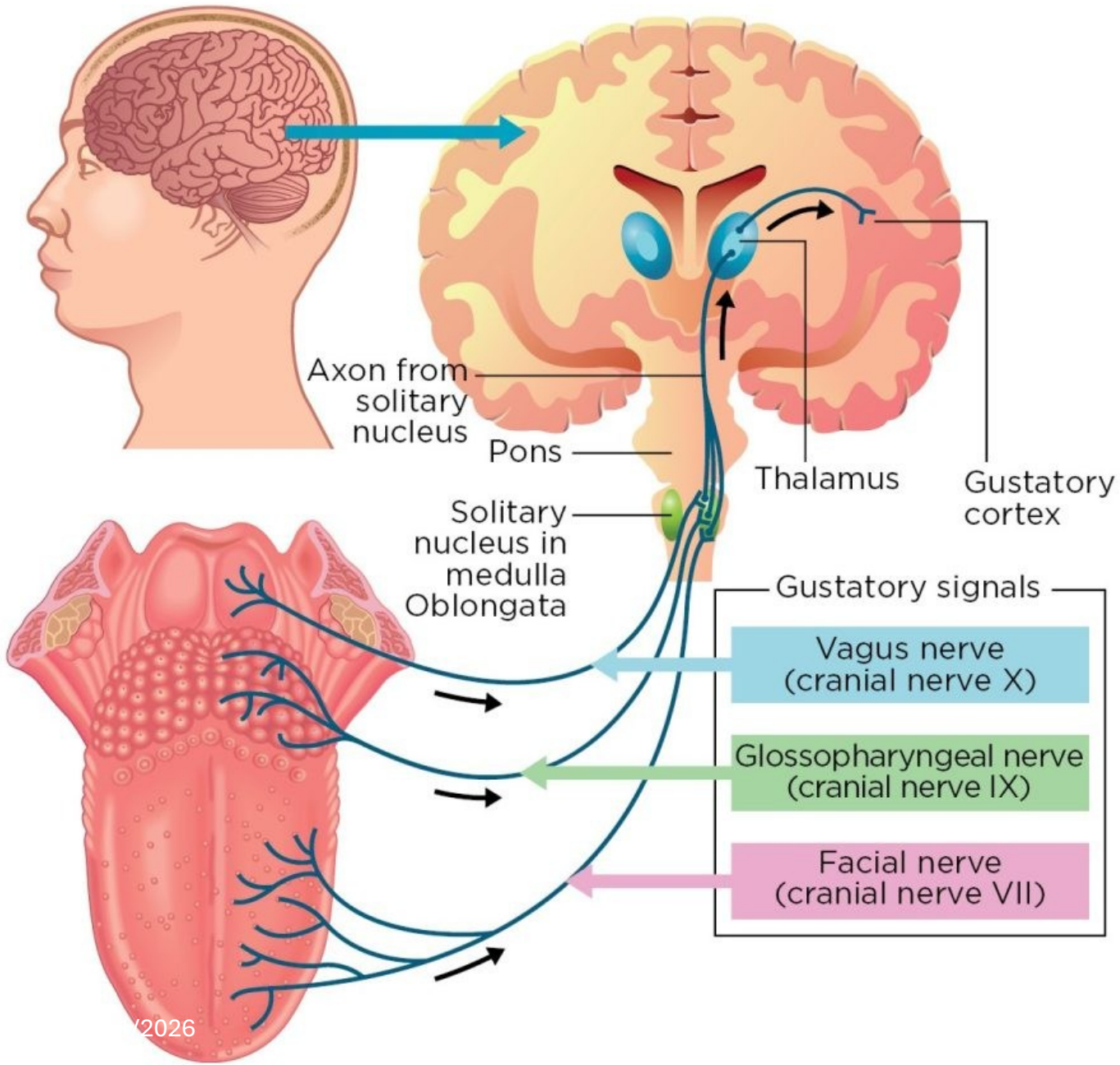

A
HEALTHY
SICK
T
T
T
T = turbinates
B
HEALTHY
SICK
gland
BC
OC
SC
mucus
molecule
pathogen
BC = basal cell
OC = olfactory receptor cell
SC = supporting cell

Fig 5. **The taste (gustatory) pathways**



Nerve Supply: The Wiring Behind Taste

This is where it gets beautifully complex.

🔹 **Taste nerves (special sensory)**

- **Facial nerve (CN VII)** → front 2/3 of tongue
- **Glossopharyngeal nerve (CN IX)** → back 1/3
- **Vagus nerve (CN X)** → throat/epiglottis

🔹 **General sensation (touch, pain, temperature)**

- **Trigeminal nerve (CN V)**

👉 This is why:

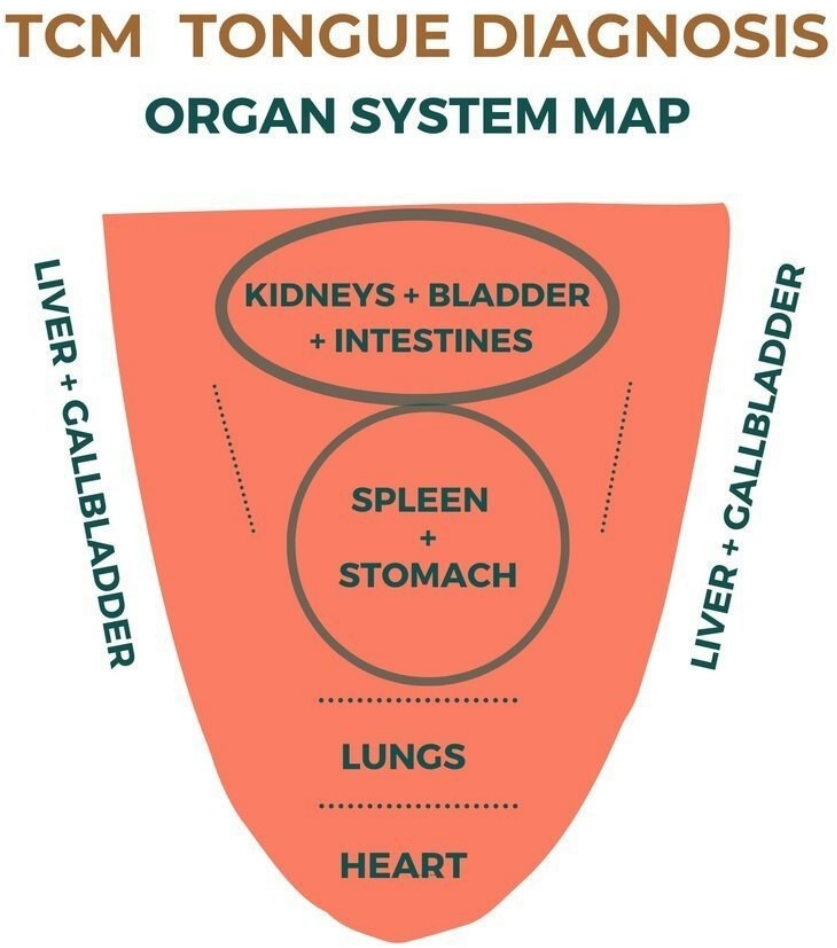
- Spicy food isn't "taste"—it's **pain/temperature signaling**
- Menthol feels cool → trigeminal activation

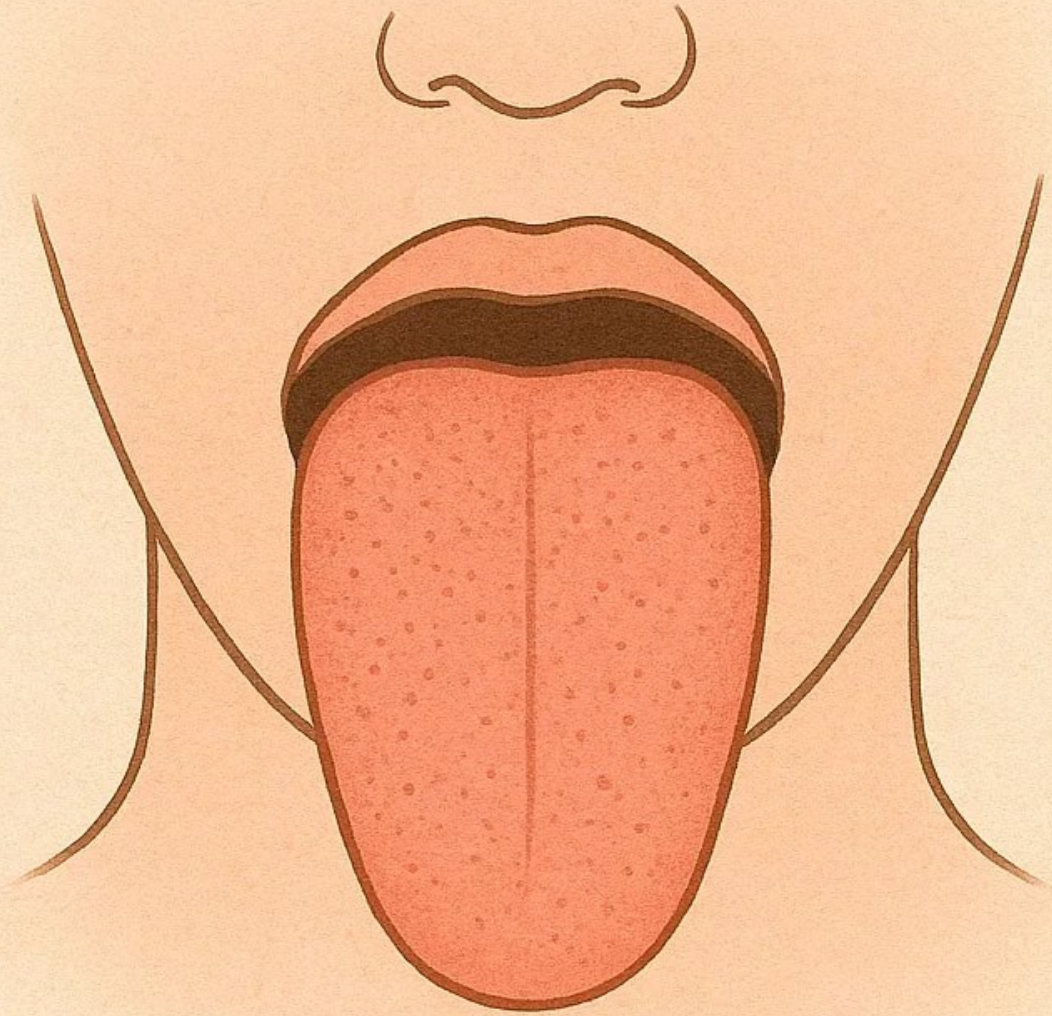
The Tongue as a Systemic Mirror

The tongue is often considered a **reflection of internal physiology**:

- Color → circulation, oxygenation
- Coating → digestion, microbiome
- Moisture → hydration, salivary function
- Texture → nutrient status (B vitamins, iron, etc.)

👉 Traditional systems (like TCM) leaned heavily on this—and modern physiology is catching up in some ways.

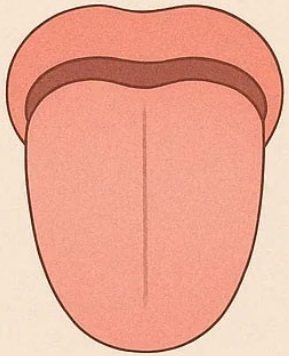
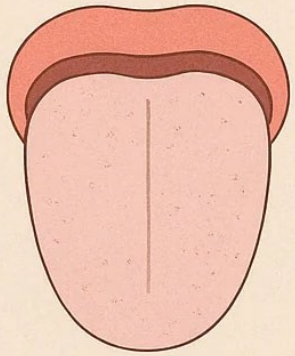
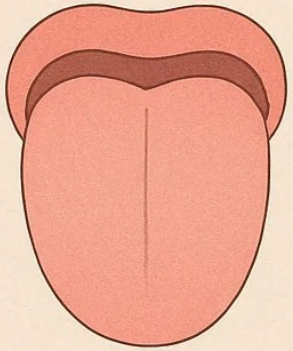
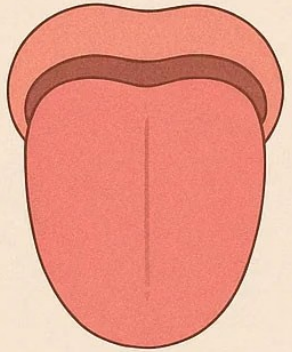




The Secrets of Tongue Diagnosis in Traditional Chinese Medicine:

Identifying Health Issues Through the Tongue

The Composition of the Tongue Manifestation

Tongue Body (舌质)	Tongue Coating (舌苔)	Tongue Shape (舌形)	Tongue Color (舌色)
			
The tongue body reflects the overall state of qi and blood, as well as the health of internal organs.	This is the white or yellowish substance covering the tongue's surface, indicating the presence of internal dampness, heat, toxins,	The size, shape, and appearance of the tongue can reveal whether the qi and blood flow smoothly.	The color of the tongue reflects the balance of qi and blood and the yin-yang harmony of the internal organs.

Integration with the Whole Body

The tongue and oral cavity connect to:

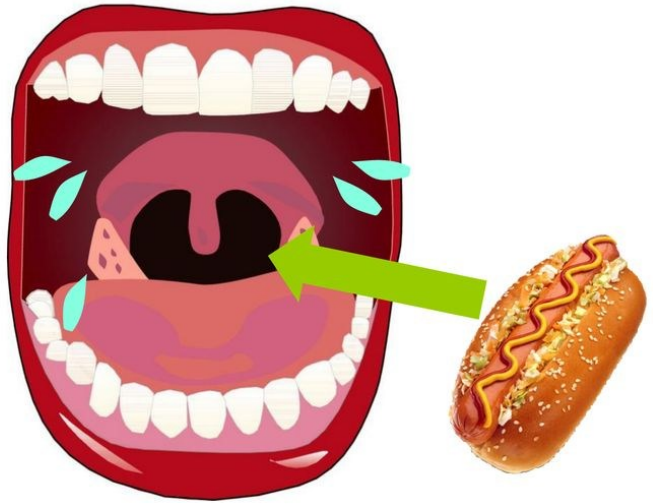
- **Digestion**
- First stage of digestion (mechanical + enzymatic)
- Signals downstream digestive activity
- **Immune system**
- Oral microbiome
- Tonsils and mucosal immunity
- **Nervous system**
- Dense sensory input → brain mapping
- Strong link to pleasure, aversion, memory
- **Hormonal & metabolic signaling**
- Taste receptors exist **outside the tongue** (gut, pancreas)
- Influence insulin, appetite, and satiety

Impact on Digestion

The tongue and oral cavity mark the true beginning of digestion, both mechanically and chemically. The tongue actively moves and positions food during chewing, helping to break it down and form a cohesive bolus for swallowing. At the same time, saliva—released from the salivary glands—contains enzymes such as amylase that begin the breakdown of carbohydrates. Just as importantly, taste and oral stimulation signal the rest of the digestive system, prompting the stomach, pancreas, and intestines to prepare for incoming nutrients. In this way, the mouth doesn't just process food—it *initiates and coordinates* the entire digestive response.

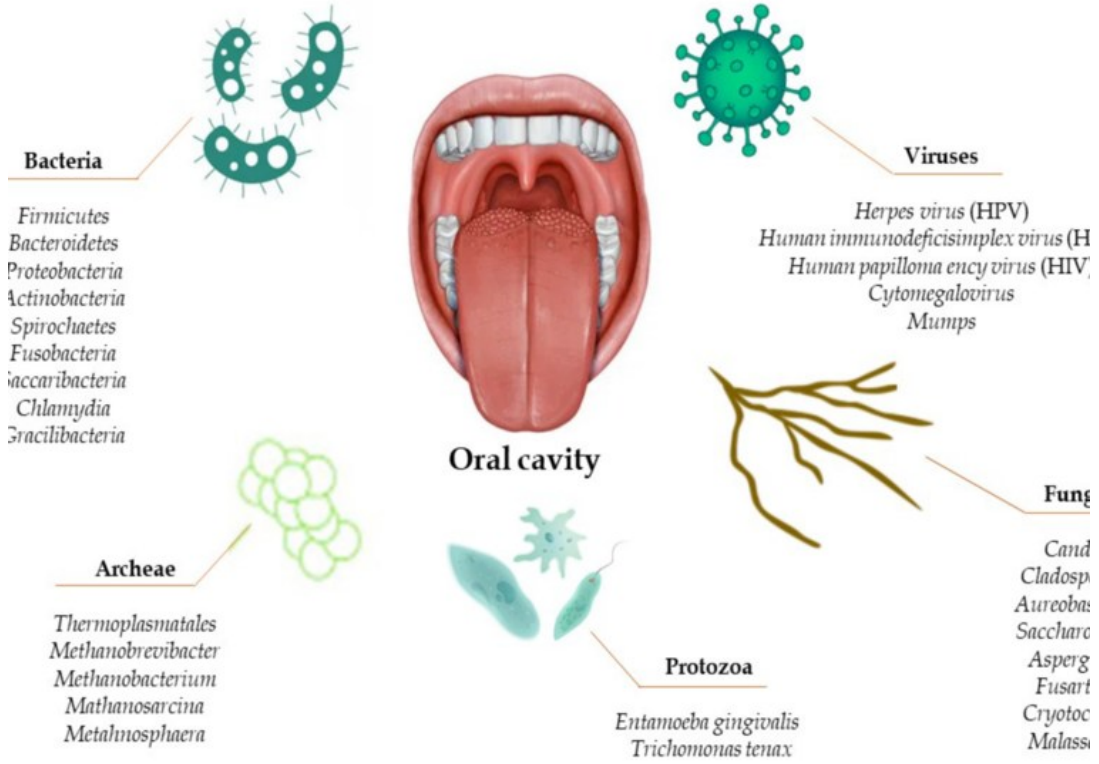
Digestion begins NOW!

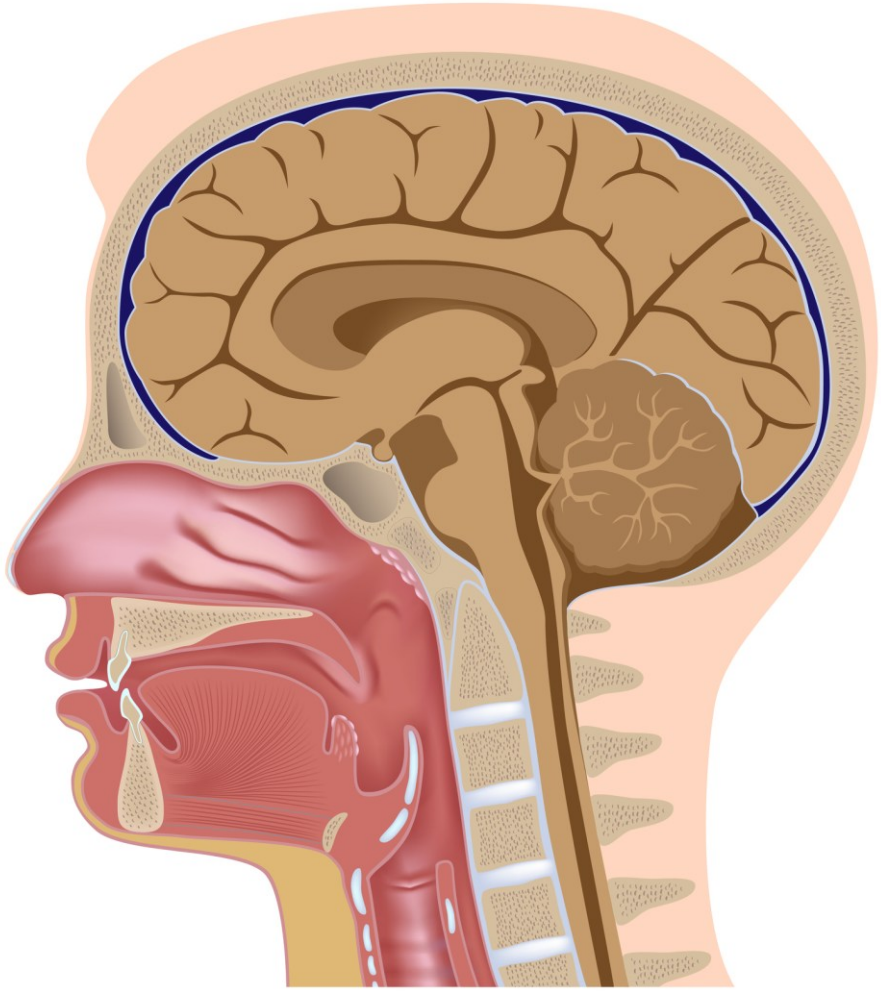
1. **Mouth:** tongue, teeth, & saliva change food into **soft mass** (**bolus**)



Impact on the Immune System

The oral cavity serves as one of the body's first lines of immune defense, constantly exposed to the external environment. It houses a complex and dynamic oral microbiome that plays a key role in maintaining health and preventing pathogenic overgrowth. The mucosal lining of the mouth, along with saliva, contains immune factors such as antibodies and antimicrobial compounds that help neutralize potential threats. Structures like the tonsils further contribute by sampling and responding to pathogens. Together, these elements make the oral cavity a critical checkpoint where the immune system evaluates what is entering the body.





Impact on the Nervous System

The tongue is one of the most richly innervated structures in the body, providing continuous sensory input to the brain. It detects taste, texture, temperature, and irritation, all of which are rapidly transmitted through multiple cranial nerves. This sensory information contributes not only to basic perception but also to complex neurological responses involving pleasure, aversion, and memory. The tongue also functions as a highly precise motor organ, coordinating intricate movements required for speech and swallowing. Through these sensory and motor roles, it serves as a direct and dynamic link between the external environment and the brain.

Impact on Hormonal & Metabolic Signaling

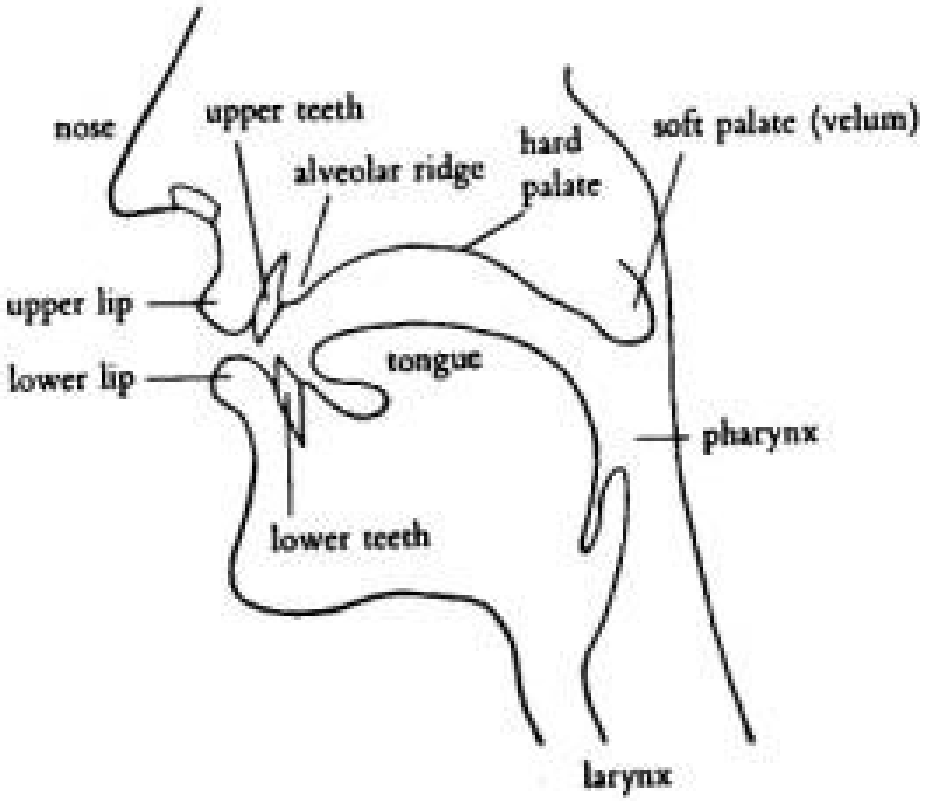
The tongue plays an important role in hormonal and metabolic regulation by helping to influence how the body responds to food. Taste receptors on the tongue detect nutrients and send signals that can affect appetite, satiety, and digestive readiness. Interestingly, similar taste receptors are also found in other parts of the body, including the gut and pancreas, where they help regulate processes such as insulin release and nutrient absorption. This means that what we taste—and how we perceive it—can directly impact metabolic responses, linking the sensory experience of eating with the body's internal regulation of energy and balance.

The Tongue Beyond Taste

From Sensation to Expression

The Tongue as an Instrument of Speech

Speech is not just about the vocal cords—it's about **precision shaping of sound**, and the tongue is the primary sculptor.



- 🔹 **What actually produces speech?**
- **Lungs** → provide airflow
- **Vocal cords** → create sound
- **Tongue + lips + palate** → shape that sound into language

👉 The tongue turns *noise into meaning*.

Precision & Speed: A Neurological Marvel

The tongue is capable of:

- Rapid, coordinated movements (milliseconds)
- Fine positional control (millimeters)
- Continuous adjustment during speech

It is one of the most **densely innervated and finely controlled muscular systems** in the body.

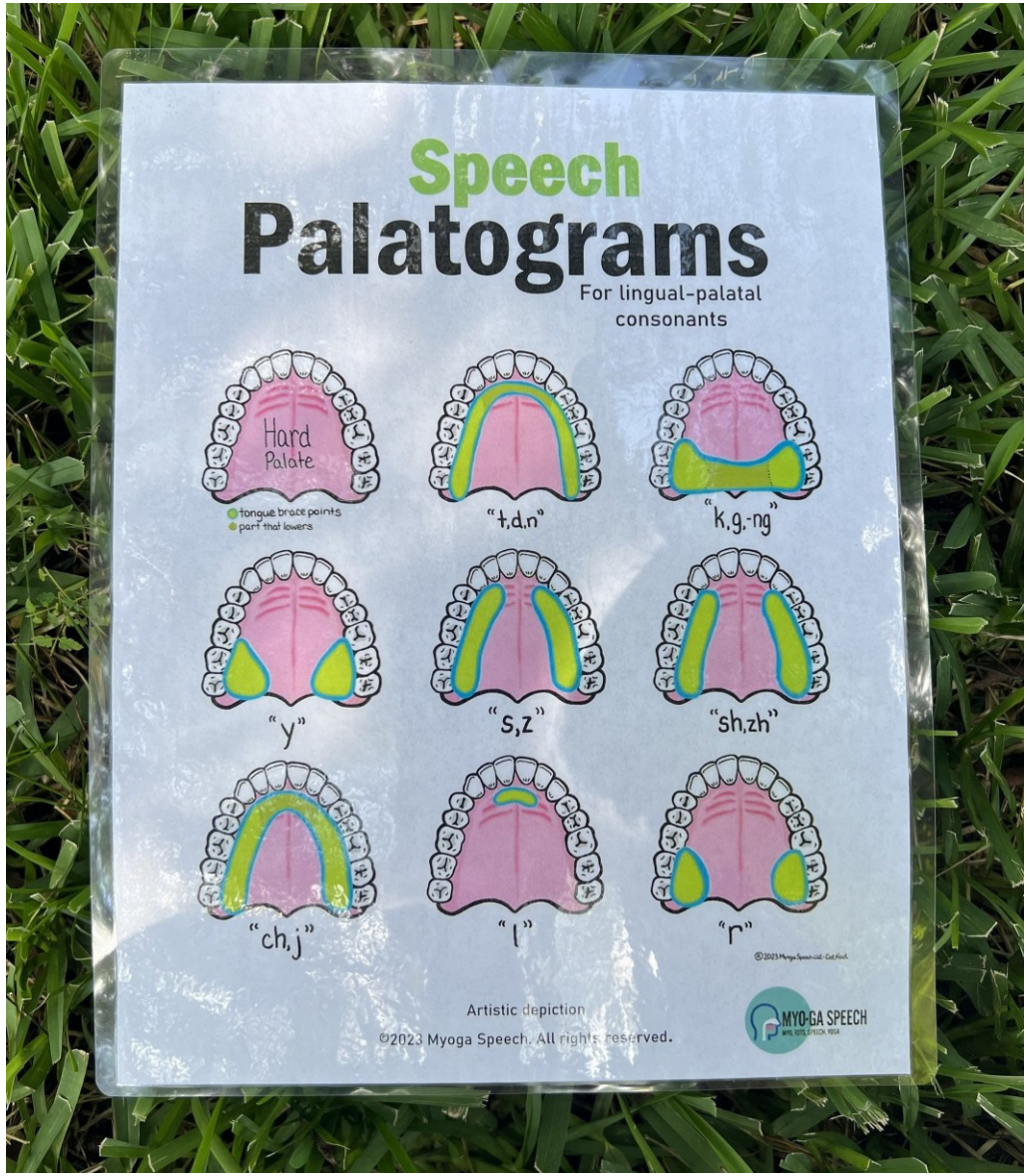
👉 This is why:

- Slurred speech is an early neurological sign
- Stroke, B12 deficiency, or nerve damage often show up *first* in speech changes

Key Structures in Speech Formation

- **The tongue interacts with:**
- **Hard palate** → “t,” “d,” “n” sounds
- **Soft palate** → controls airflow (nasal vs oral sounds)
- **Teeth** → “th,” “f”
- **Lips** → “b,” “p,” “m”

👉 Speech is a **team effort**, but the tongue is the lead performer.

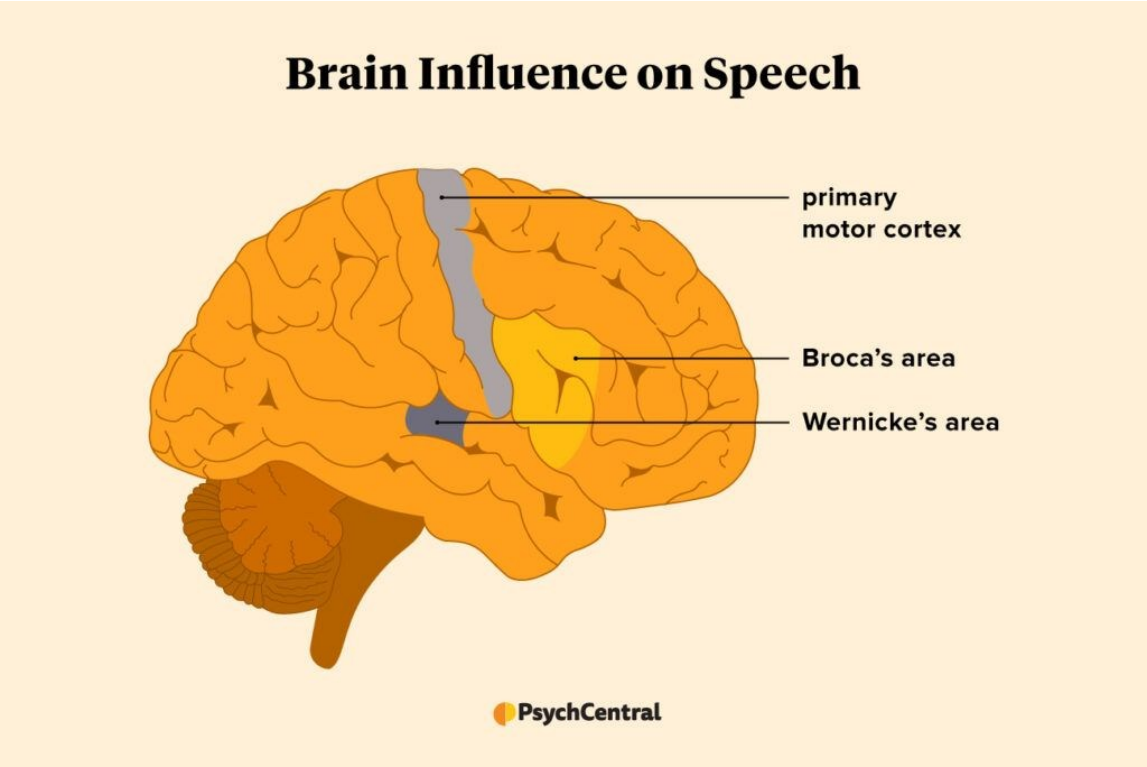


The Tongue & the Brain: A Direct Line

Speech is one of the most complex functions in the human body.

It requires:

- **Motor planning (Broca's area)**
- **Language comprehension (Wernicke's area)**
- **Cranial nerve coordination**
- **Auditory feedback loops**



👉 The tongue is where **thought becomes audible.**

Development: How Speech Emerges

🔹 **In infants:**

- Tongue movements begin with **suckling and swallowing**
- Gradually refine into **babbling → words → language**

👉 **The same structure that:**

- Nourishes the body
- Also develops the ability to **communicate, connect, and influence**

The Tongue as a Gatekeeper

The tongue does two critical things:

🔹 **1. Decides what enters the body**

- Taste
- Texture
- Safety (bitter = often toxic)

🔹 **2. Determines what leaves the body**

- Words
- Tone
- Expression

👉 It is both:

- A **filter of intake**
- A **filter of output**

Wrapping Up & Looking Forward…

Today we've seen that the tongue is far more than a simple organ of taste—it is a dynamic, highly integrated structure that plays a central role in digestion, sensation, immunity, communication, and neurological function. From initiating the digestive process to shaping speech, from detecting the chemistry of what we consume to expressing what is within us, the tongue truly serves as both a receiver and a messenger. As a gatekeeper, it helps determine what enters the body and what is released into the world, linking physical function with deeper layers of interaction and influence.

In our next session, we'll take this understanding further by exploring what happens when things go wrong—examining conditions that affect taste, speech, and oral function, including structural, neurological, and nutritional factors that can disrupt this finely tuned system. By understanding both function and dysfunction, we gain a clearer picture of how to support and restore this remarkable organ.

Thank you!

Wondrous Roots, Inc.

103 Roxbury St.; Keene, NH 03431

603-439-2603

www.shopwondrousroots.com

www.wondrousroots.org

Rebecca Roentsch Montrone, BS

"You have more power than you know..."