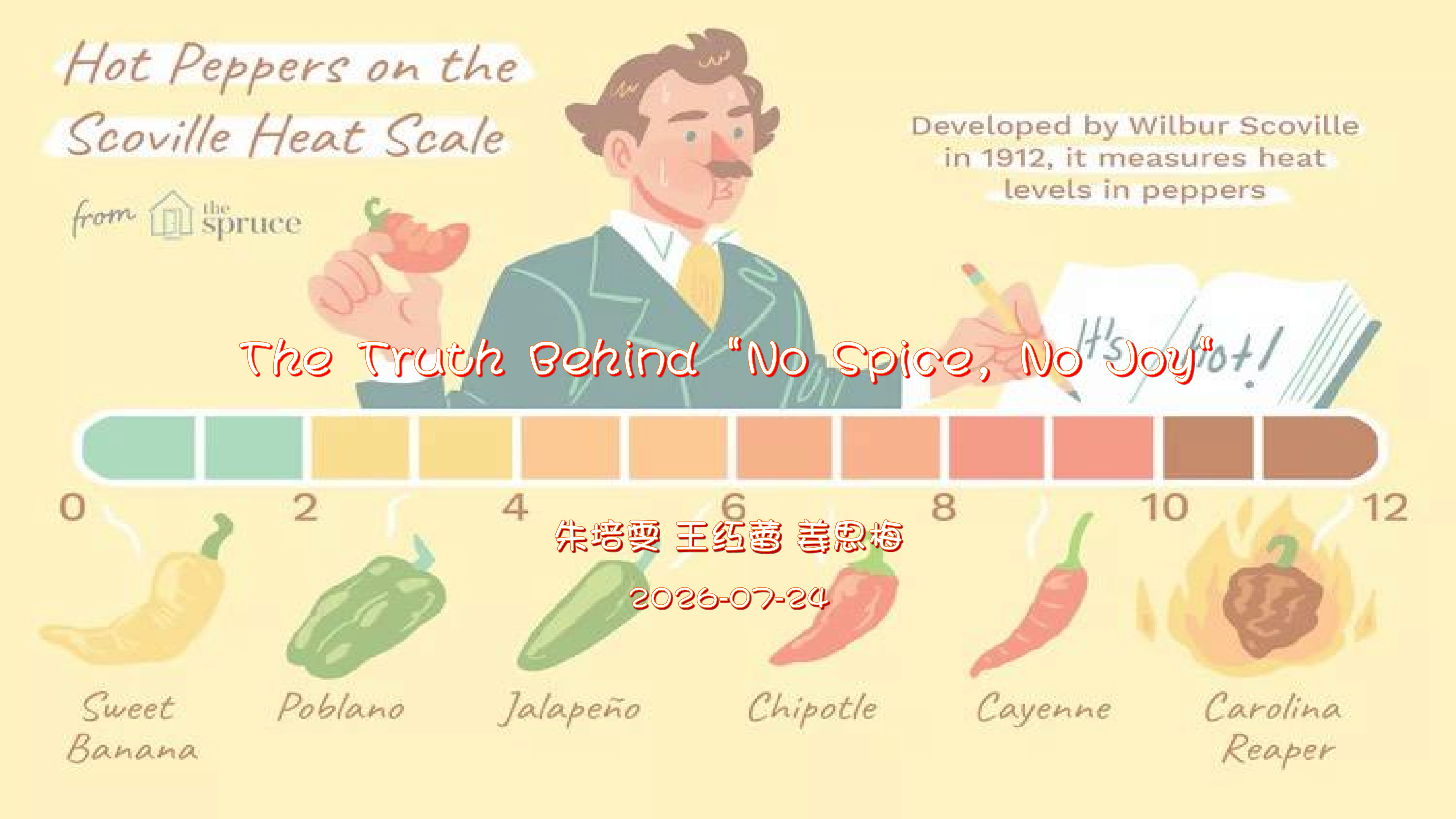


The Truth Behind "No Spice, No Joy"

朱培雯 王红蕾 養恩梅

2026-07-24

①	②	③	④	⑤	⑥
中辣	特辣	很辣	中辣	微辣	不辣

二荆条 小米辣 朝天椒 线椒 螺丝椒 灯笼椒/菜椒

The Truth Behind "No Spice, No Joy"

Part1: Why Spiciness Is a Chemical Burn, Not a Gustatory Taste——姜思梅

Part2: Why Spicy Food Makes You Sweat, Sniffle, and Feel a “High”——王红蕾

Part3: Why Some People Can Handle Spice: Is It Good or Bad for You?——朱培雯

Your tongue has been tricked！
——Spiciness is a chemical burn, not a gustatory taste

姜思梅

2026.7.24

"What does spicy taste like?"

Your skin can’t taste. But it can feel heat and pain.

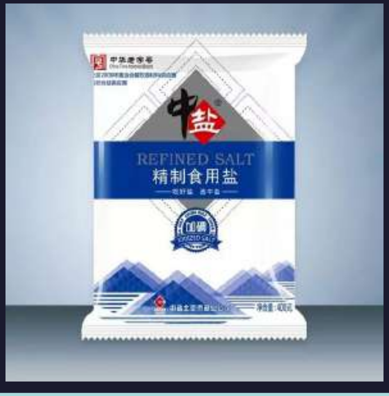
Your tongue knows 5 tastes　　“五味杂陈”

Sour
Acids, H^+ ions

Sweet
Sugars

Bitter
Alkaloids

Salty
Na^+ ions



Umami
Amino acid, Glutamate

Spicy
Pain and hot, not a taste modality!

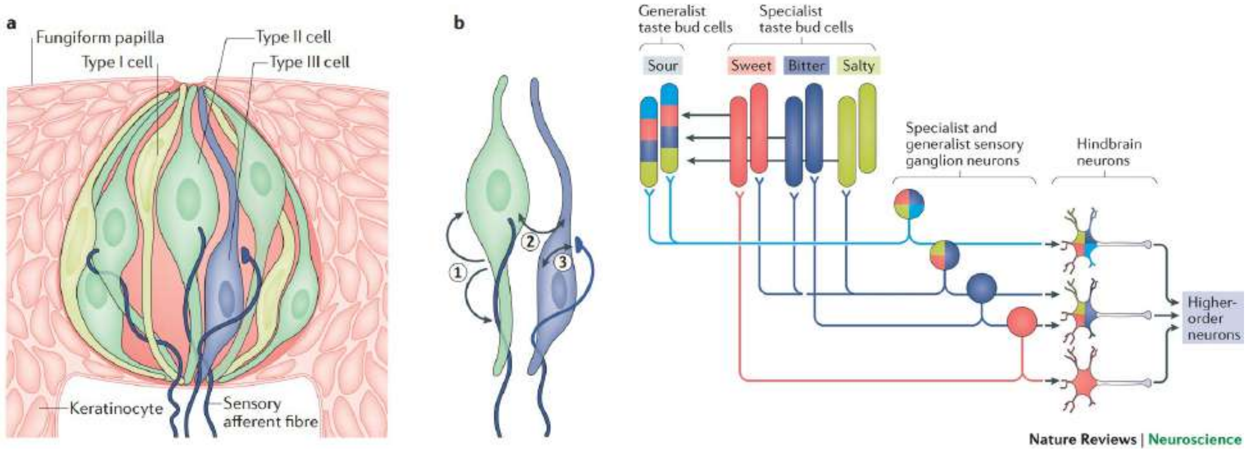
Two different systems on your tongue

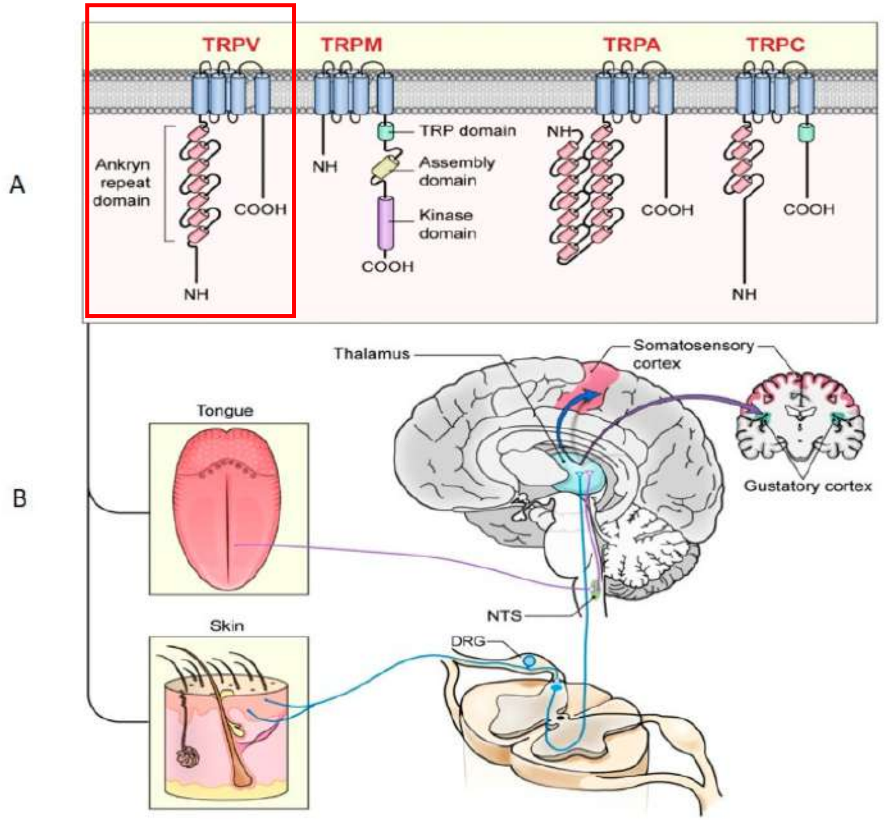
Taste buds

- Located inside fungiform papilla 菌状乳突
- Each bud: contain 50–100 cells
- Each bud: divided into 3 cell types
- The brain recognizes tastes by analyzing combinations of activated cells

Pain nerve endings (Nociceptors)

- Express TRPV1 receptor
- Activated by heat >43°C, acid, capsaicin
- Make the brain perceive pain





Roper SD, et al. *Nat Rev Neurosci*. 2017

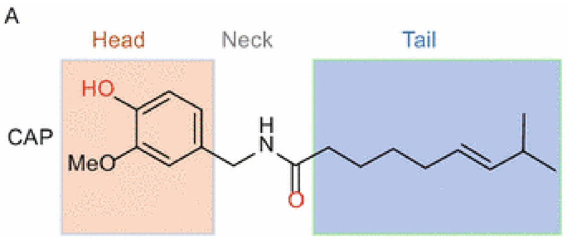
Aroke EN, et al. *Int J Mol Sci*. 2020

Capsaicin: A “🔑” that opens the pain perception channel

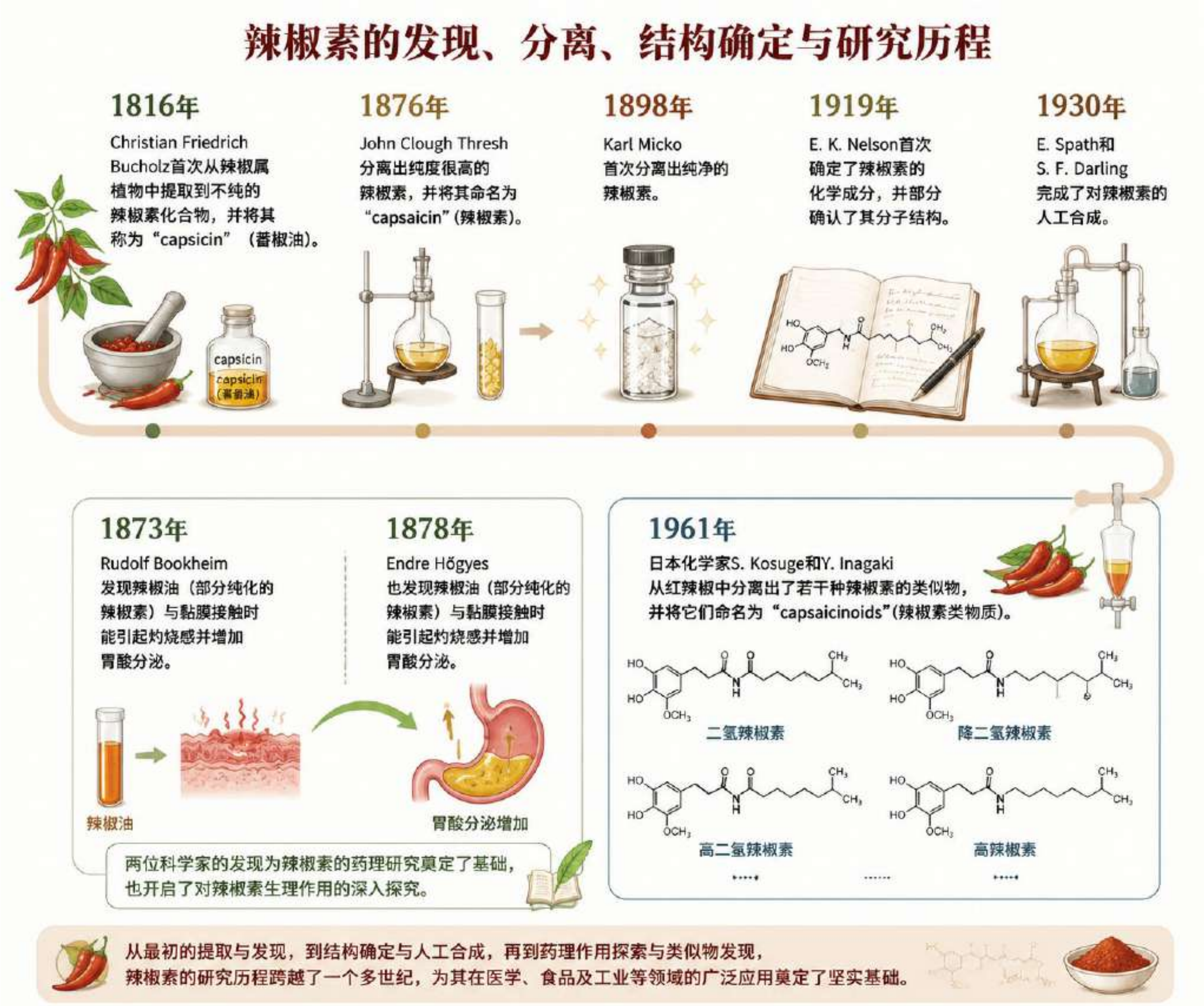
分子式：$C_{18}H_{27}NO_3$

性状：白色无味的结晶或粉末

特质：不溶于水，溶于油脂和酒精



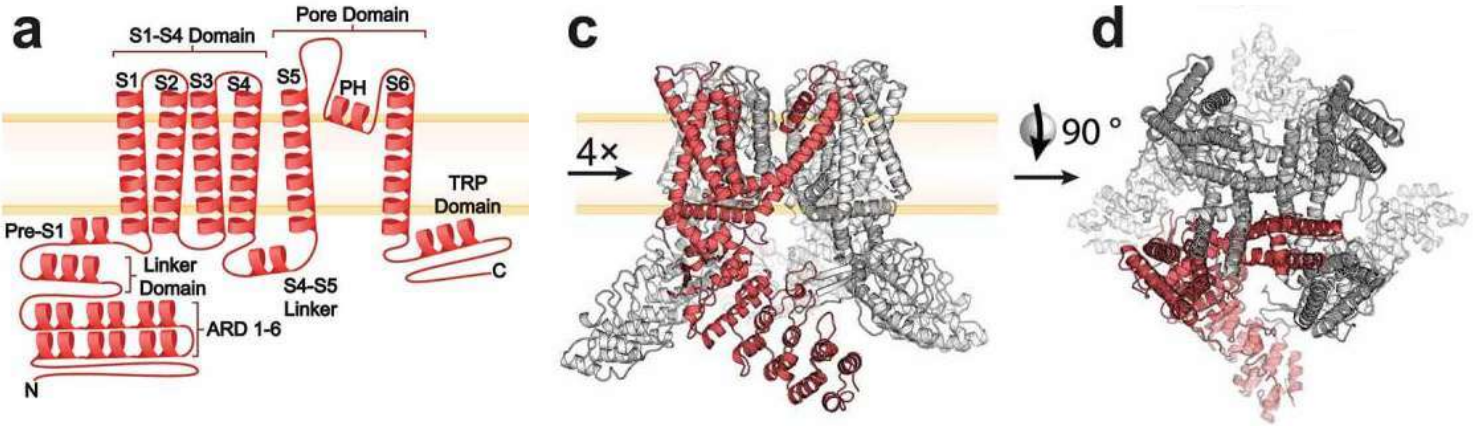
Yang F, et al. *Protein Cell*. 2017



Refer to Wikipedia

TRPV1: A “🔒” equipped with an alarm system

Transient Receptor Potential Vanilloid 1
瞬时受体电位香草素1



Luu Dustin D, et al. *Temperature (Austin)*. 2021

热 >43°C

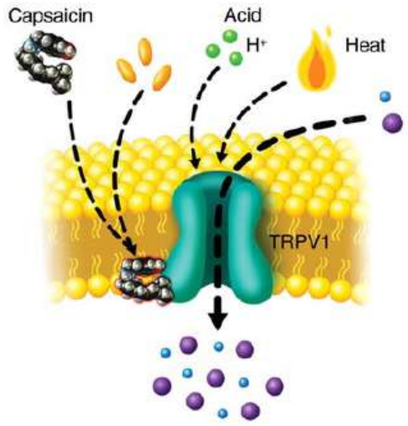
这是受体最原始的功能。
在组织损伤发生前检测危险的高温。

酸 (pH <5.9)

也可被质子激活，响应体内炎症信号。TRPV1受热与酸性环境共同刺激而激活。

辣椒素

在体温条件下，该通道已处于开放状态，无需实际热量刺激即可激活。

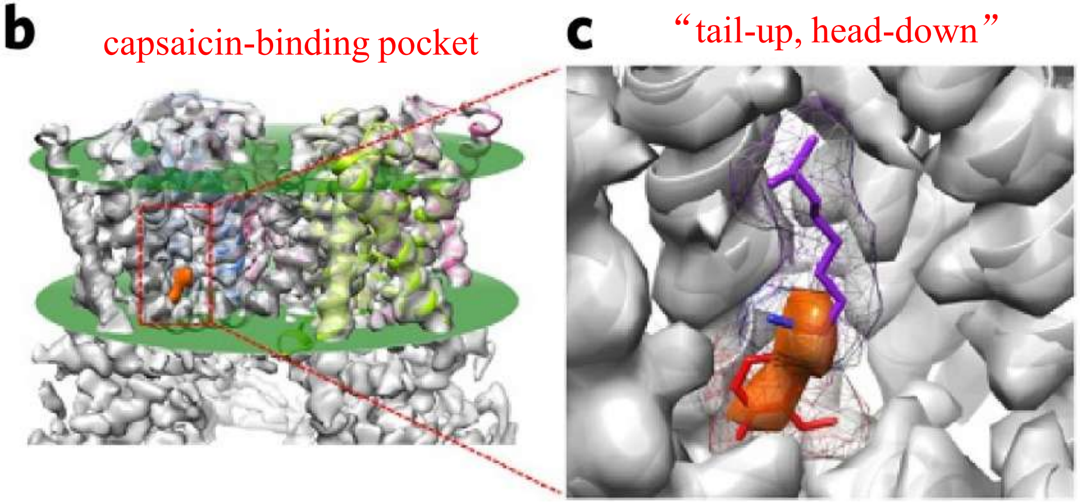


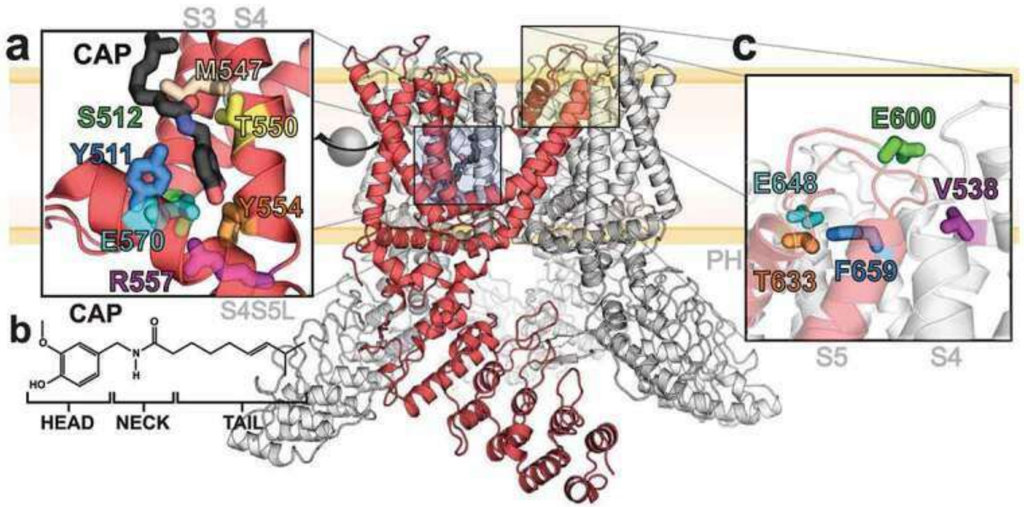
Source: Wikimedia Commons

大脑产生的混乱：

1 你吃了辣椒 → 2 辣椒素接触舌头 → 3 激活舌头上的TRPV1受体 → 4 神经元放电，引发一系列级联反应，大脑收到疼痛信号 → 5 大脑认为：好痛！我的舌头着火了！

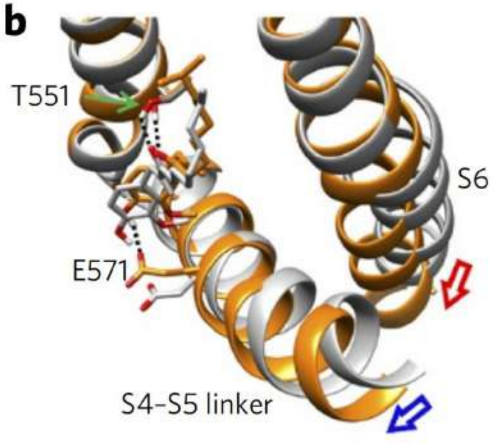
How capsaicin activates the TRPV1 channel?

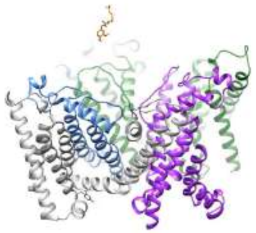


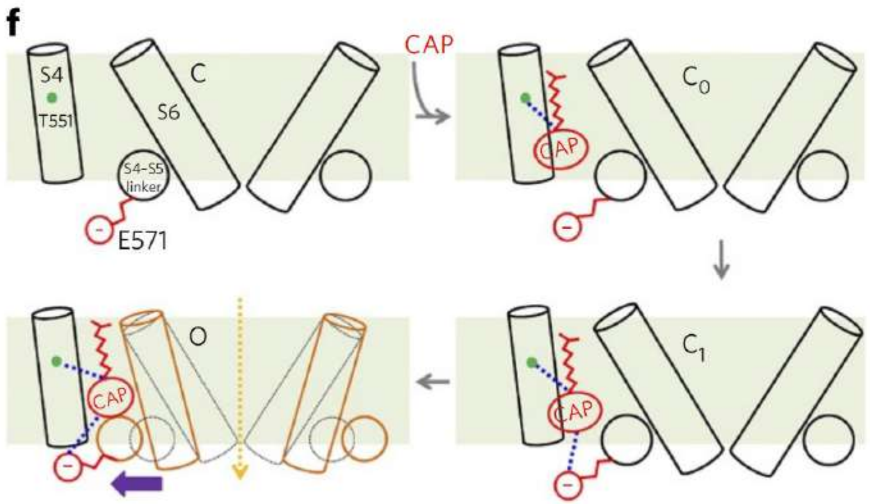


尾部的长度通过非特异性范德华力决定了与受体的结合强弱。
头部和颈部通过与受体上特定氨基酸残基形成氢键提供激活功能。

Luu Dustin D, et al. *Temperature (Austin)*. 2021

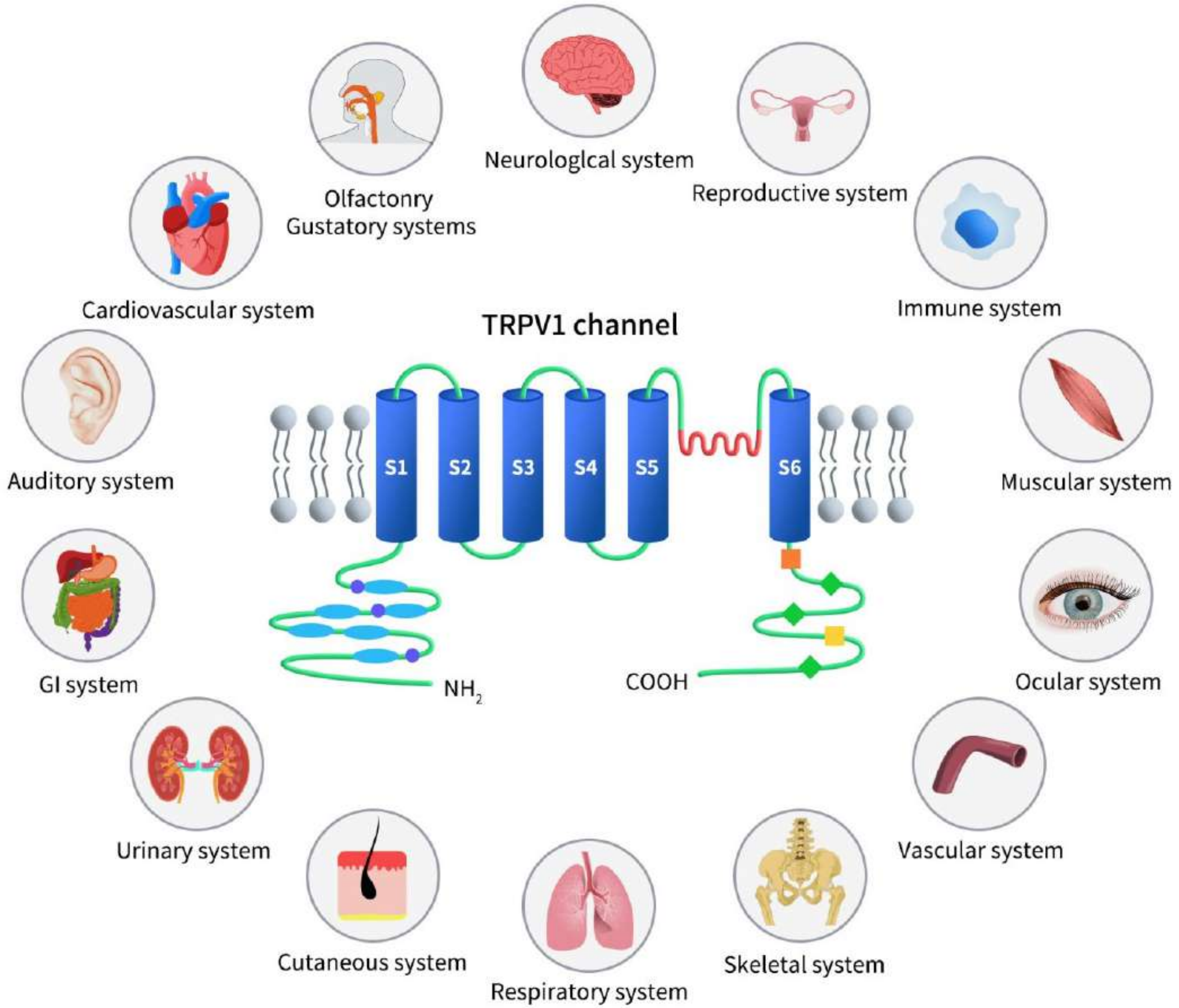






Yang F, et al. *Nat Chem Biol*. 2015

Where does your body feel spicy?



Jaffal SM, et al. *J Explor Res Pharmacol*. 2023

The story behind the Nobel Prize

David Julius——Found TRPV1 in 1997

1 假设

可能有一个基因能够使得原本对辣椒素不敏感的细胞也变得对辣椒素敏感。

→

2 提取 mRNA，构建cDNA文库

从大鼠背根神经节中提取mRNA，构建了一个cDNA文库（包含了~16000个克隆）

→

3 表达与筛选

将这些cDNA分批转入对辣椒素不敏感的细胞中，往培养液里加入辣椒素。

→

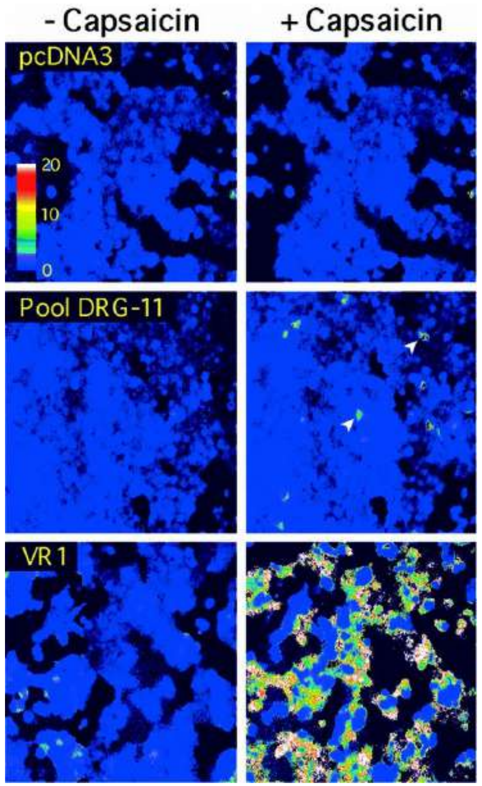
4 观察钙离子信号

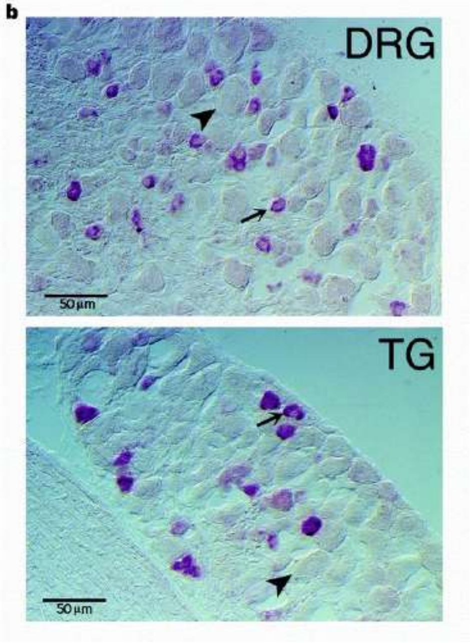
用 Ca^{2+}敏感荧光染料装载细胞。观察哪些细胞产生了反应（钙离子内流）。

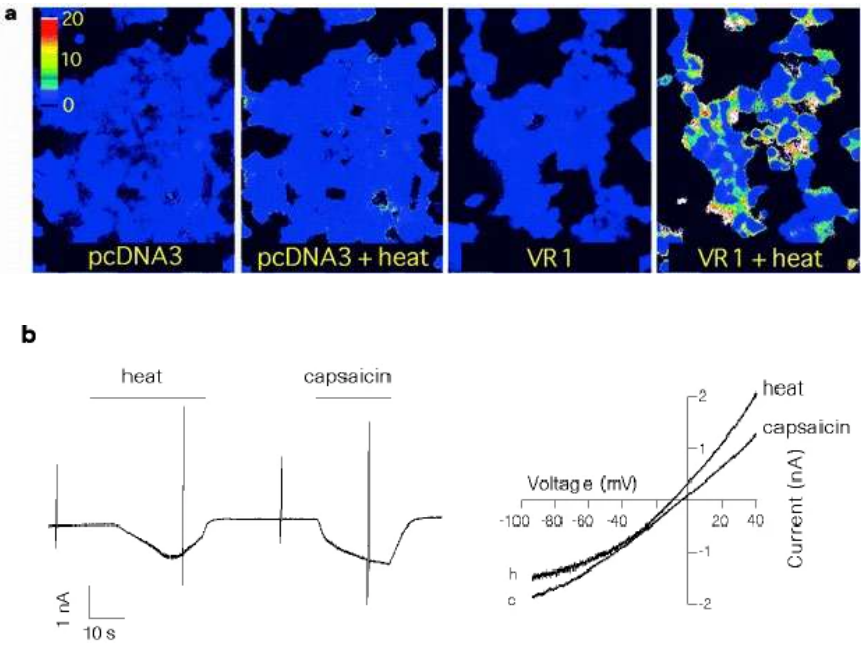
→

5 找到 TRPV1

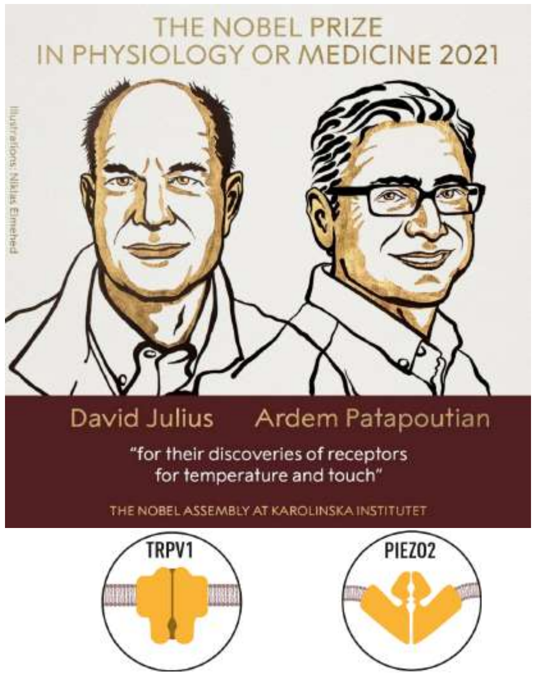
成功分离出一个使细胞对辣椒素和高温产生反应的 cDNA 克隆。



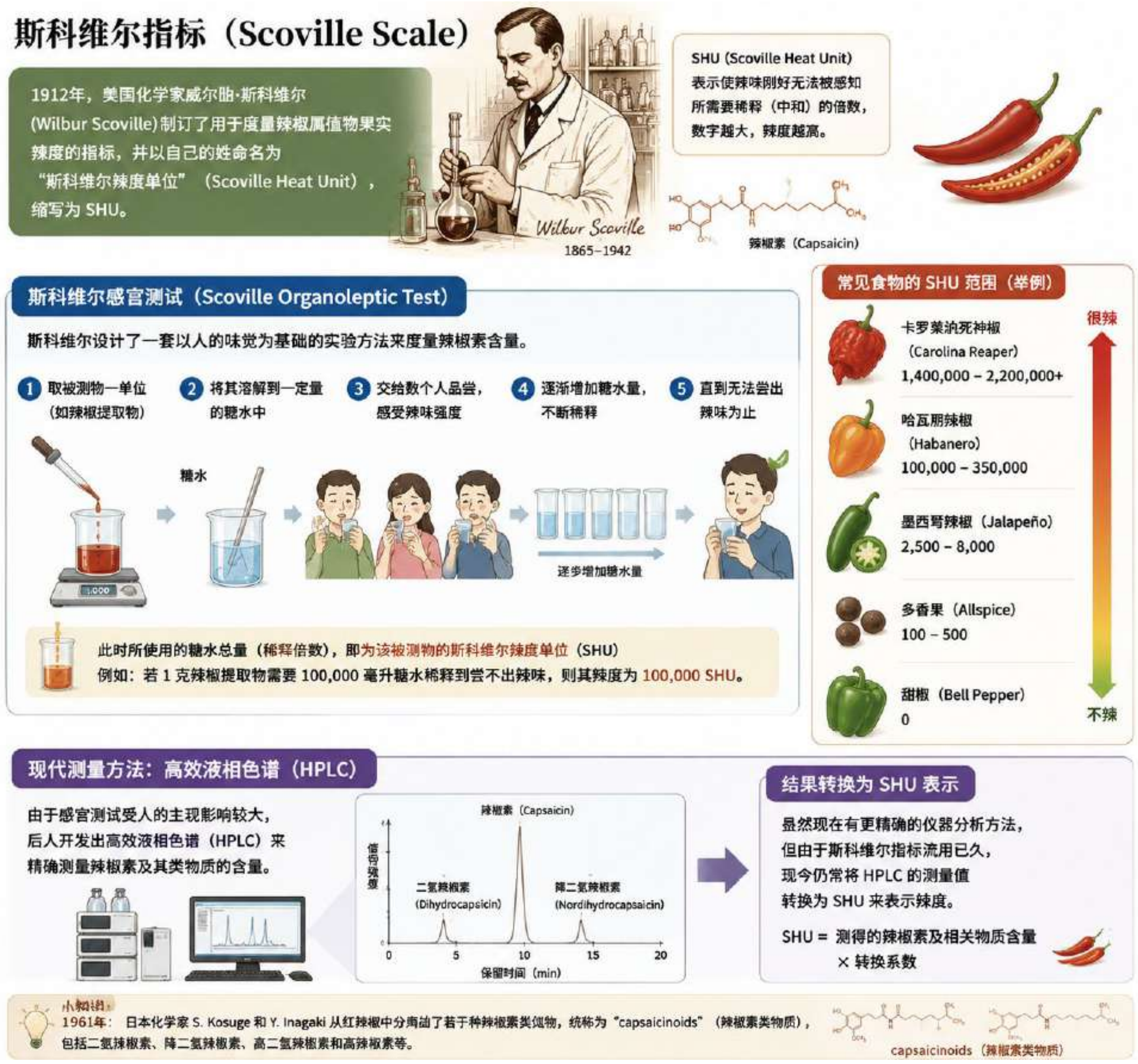




Caterina MJ, et al. *Nature*. 1997



Spicy or not spicy? The Scoville Scale

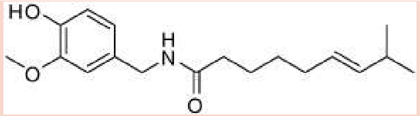
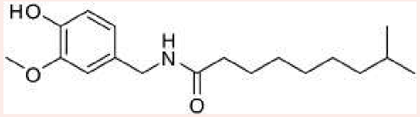
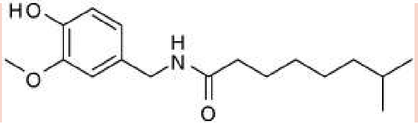
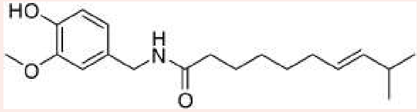
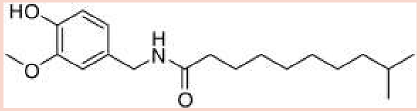


Refer to Wikipedia

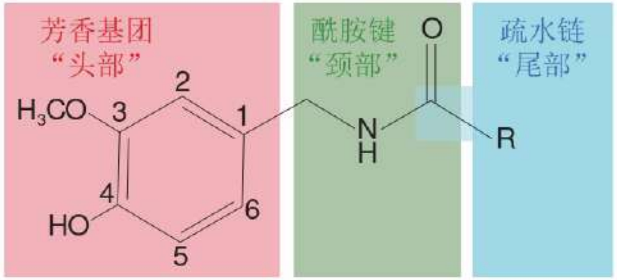
纯辣椒素（Pure capsaicin）= 1600万 SHU.

Not all “spicy” flavors are the same—Capsaicinoids

辣椒素类似物(Capsaicinoids)：一类结构与辣椒素(capsaicin)相似、由辣椒属植物产生的含有香草酰基和脂肪酸链结构的化合物总称。

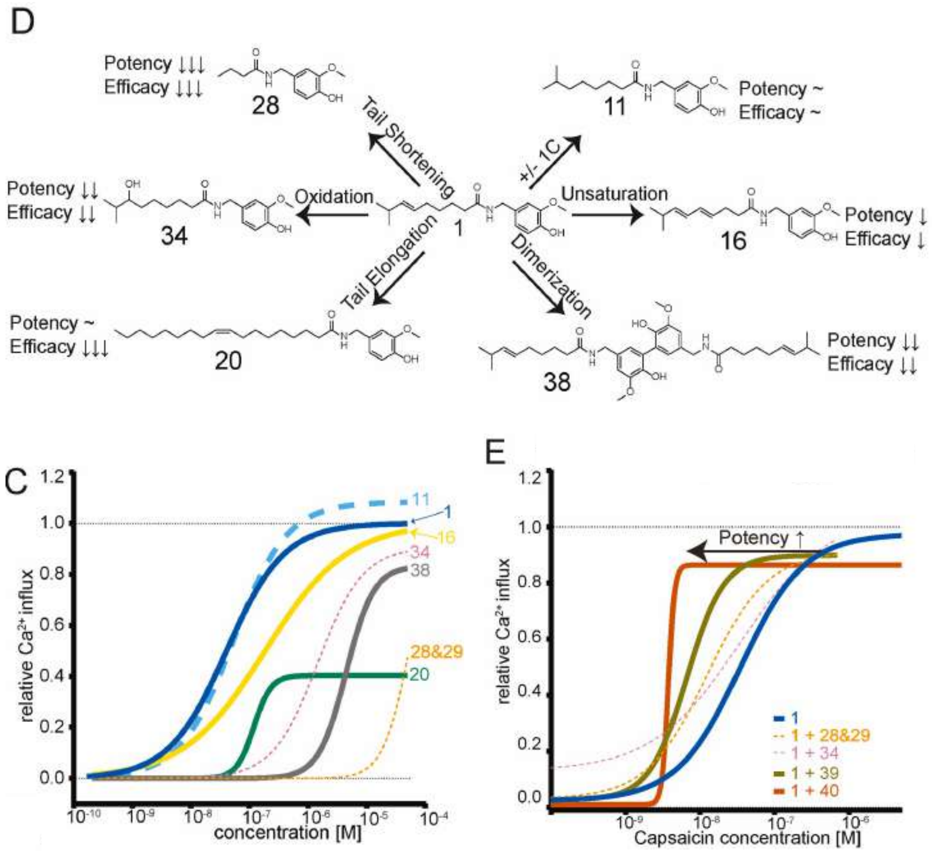
Name	Abbreviation	Molecular formula	Content	SHU	Structural formula
辣椒素 Capsaicin	C	$C_{18}H_{27}NO_3$	69%	16,000,000	
二氢辣椒素 Dihydrocapsaicin	DHC	$C_{18}H_{29}NO_3$	22%	16,000,000	
降二氢辣椒素 Nordihydrocapsaicin	NDHC	$C_{17}H_{27}NO_3$	7%	9,100,000	
高辣椒素 Homocapsaicin	HC	$C_{19}H_{29}NO_3$	1%	8,600,000	
高二氢辣椒素 Homodihydrocapsaicin	HDHC	$C_{19}H_{31}NO_3$	1%	8,600,000	

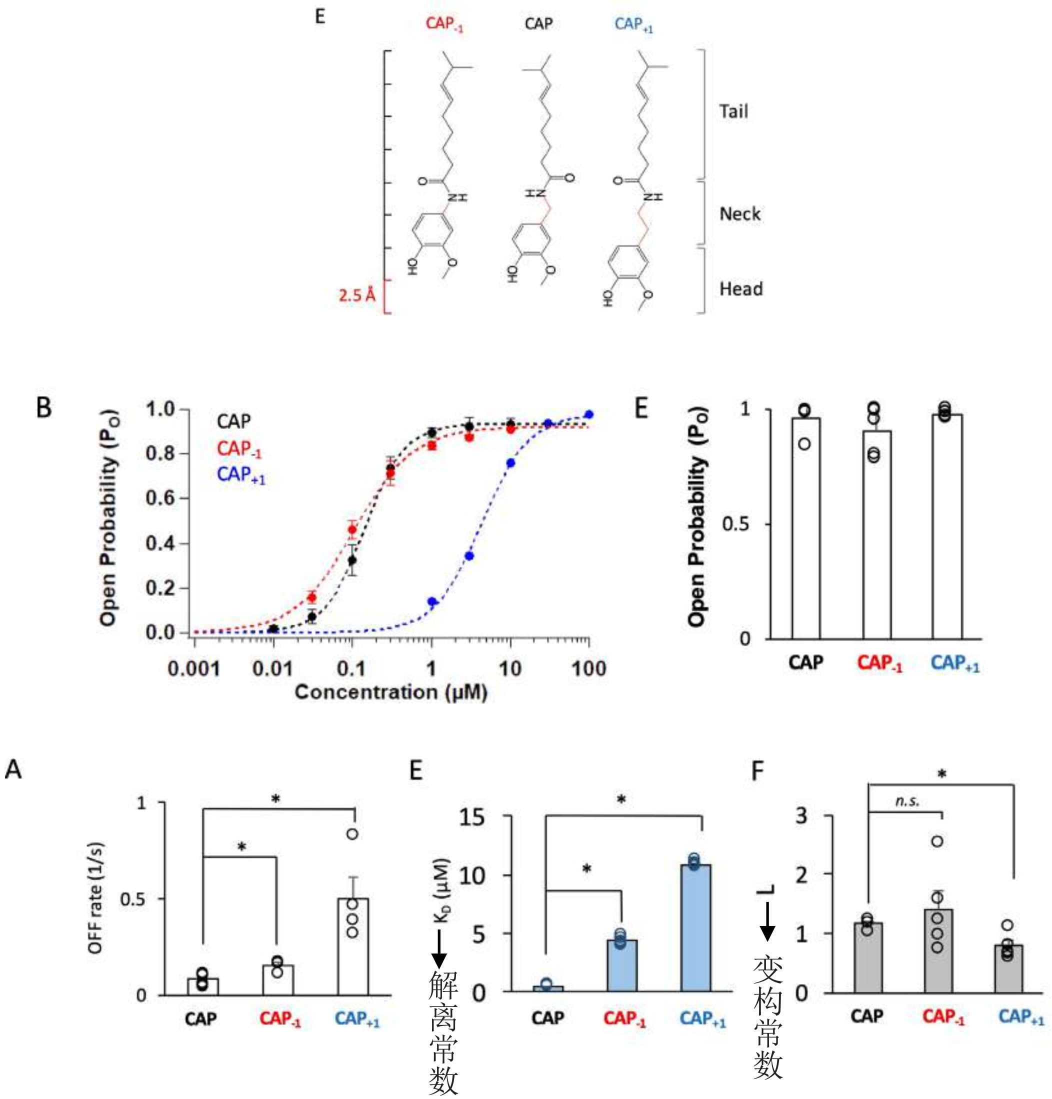
Refer to Wikipedia and
Luo XJ, et al. *Eur J Pharmacol*. 2011



范智义, et al. *食品科学*. 2023

Not all “spicy” flavors are the same—Capsaicinoids





Potency（效力）：指化合物与靶点（TRPV1）结合的亲和力，可理解为“产生辣感所需的浓度”。

Efficacy（效能）：指化合物与靶点结合后，能产生最大效应的能力，可理解为“理论上能引发的最大辣感强度”。

Smith JD, et al. *Eur J Pharmacol*. 2025

Vu S, et al. *Elife*. 2020

Why peppers make capsaicin?

🐀 Threat: Mammals

• 哺乳动物的牙齿会碾碎辣椒种子，使其无法发芽，阻碍辣椒的繁衍与传播。
• 辣椒素激活哺乳动物体内的TRPV1受体，产生灼烧和疼痛感，从而主动回避。

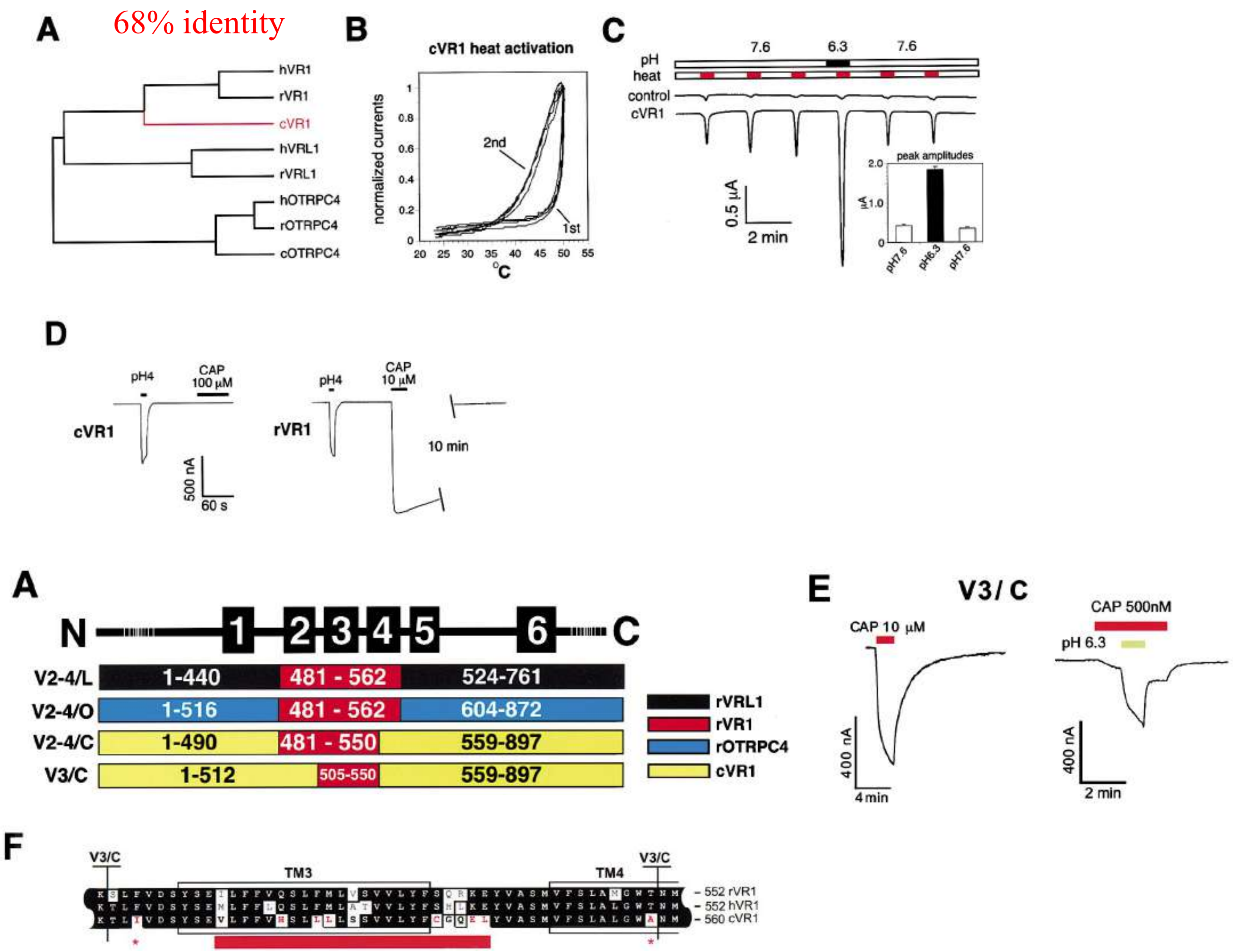
🐦 Helper：Birds

• 鸟类没有牙齿，会整粒吞下辣椒种子，且飞行能力强，能将种子传播到更远的地方。
•鸟类完全感受不到辣。

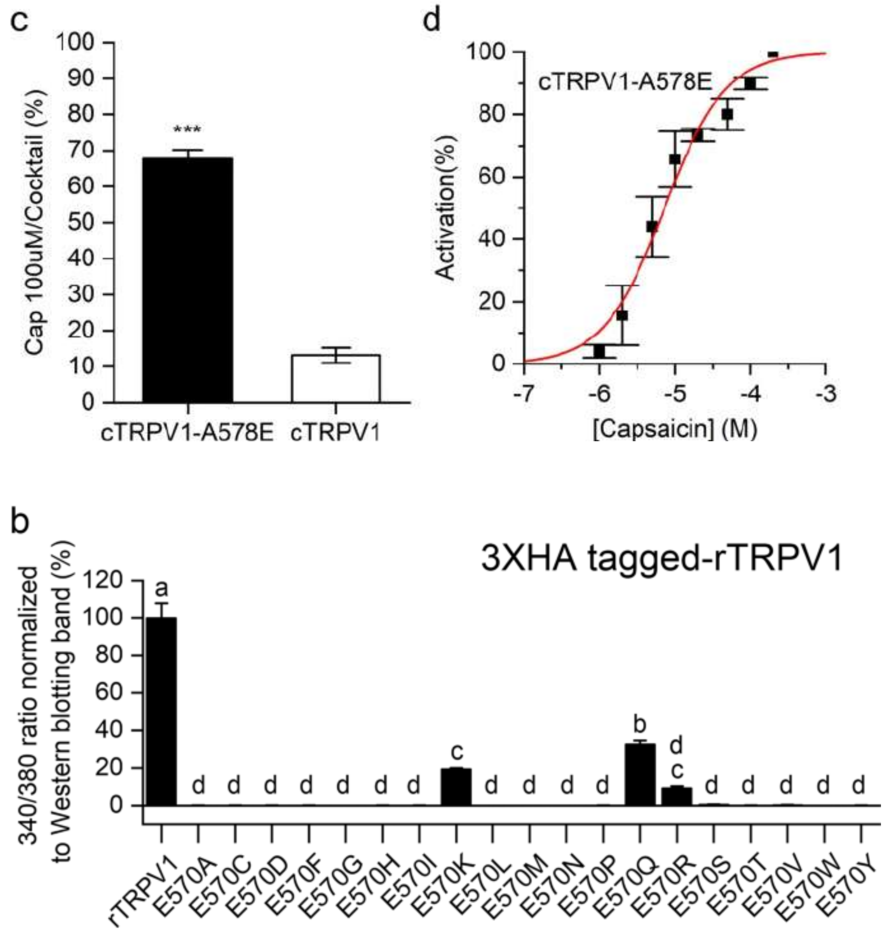
🌶️ Tips

辣椒素合成于辣椒果实的胎座组织——包裹种子的白色囊状物。这就是为什么去掉白色内膜能大幅降低辣度。胎座组织中有专门的表皮细胞，将辣椒素类物质合成并储存在囊泡中。

Birds don’t feel the spicy



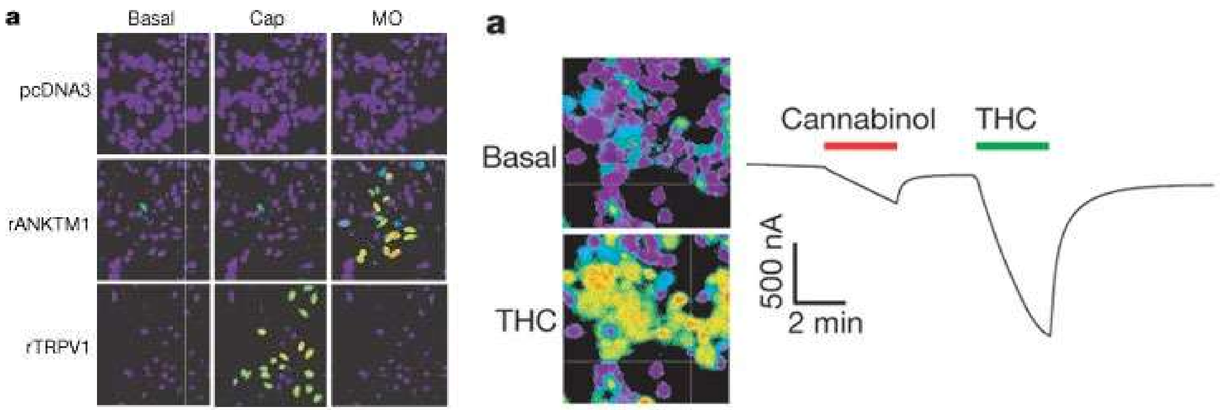
丙氨酸(A) →谷氨酸(E)

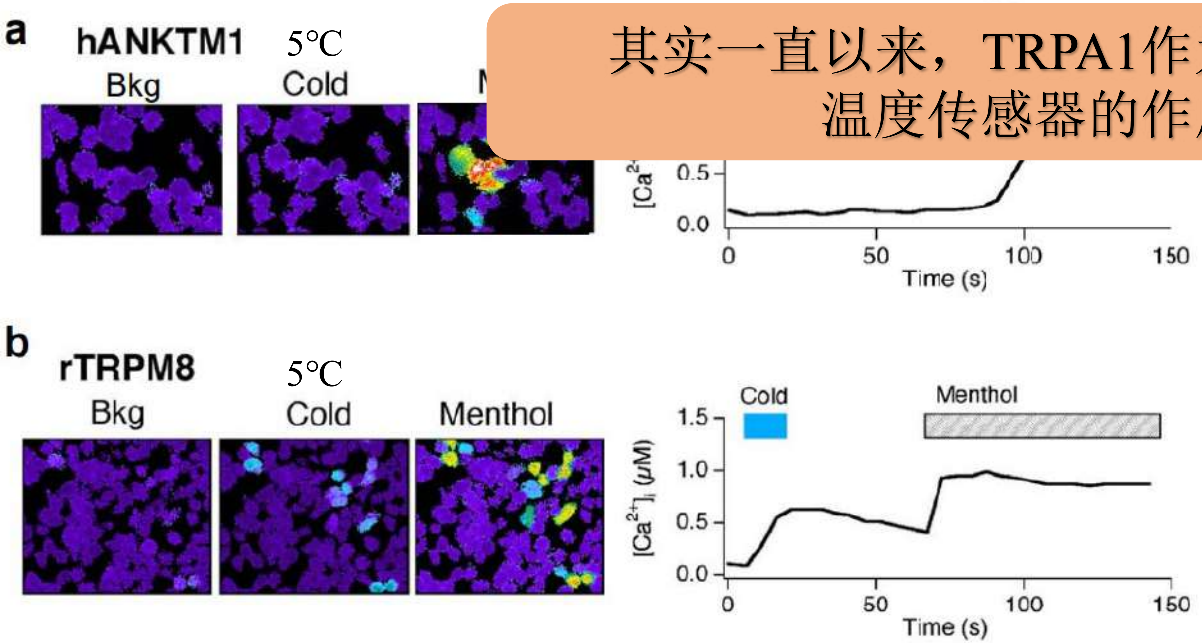


Jordt SE, et al. *Cell*. 2002

Chu Y, et al. *Sci Rep*. 2020

The three brothers of temperature sensors-TRPA1



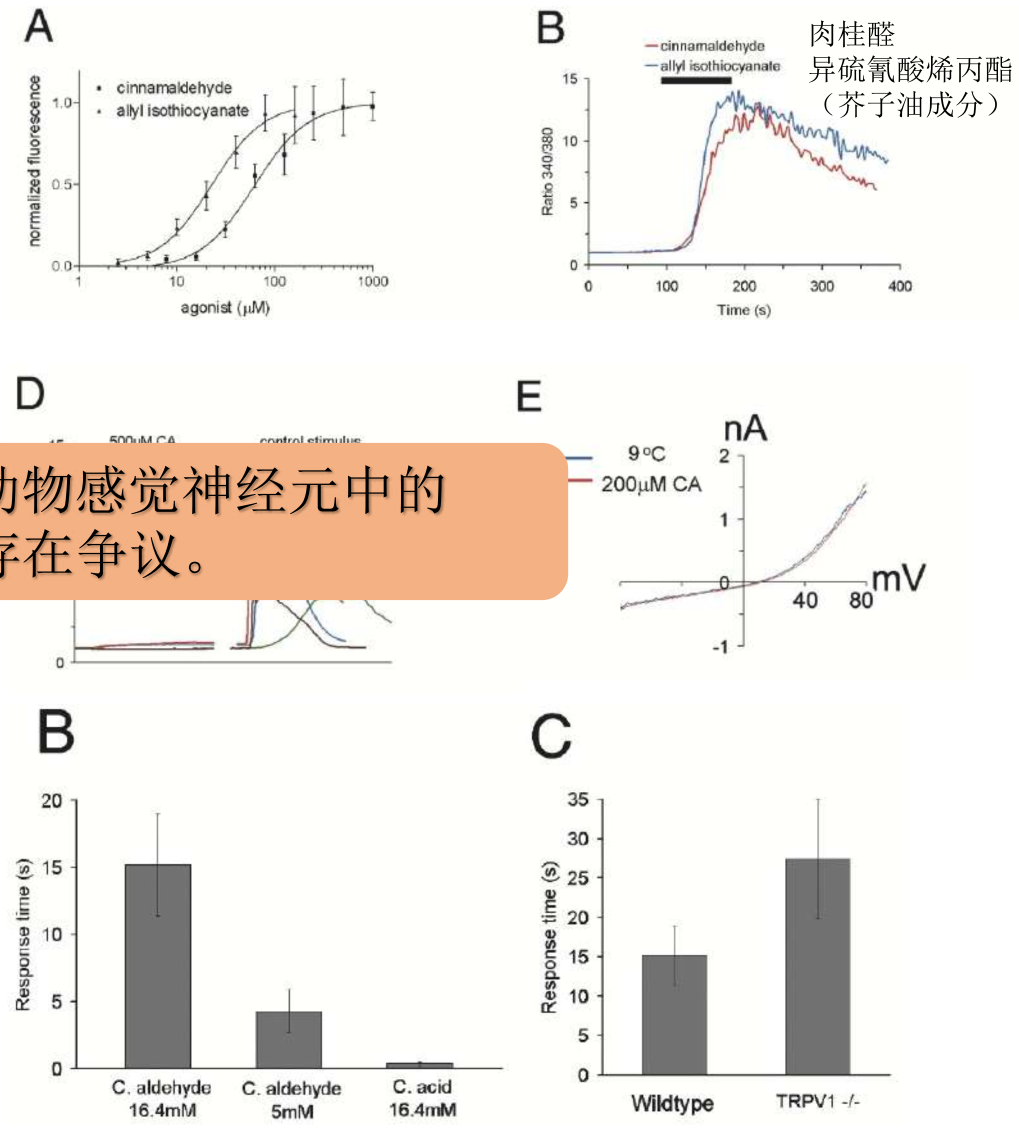


矛

论

？

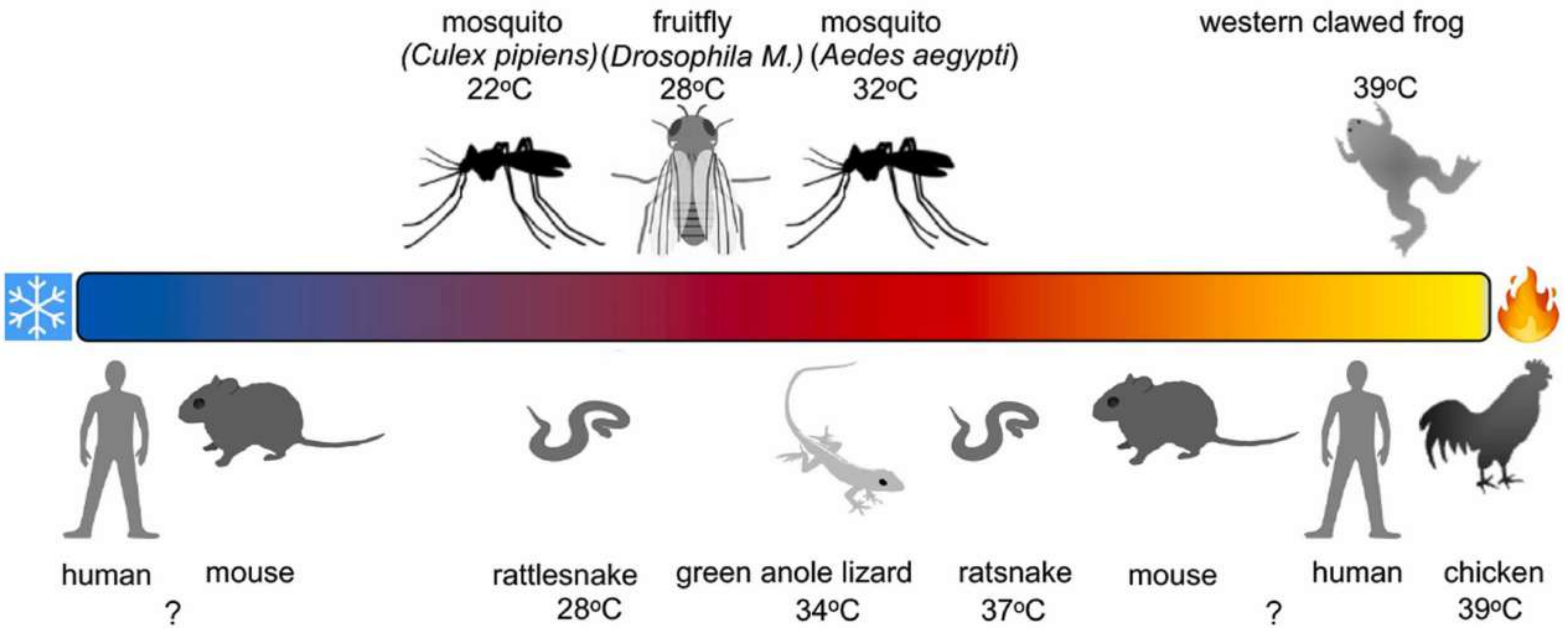
其实一直以来，TRPA1作为哺乳动物感觉神经元中的温度传感器的作用一直存在争议。



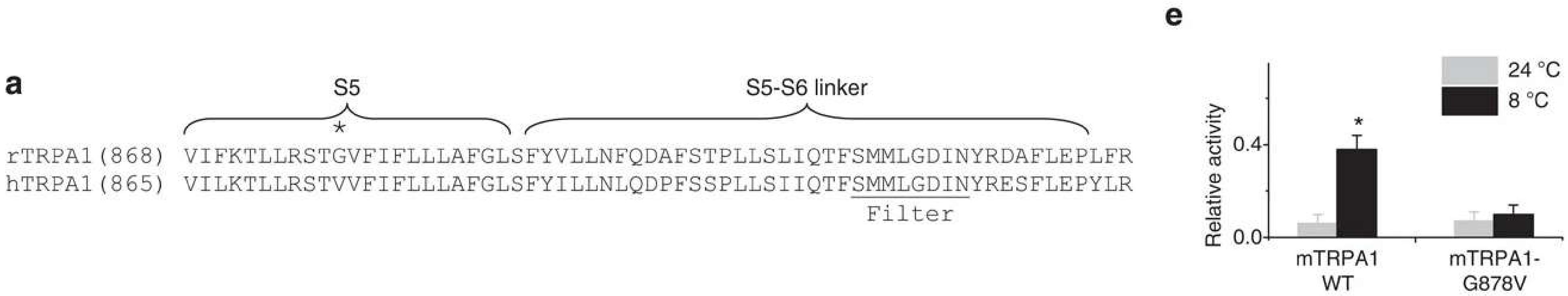
Jordt SE, et al. *Nature*. 2004

Bandell M, et al. *Neuron*. 2004

Species-specific temperature sensitivity of TRPA1



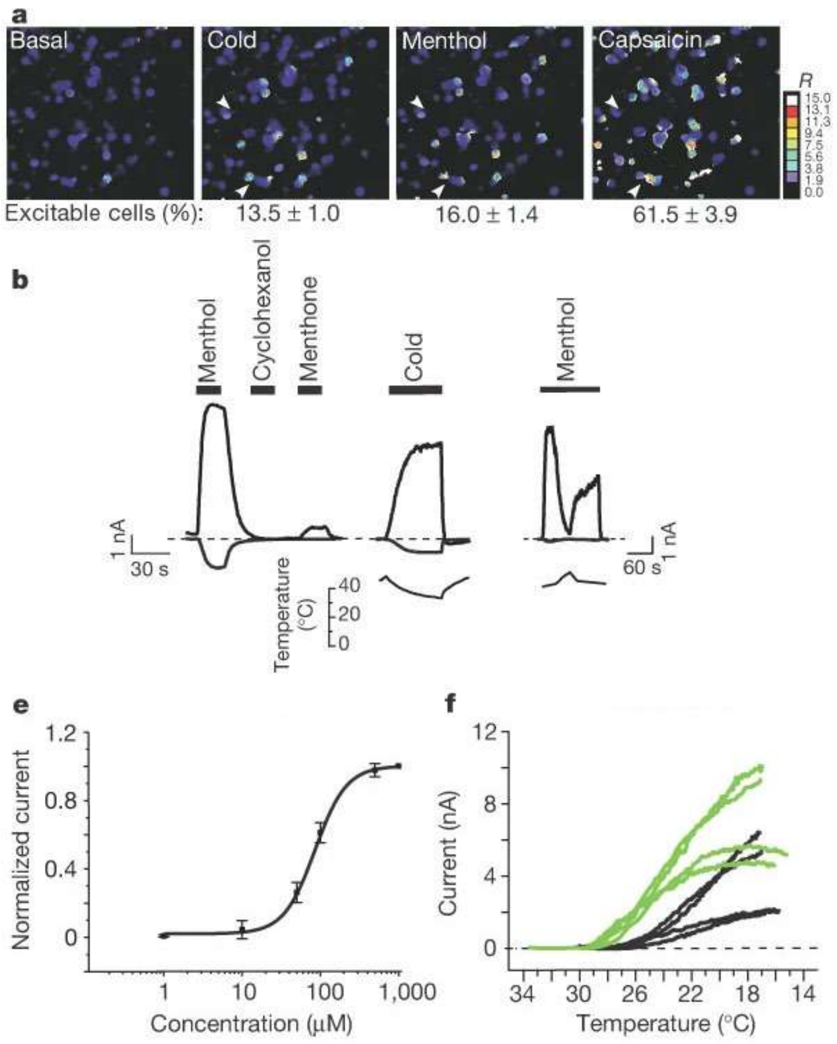
Tominaga M, et al. *J Physiol Sci*. 2025



Chen J, et al. *Nat Commun*. 2013

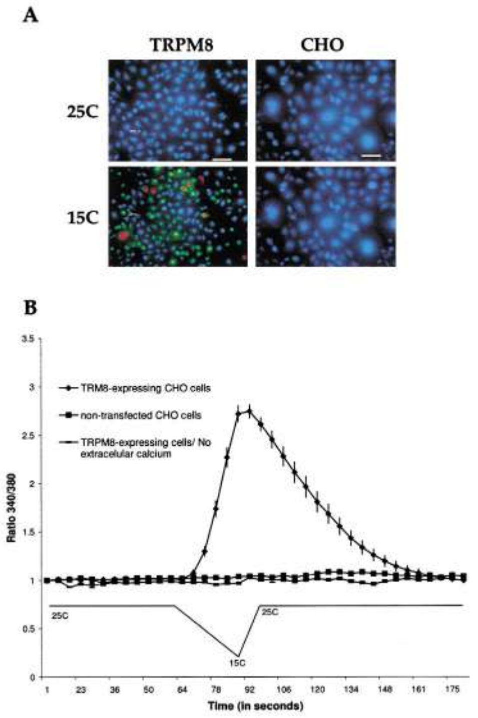
The three brothers of temperature sensors-TRPM8

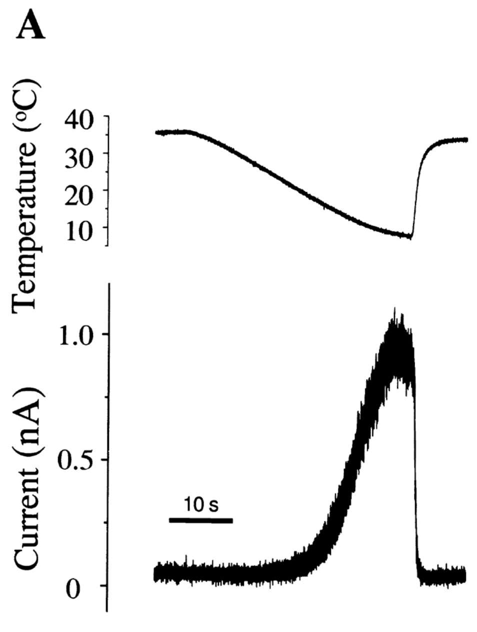
功能表达克隆（用辣椒素找VR1同一套方法）

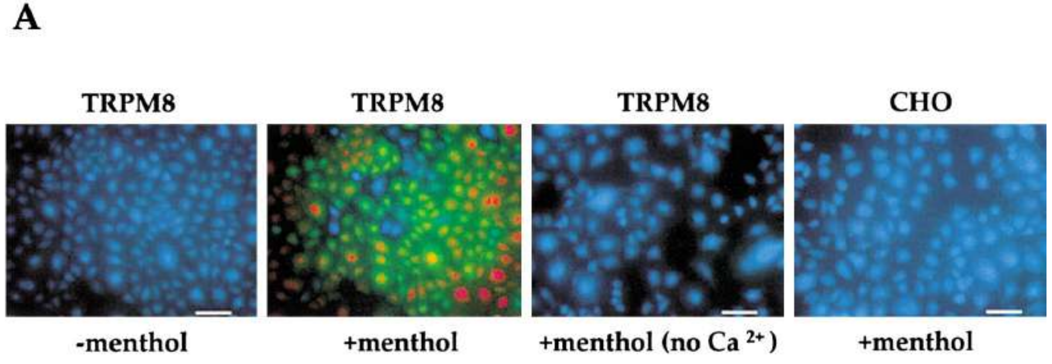


McKemy DD, et al. *Nature*. 2002

生物信息学+同源性筛选







Peier AM, et al. *Cell*. 2002

The three brothers of temperature sensors

TRPV1

激活因素：

热 >43°C
酸 (pH<5.9)
辣椒素

感觉：

热辣，灼烧

进化角色：

检测植物化学防御物质与有害热，引发灼烧痛和热痛觉

TRPA1

激活因素：

冷 <17°C
肉桂醛
异硫氰酸烯丙酯(芥末、辣根、甘蓝)

感觉：

刺激性辛辣、刺痛

进化角色：

检测植物化学防御物质与有害低温，引发冷痛觉

TRPM8

激活因素：

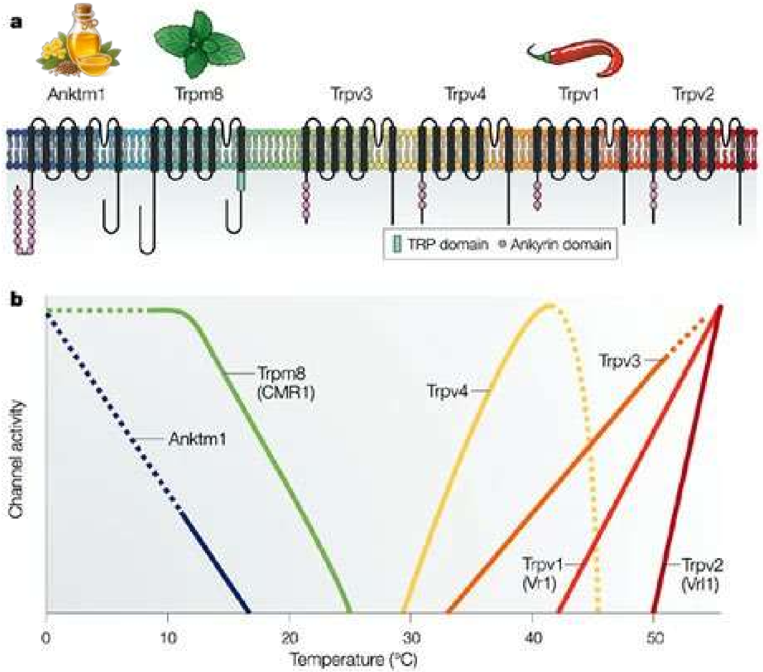
凉 8–28°C
薄荷醇
桉叶油素

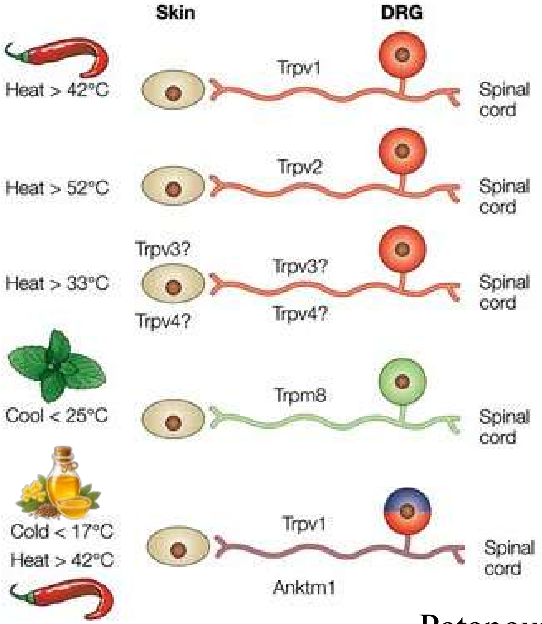
感觉：

清凉感

进化角色：

检测温和冷刺激，产生清凉感，帮助感知环境温度下降





polymodal nociceptors
多模态伤害感受器

Patapoutian A, et al. *Nat Rev Neurosci*. 2003

Summary

- The basic tastes of human are only five: sour, sweet, bitter, salty and umami.
- Capsaicin does not act on any taste receptors on the tongue; instead, it activates the nociceptors TRPV1——Spiciness is not a taste, but a sensation of pain.
- In addition to capsaicin, TRPV1 can also be activated by heat and protons.
- Capsaicinoids, together with capsaicin, determine the ‘spicy’ flavor we perceive.
- Birds don’t feel the spicy because of a mutation in the key site on their TRPV1 receptor that is sensitive to capsaicin.
- TRP channels for thermal sensation——TRPV1, TRPA1 and TRPM8 are activated by different chemicals and temperature ranges, respectively.

Thank you!

Why do spicy foods make you sweat, sniffle, and feel a “High”?

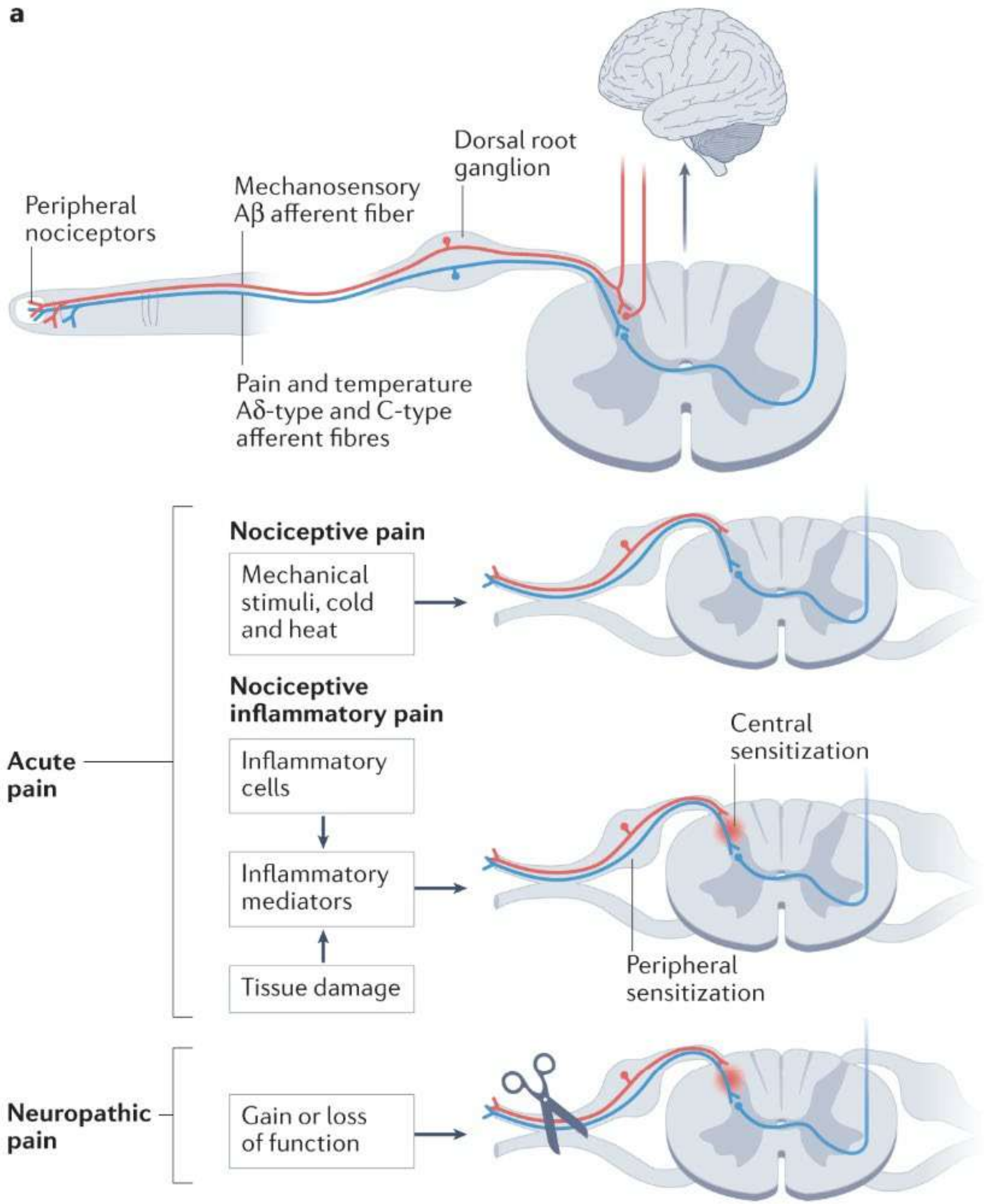
Honglei

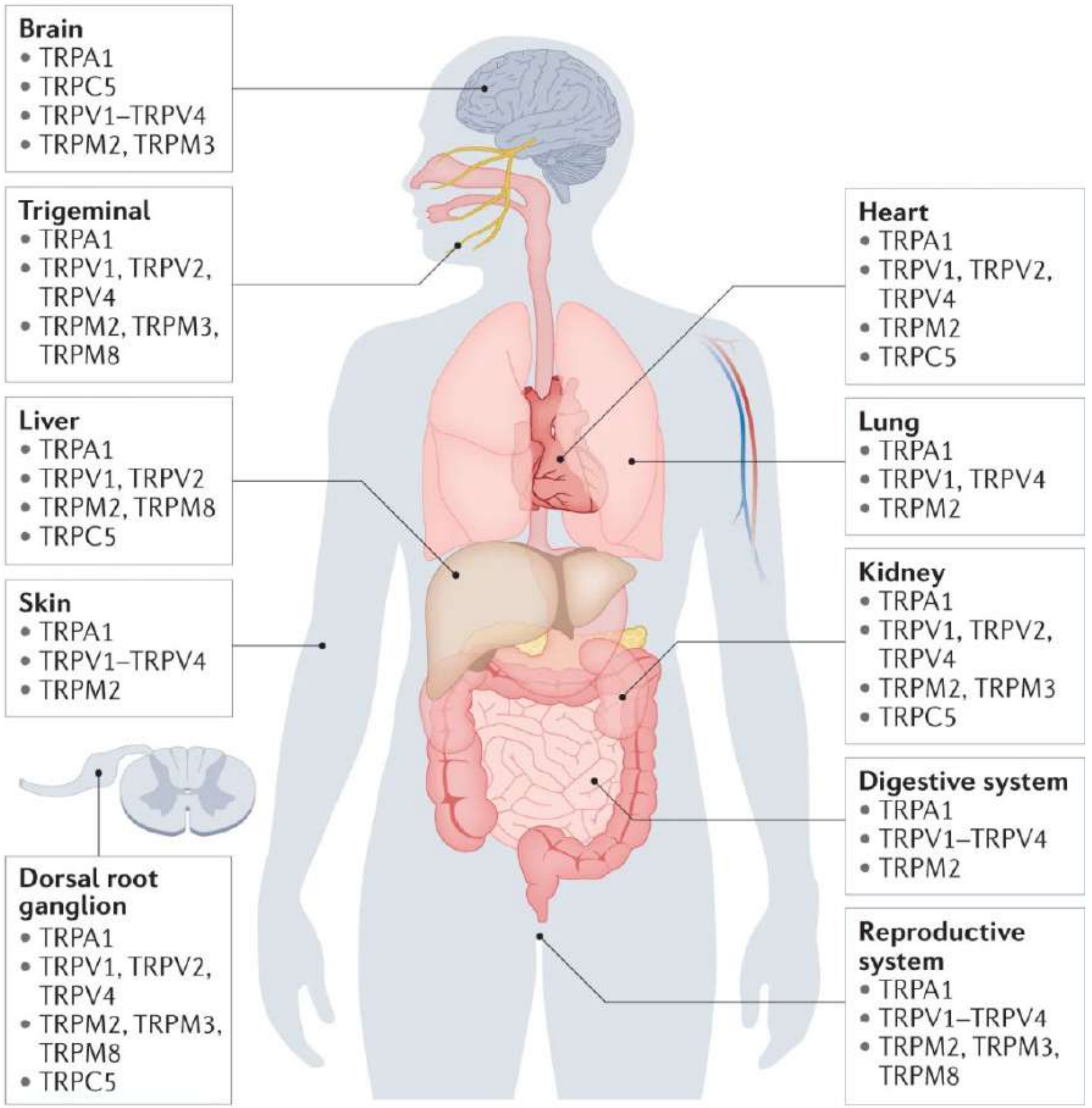
7/24/2026

Contents:

1. Introduction of pain-processing pathways
2. The neural mechanisms of the body's reactions after eating spicy food
3. The mechanism of addiction to spicy food

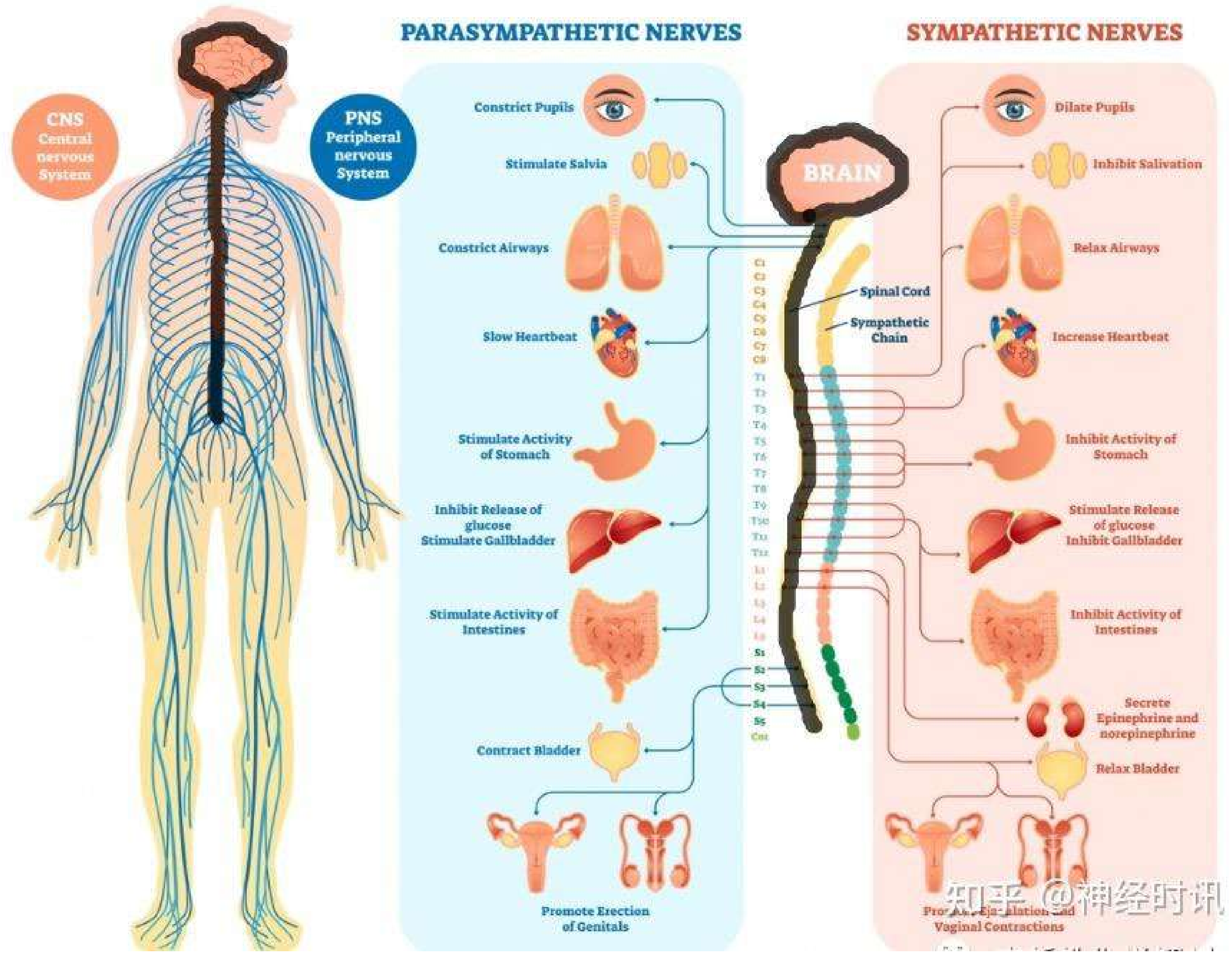
Pain-processing pathways





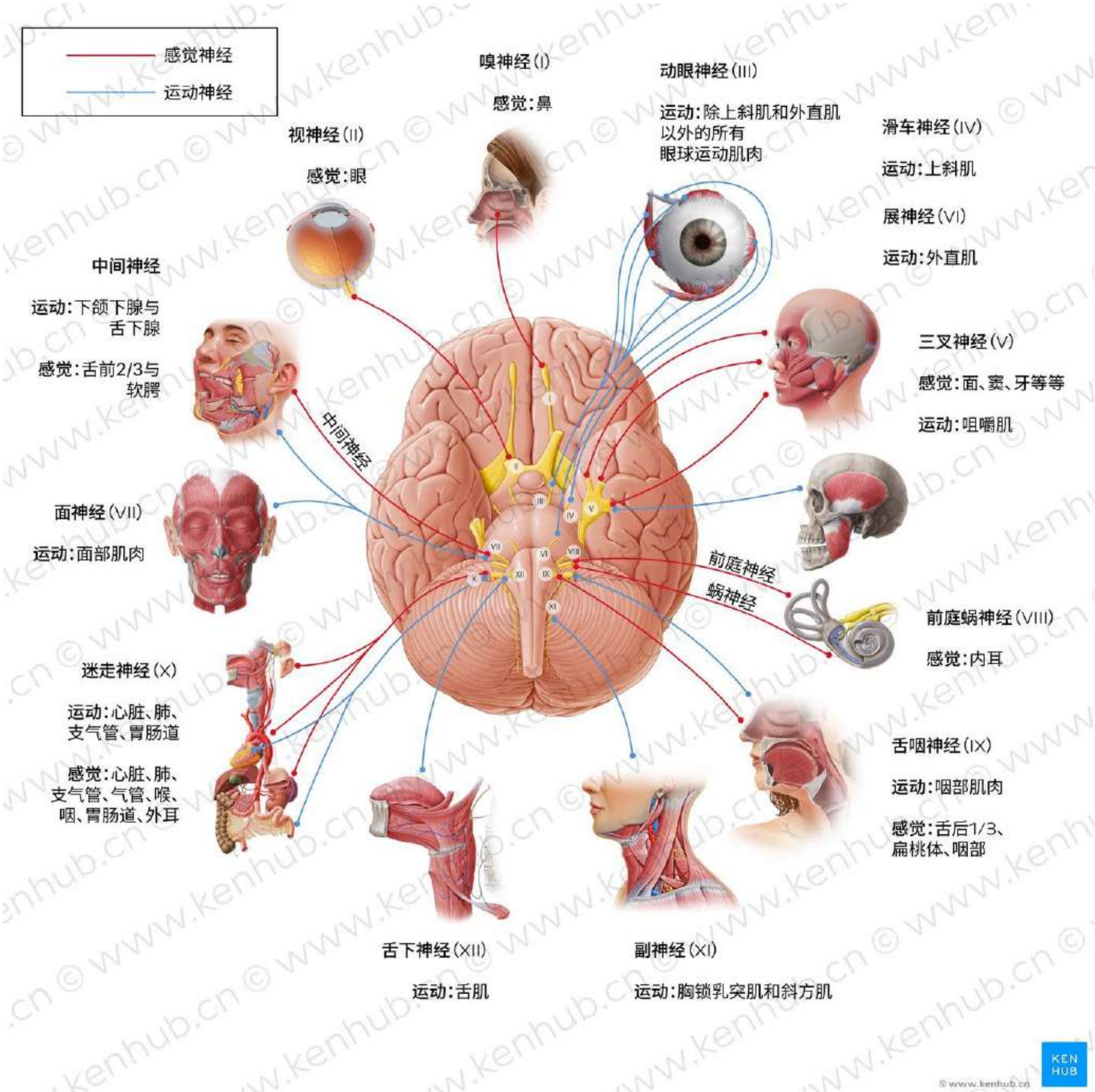
Rosenbaum, T., Morales-Lázaro, S.L. & Islas, L.D., *Nat Rev Neurosci*, 2022

HUMAN NERVOUS SYSTEM



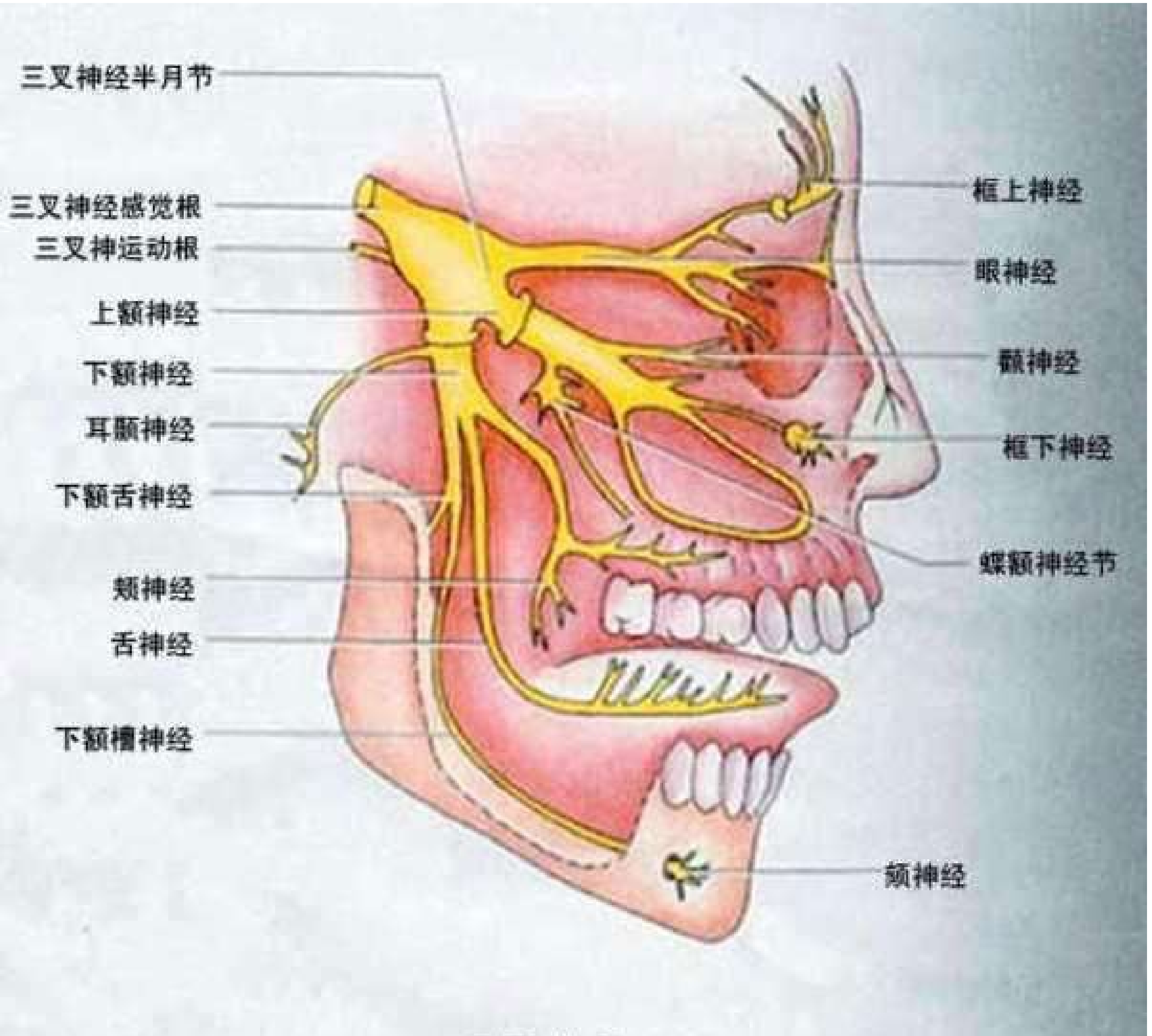
Picture from web

The cranial nerves（颅神经） in the peripheral nervous system



Picture from web

The fifth pair of cranial nerves: the trigeminal nerve

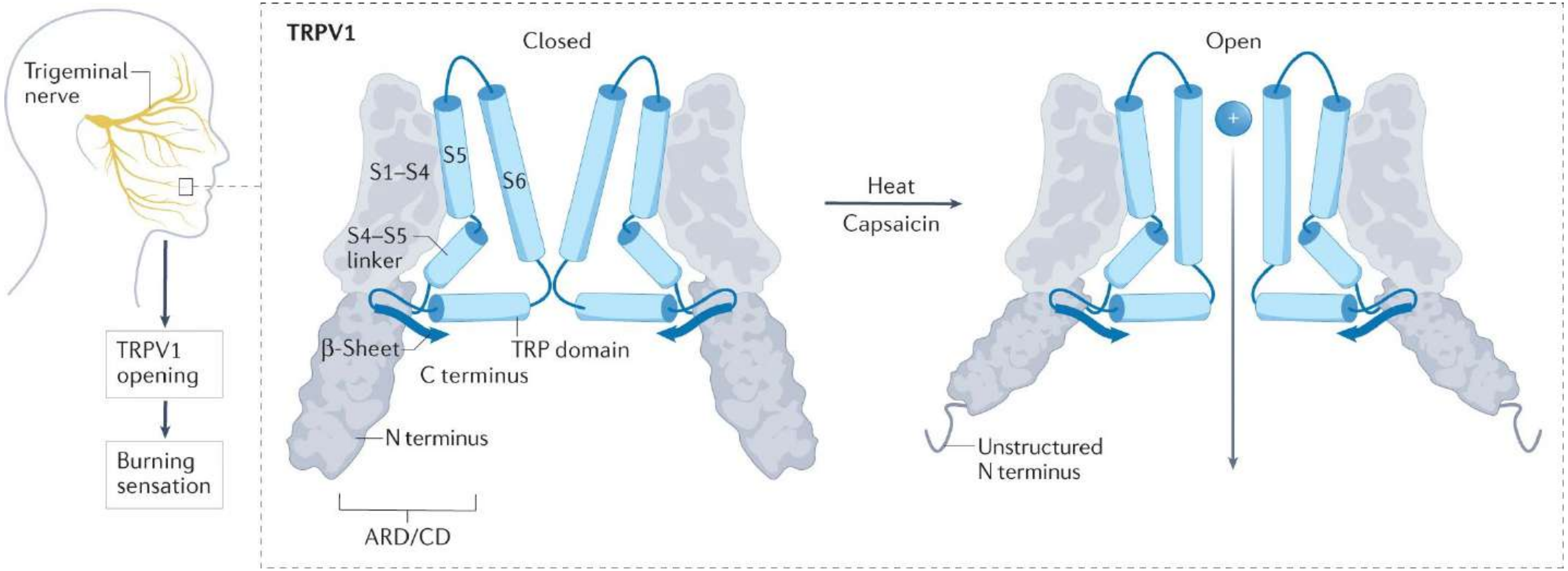


三叉神经

- 三叉神经(n. trigminus)为混合神经，含有感觉和运动两种神经，也是面部最粗大的神经。
- 支配脸部、口腔、鼻腔的感觉和咀嚼肌的运动，并将头部的感觉讯息传送至大脑。
- 三叉神经由眼支（第一支）、上颌支（第二支）和下颌支（第三支）汇合而成，分别支配眼裂以上、眼裂和口裂之间、口裂以下的感觉和咀嚼肌收缩。

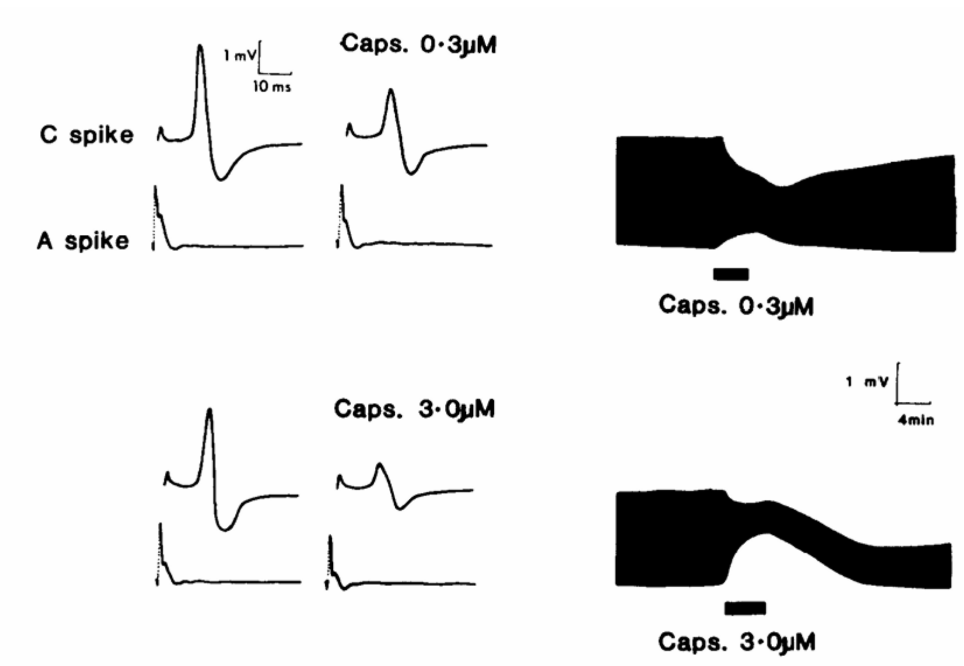
Picture from web

Activation of TRPV1 by heat and capsaicin has been proposed to occur through a two-step model

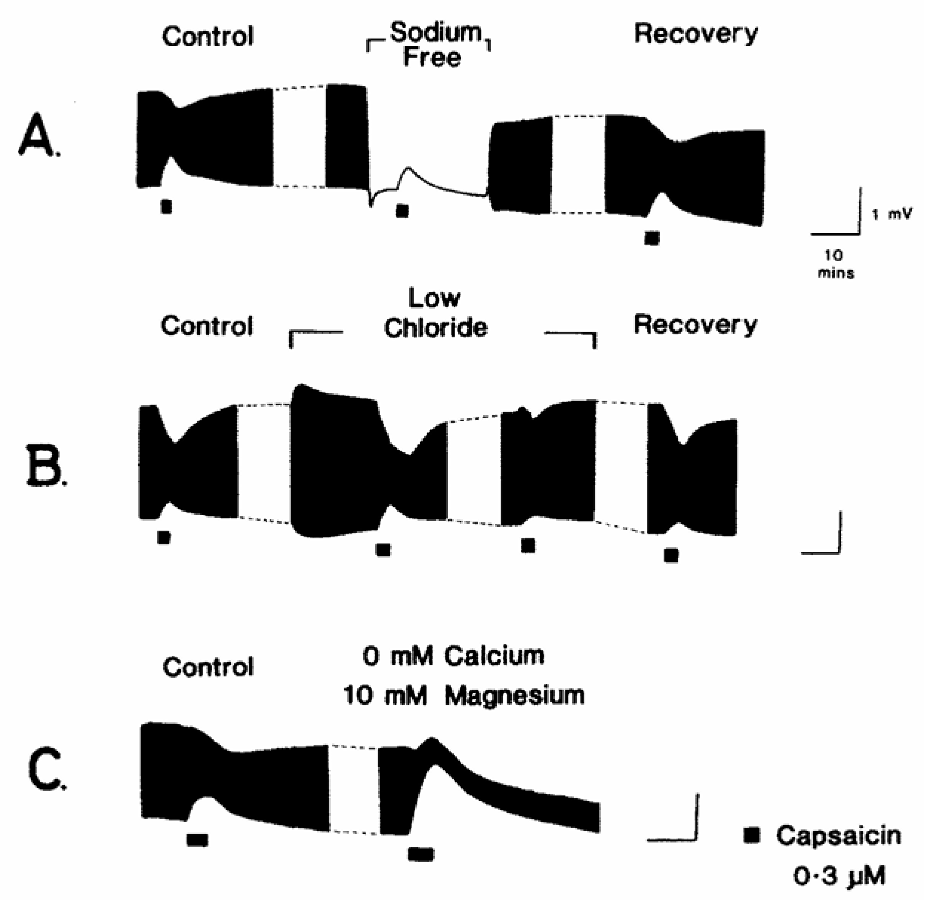


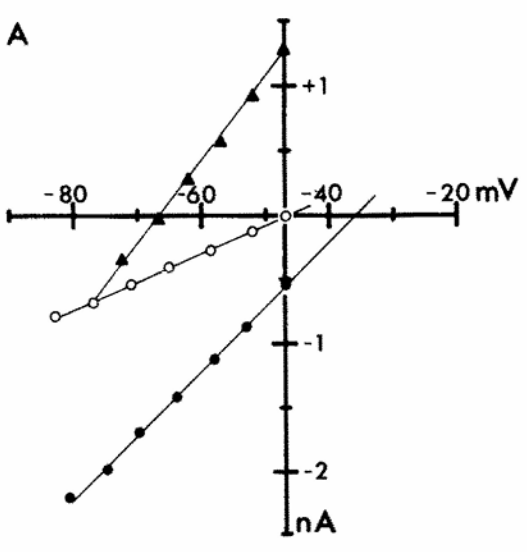
Rosenbaum, T., Morales-Lázaro, S.L. & Islas, L.D., *Nat Rev Neurosci,* 2022

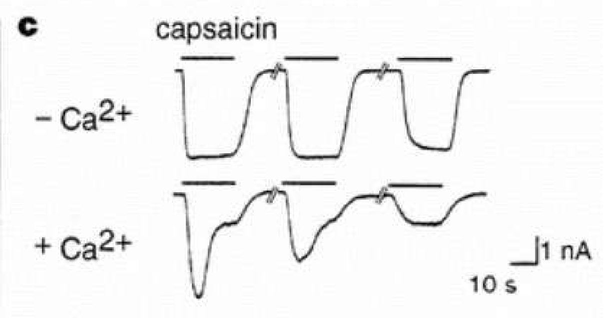
Capsaicin activates C-type unmyelinated fibres



Capsaicin activates neurons in low dose.







The response of neurons to capsaicin is influenced by the concentrations of extracellular Ca^{2+}

S.J. Marsh, and *et al., Neuroscience*, 1987

Caterina, M., and et al., *Nature*, 1997

Capsaicin activates neurons, leading to the release of bioactive substances

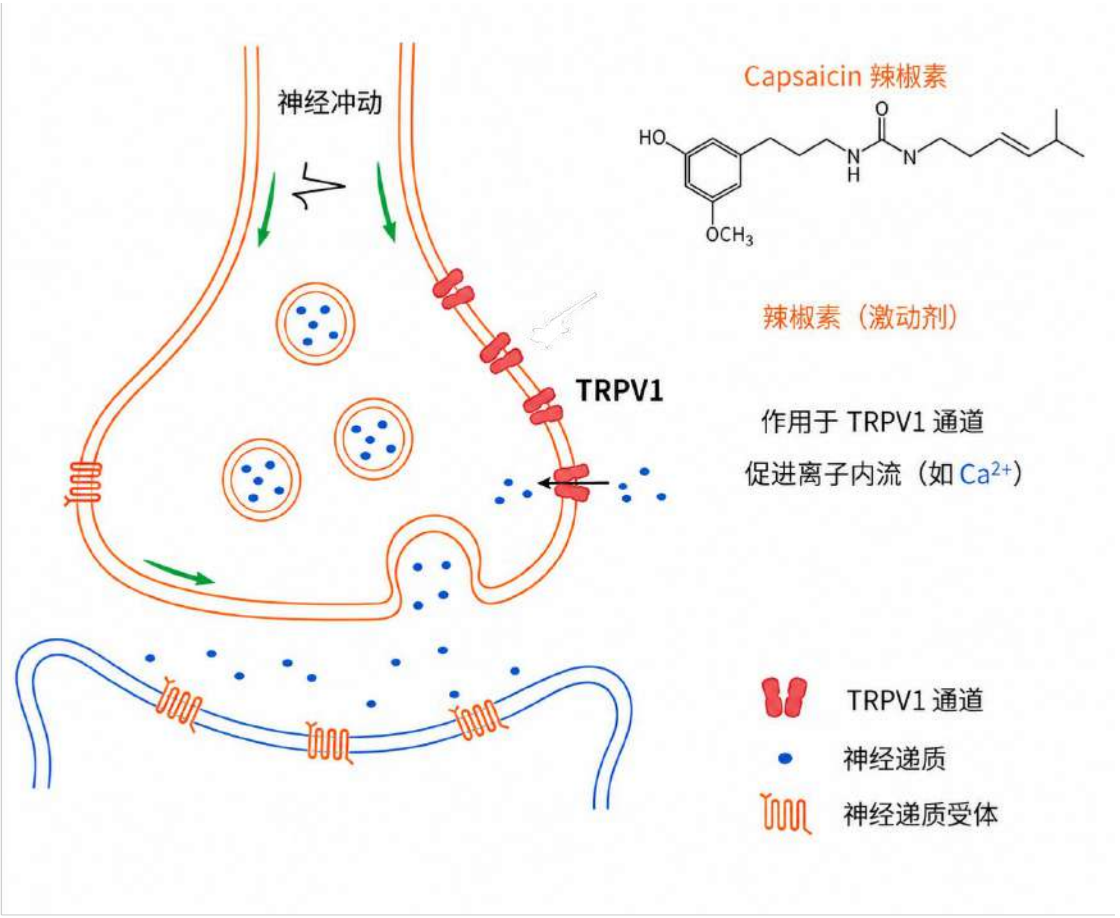


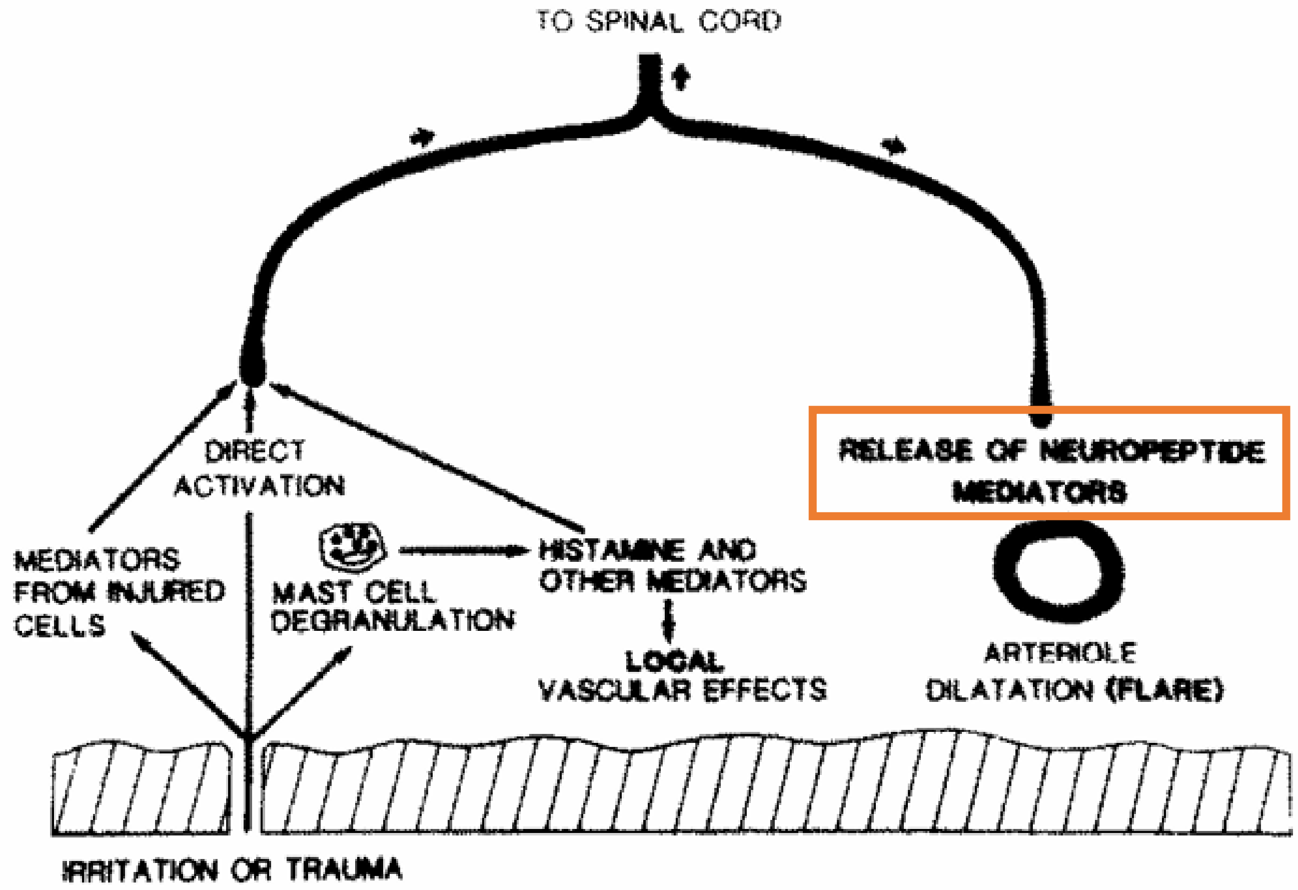
Table 2. Demonstration of a release of putative mediators from peripheral terminals of presumably primary afferent neurons

Tissue	Type of stimulation	Mediators
Rat skin, blister fluid	antidromic nerve stimulation	SP-IR[396,397]
	thermal noxious stimulation	SP-IR[128]
Human skin, blister fluid	inflammatory skin disease	SP-IR[392], vasoactive intestinal polypeptide-IR[392]
Human joint fluid	rheumatic inflammatory disease	TK-IR[68]
Canine skin, lymph	scalding injury	SP-IR[176]
Rabbit ear, vascular perfusion	antidromic nerve stimulation	adenosine triphosphate[140]
Rabbit eye, aqueous humour	antidromic nerve stimulation	SP-IR[23], CGRP-IR[389]
	intracameral administration of capsaicin or hypertonic KCl or NaCl	SP-IR[263]
Feline tooth pulp	antidromic nerve stimulation	SP-IR[31,110,295]
Guinea-pig cerebral blood vessels *in vitro*	depolarization	SP-IR[79]
Bovine cerebral blood vessels *in vitro*	capsaicin or depolarization	SP-IR[264,279]
Guinea-pig heart *in vitro*	capsaicin	SP-IR,[152] NKA-IR,[92] CGRP-IR[92]
Guinea-pig lungs *in vitro*	capsaicin	SP-IR,[340] NKA-IR,[340] CGRP-IR[264]
	bradykinin, histamine, nicotine or vagal nerve stimulation	SP-IR,[339] NKA-IR,[339] eledoisin-like IR[339]
Guinea-pig bronchi *in vitro*	capsaicin or nicotine	SP-IR[191]
Guinea-pig ureter *in vitro*	capsaicin or depolarization	SP-IR,[157,335] NKA-IR[157]
Guinea-pig small intestine *in vitro*	capsaicin	SP-IR[69]
Guinea-pig prevertebral sympathetic ganglia *in vitro*	capsaicin or depolarization	SP-IR[107,198,377]

CGRP, calcitonin gene-related peptide（降钙素基因相关肽）;
IR: immunoreactivity;
NKA, neurokinin A（神经激肽A）;
SP, substance P;
TK, tachykinin（速激肽）.

P. Holzer, *Neuroscience*, 1988

Capsaicin causes vasodilation（血管舒张）.



A peripheral branch of a sensory neuron is activated by a noxious stimulus.

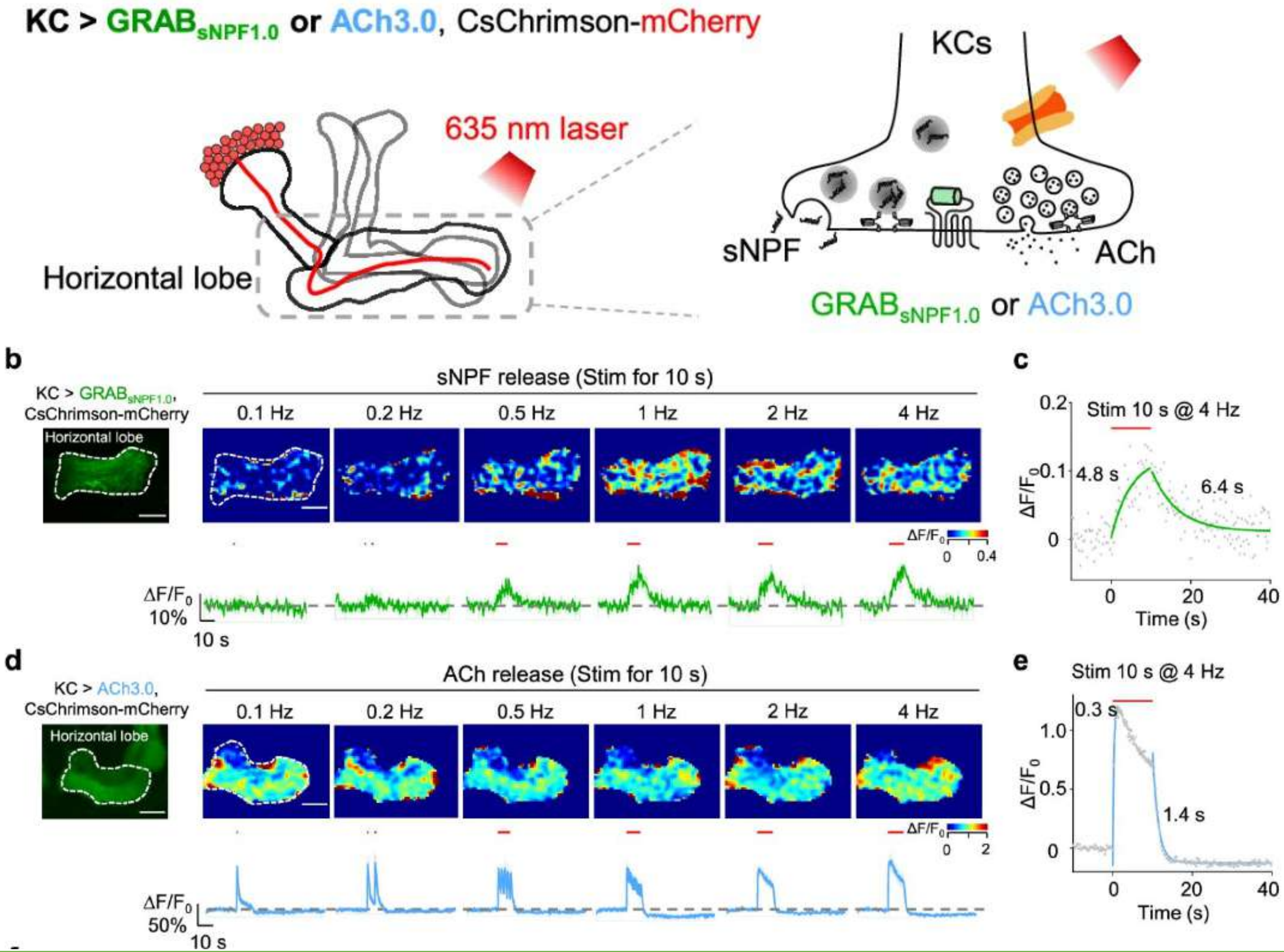
Neuropeptide mediators:

CGRP, calcitonin gene-related peptide（降钙素基因相关肽）;
NKA, neurokinin A（神经激肽A）;
SP, substance P;
TK, tachykinin（速激肽）.

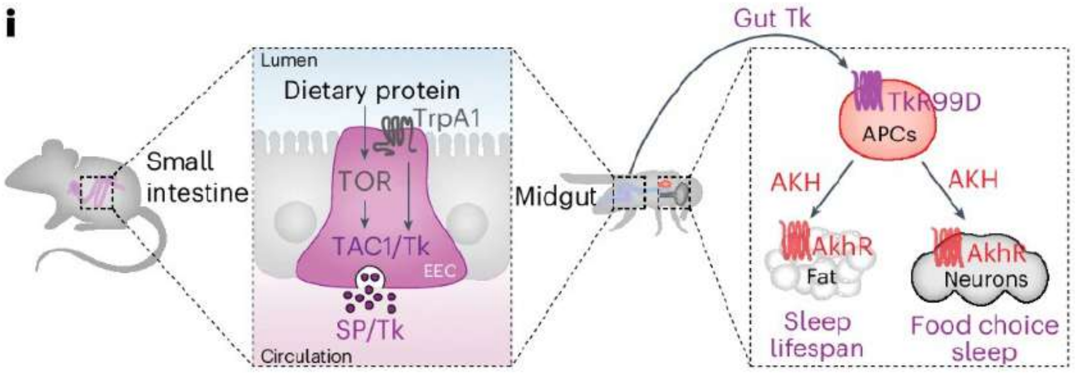
C-terminal of tachykinin family:
-Phe-Xaa-Gly-Leu-Met-NH2 (-FXGLM-NH2)
X, alternative amino acids

P. Holzer, *Neuroscience*, 1988
U.S. Von Euler, J.H. Gaddum, *J. Physiol. (Lond.)*, 1931
Jacek J. Preibisz, *American Journal of Hypertension*,1993

Differences in the dynamics and molecular regulation between neuropeptide and neurotransmitter release



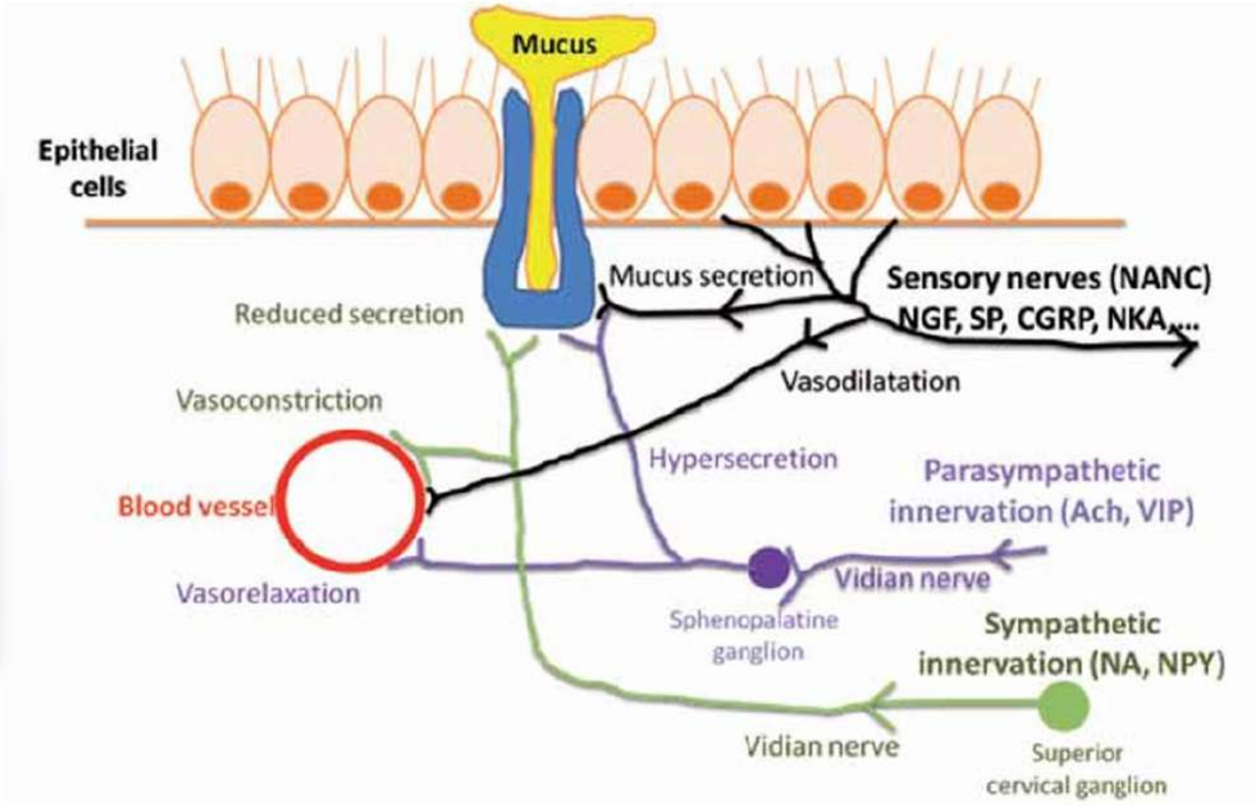
Tachykinin directs food choice and impacts lifespan



	Stimulation intensity	Kinetics	Plasticity
The release of **Neuropeptide**	high	slower	Long-term
The release of **neurotransmitter**	low	faster	Short-term

Xia, X., Li, Y. , *Nat Commun,* 2025
Ahrentløv N, and *et al., Nat Metab.* 2025

Why do you have a runny nose when eating spicy food?

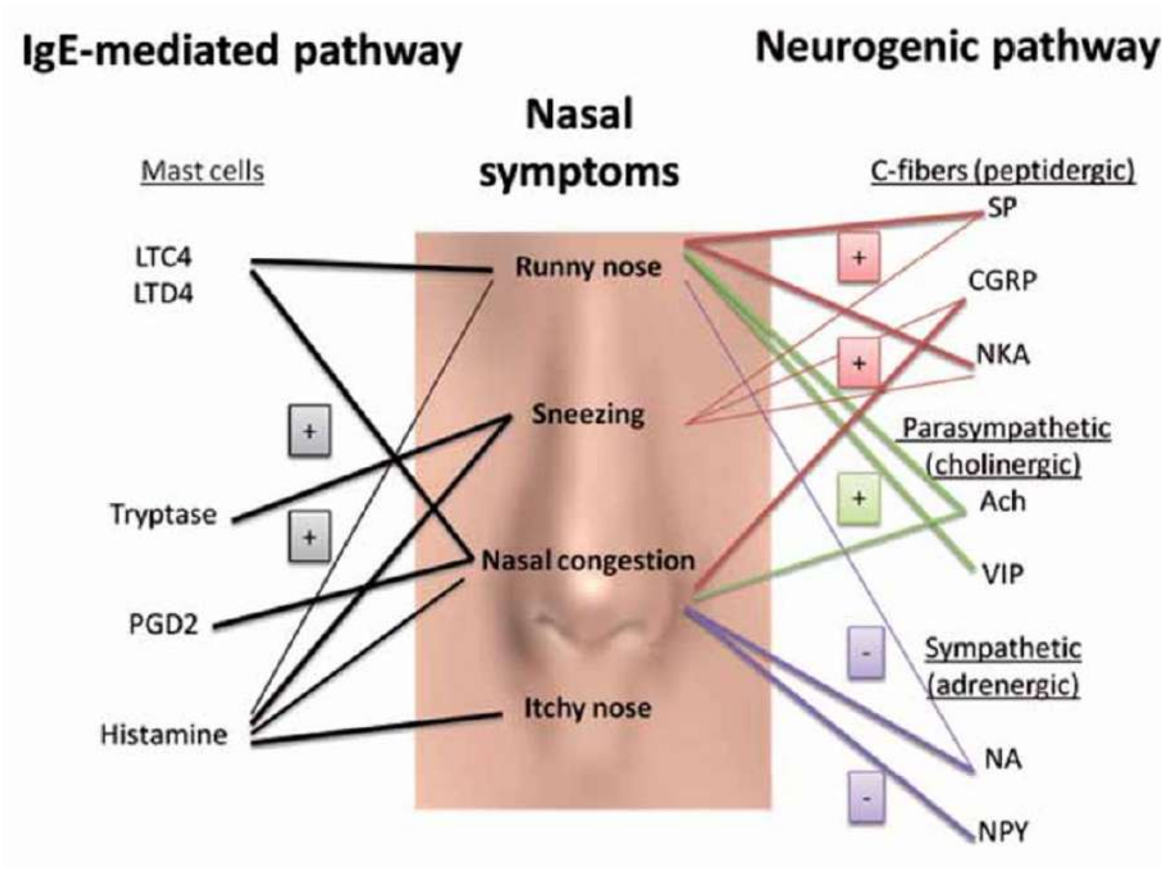


The nerve distribution of the nasal mucosa（鼻黏膜）

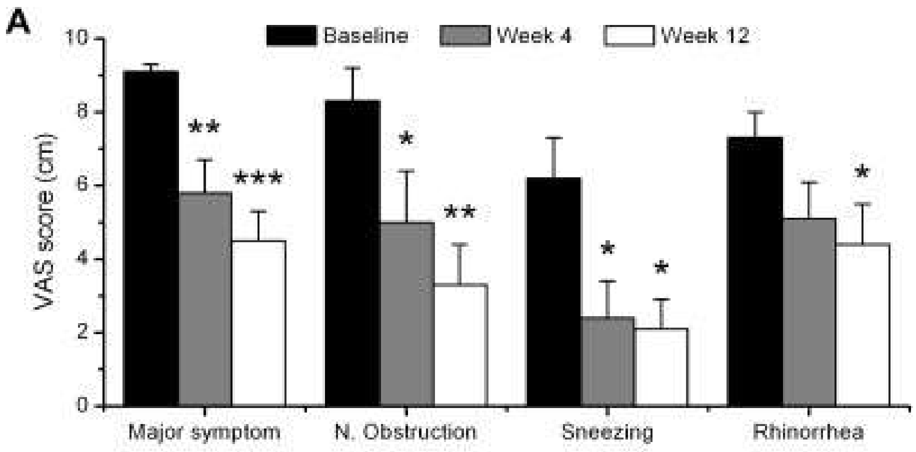
L. Van Gerven, G. Boeckxstaens, P. Hellings, *Rhinology,* 2012

Fokkens W, Hellings P, Segboer C., *Curr Allergy Asthma Rep*. 2016

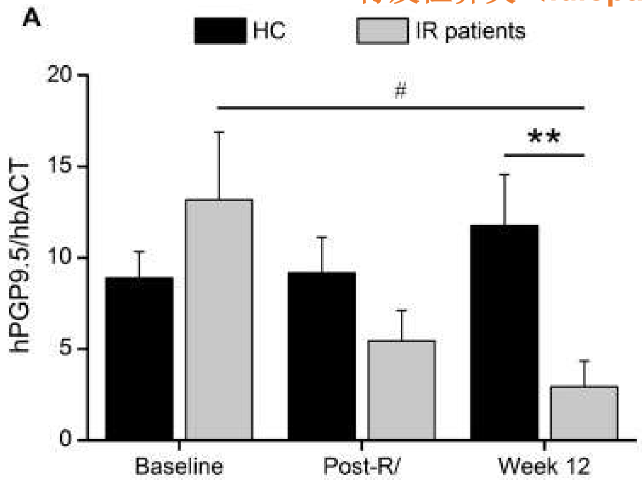
The mechanism of capsaicin sensitization in the nasal cavity

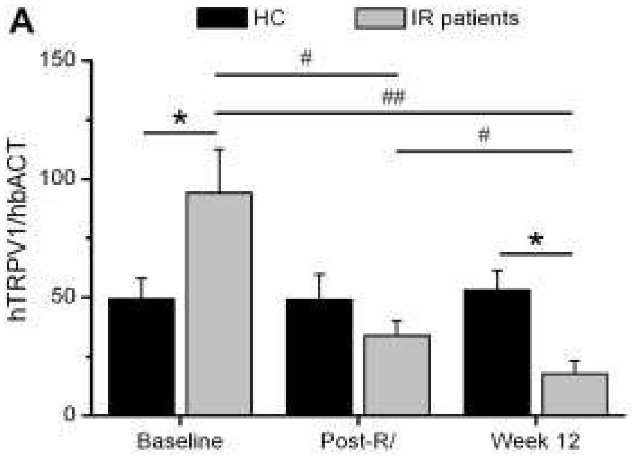


The signaling pathways involved in nasal reactions



特发性鼻炎（idiopathic rhinitis，IR）





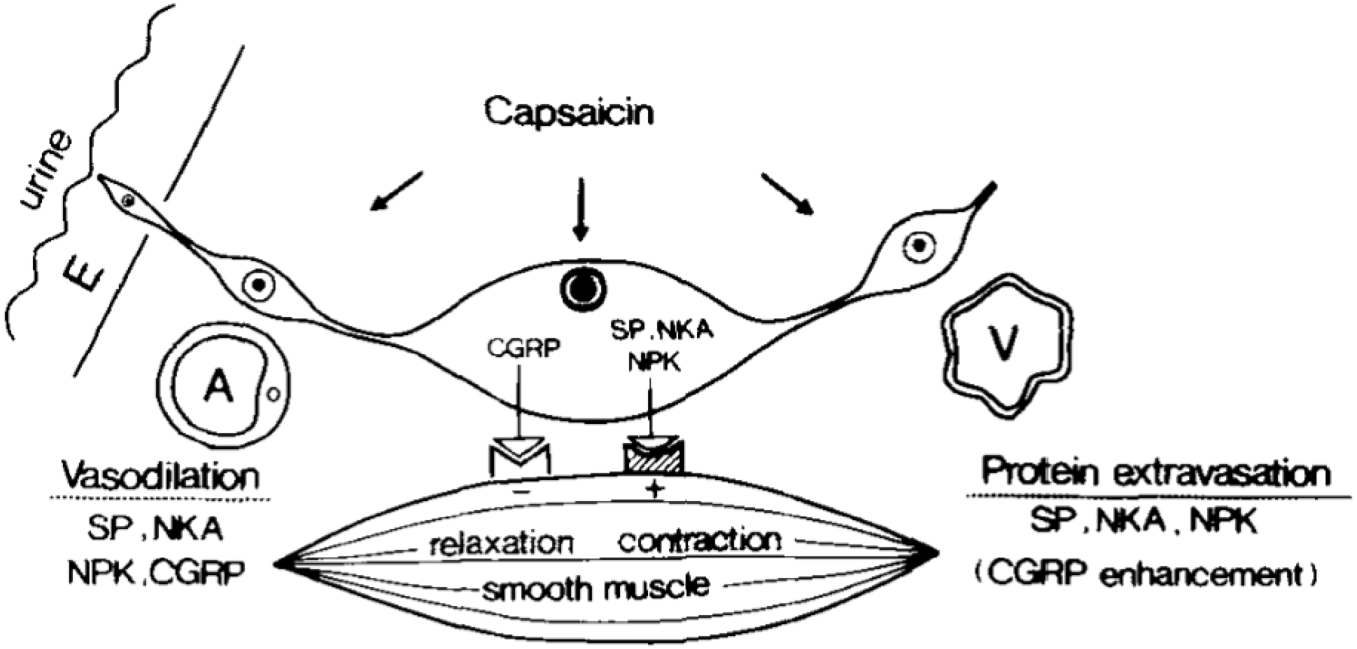
PGP 9.5, pan-neuronal marker
hbACT, human β-actin

L. Van Gerven, G. Boeckxstaens, P. Hellings, *Rhinology*, 2012

Laura Van Gerven, and et al., *Journal of Allergy and Clinical Immunology*, 2014

Fokkens W, Hellings P, Segboer C., *Curr Allergy Asthma Rep*. 2016

The diuretic（利尿的） effect of capsaicin shows a dose-dependent effect



Rosenbaum, T., Morales-Lázaro, S.L. & Islas, L.D., *Nat Rev Neurosci,* 2022

HUA, X.-.Y. and LUNDBERG, J.M., *Acta Physiologica Scandinavica*, 1986

Donna H Wang, *Acta Pharmacologica Sinica*, 2005

Why do some people get addicted to spicy food？

Paul Rozin

Professor

rozin@psych.upenn.edu
215-898-7632

Solomon Labs
3720 Walnut St, Room D17

WEBSITE ›

Research Interests

Psychopathology and Psychotherapy
Developmental Psychology
Evolutionary Psychology
Individual Differences and Behavior Genetics
Positive Psychology
Social and Cultural Psychology
Specific Research Areas

Cultural psychology, with a focus on understanding the role of food in human life, positive psychology, the meaning of "natural" and positive and negative memories

Research Synopsis

Cultural Psychology, with a focus on understanding the role of food in human life positive psychology the meaning of "natural" and positive and negative memories. Work on food includes comparative studies of food attitudes and the function of pleasure in a number of cultures, including the USA, France, India and Japan; the role of relatively subtle environmental factors (such as portion size) on food intake; the meaning and reason for preference for natural things, in a cultural context, ambivalence to foods, especially meat and chocolate; attitudes and beliefs about the relationship between diet and health; the psychology of water; and the acquisition of likes and dislikes for foods. Work on positive psychology includes the relation between memories of valenced experiences and the actual experiences, and the distinction between comforts and joys, in a cultural context with comparisons of France and the USA. Behind all of this is a general interest in cultural evolution.

https://psychology.sas.upenn.edu/people/paul-rozin

Interviews, observations, and measurements were carried out in both Mexico and the United States.

Four children eating lunch in a home in the village studied.

Table II. Chili Thresholds, Preference, and Tolerance in American Subjects as a Function of Chili Liking[a]

Measure	Chili likers			Chili neutral or dislikers		
	N	$\overline{X}$	s	N	$\overline{X}$	s
Threshold (clean)	27	8.04	1.48	9	7.44	.73
Threshold (all)	38	7.55	1.69	16	7.31	.95
Preference	38	11.26	2.16	16	7.31[c]	1.20
Tolerance	38	13.34	2.04	16	10.31[c]	1.49
Tolerance minus preference	38	2.08	1.41	16	3.00[b]	1.51
Tolerance minus threshold	38	5.79	2.44	16	3.00[c]	1.93

[a] All values are expressed as $\log_2$.
[b] $p < .025$, likers vs. neutral-dislikers, t test, one-tailed.
[c] $p < .001$.

Rozin, P., Schiller, D. , *Motiv Emot,* 1980

The formation of chili preference is the result of the combined effect of multiple factors

1. **Enhanced taste quality of ingested foods**

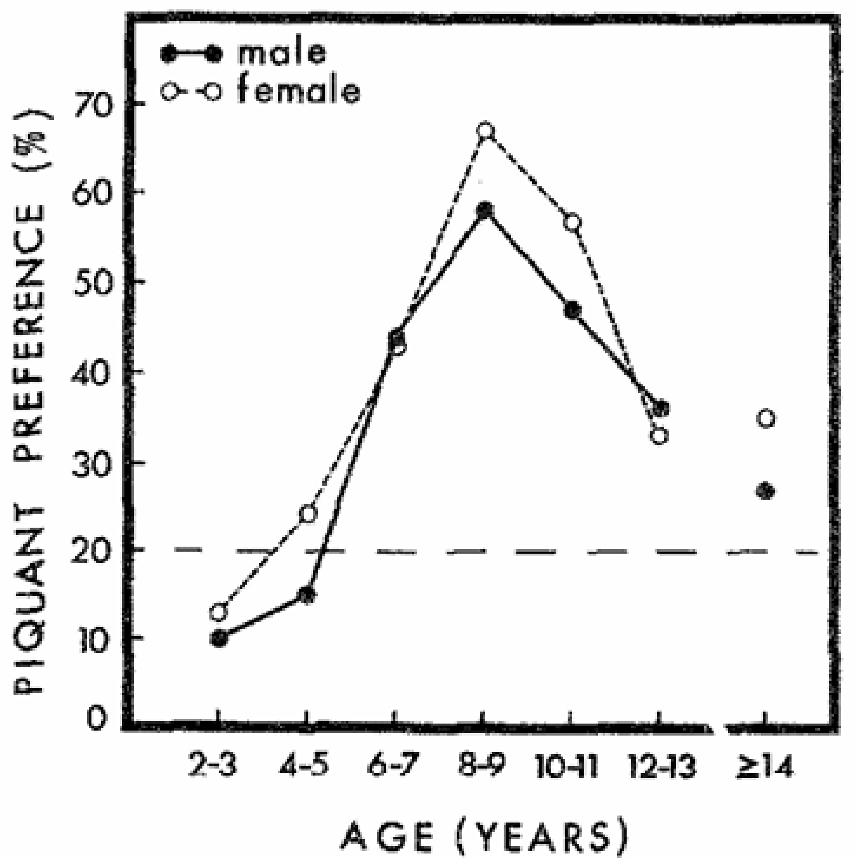


Table III. Relations among Threshold, Preference, and Tolerance for Mexican and American Subjects

Measure	Mexicans N	Mexicans r	Americans N	Americans r
Corn snacks				
Threshold vs. preference	24	+.39[b]	36	+.29[b]
Threshold vs. tolerance	24	+.36[b]	36	+.20[b]
Preference vs. tolerance	24	+.89[d]	54	+.83[d]
Liquid capsaicin and snacks[a]				
Threshold vs. preference			47	+.32[c]
Threshold vs. tolerance			47	+.23
Tortilla chips				
Threshold vs. preference	18	+.37		
Threshold vs. tolerance	18	+.35		
Preference vs. tolerance	18	+.88[d]		

[a] Liquid capsaicin thresholds from Rozin, Mark, and Schiller (1980).
[b] $p < .05$, one-tailed.
[c] $p < .025$.
[d] $p < .001$.

Rozin, P., Schiller, D. , *Motiv Emot,* 1980

2. Mere exposure （重复接触）

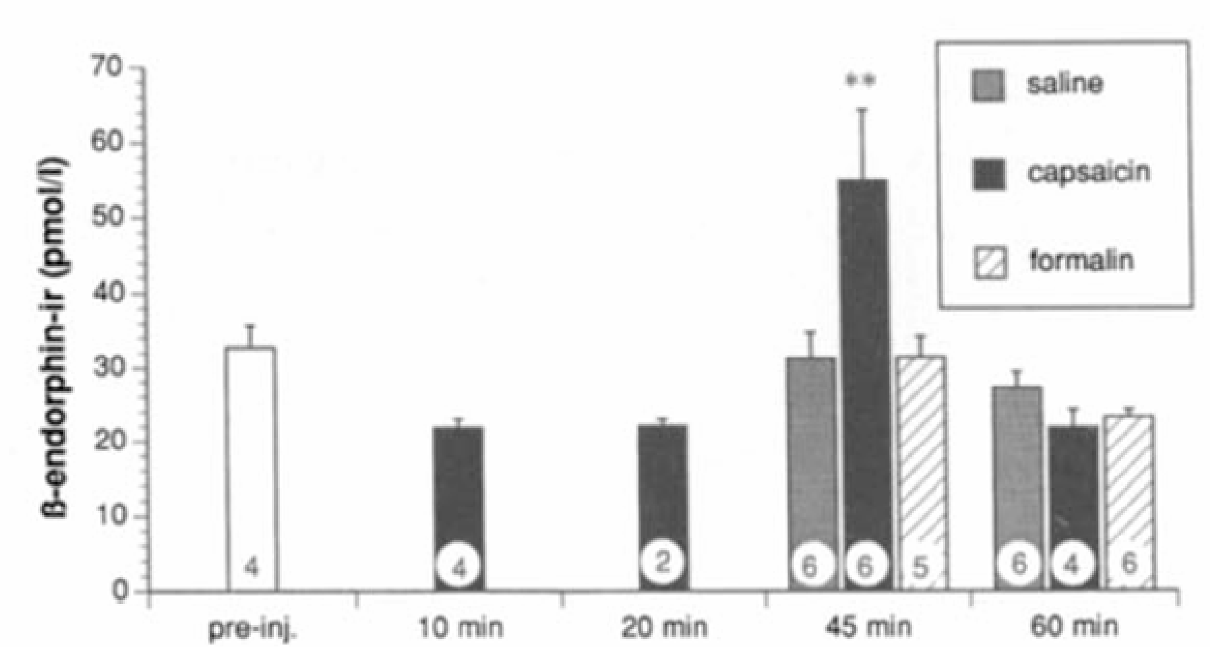
Table IV. Responses to Specific Items as Candidates that Might Explain Liking for Chili Pepper in both Mexican and American Populations

Question	Percent affirmative responses: Americans (N = 39)	Percent affirmative responses: Mexicans (N = 13)
I'm used to it.	36	100[a]
It tastes good.	95	100
I like the burning or tingling feeling.	79	85
It makes it easier to chew food.	5	77
It stimulates my appetite.	15	85
It fills me up.	3	69
It wakes me up.	15	46
It puts me to sleep.	0	0
It makes me feel warm inside.	46	69
It cools me off.	3	15
It makes me feel high.[b]	0	–[b]
I feel good after I've eaten it.	44	92[a]
It is good for me.	5	69
It keeps me from getting sick.	3	15
It kills the microbes (bad things) in the food.	3	69
It makes me think clearly.	5	50
It makes me strong.	3	92
I don't want to appear weak.	0	50[a]
Food tastes too bland without it.	41	100

[a] Only 12 subjects responded.
[b] Experimenter could not adequately translate this item.

Emotional Desensitization

3. Endorphins（内啡肽） mediates the process



The acute activation of C nerve fibers by capsaicin can cause the release of β -endorphins into cerebrospinal fluid.

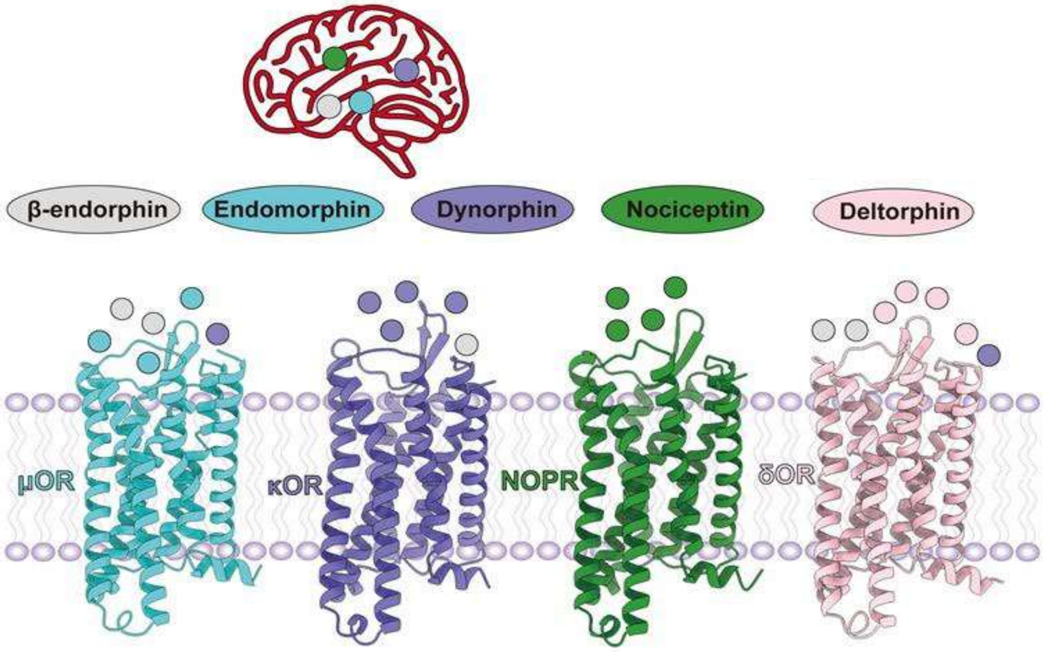
Rozin, P., Schiller, D. , *Motiv Emot,* 1980

Flemming W. Bach, and *et al., Regulatory Peptides*, 1995

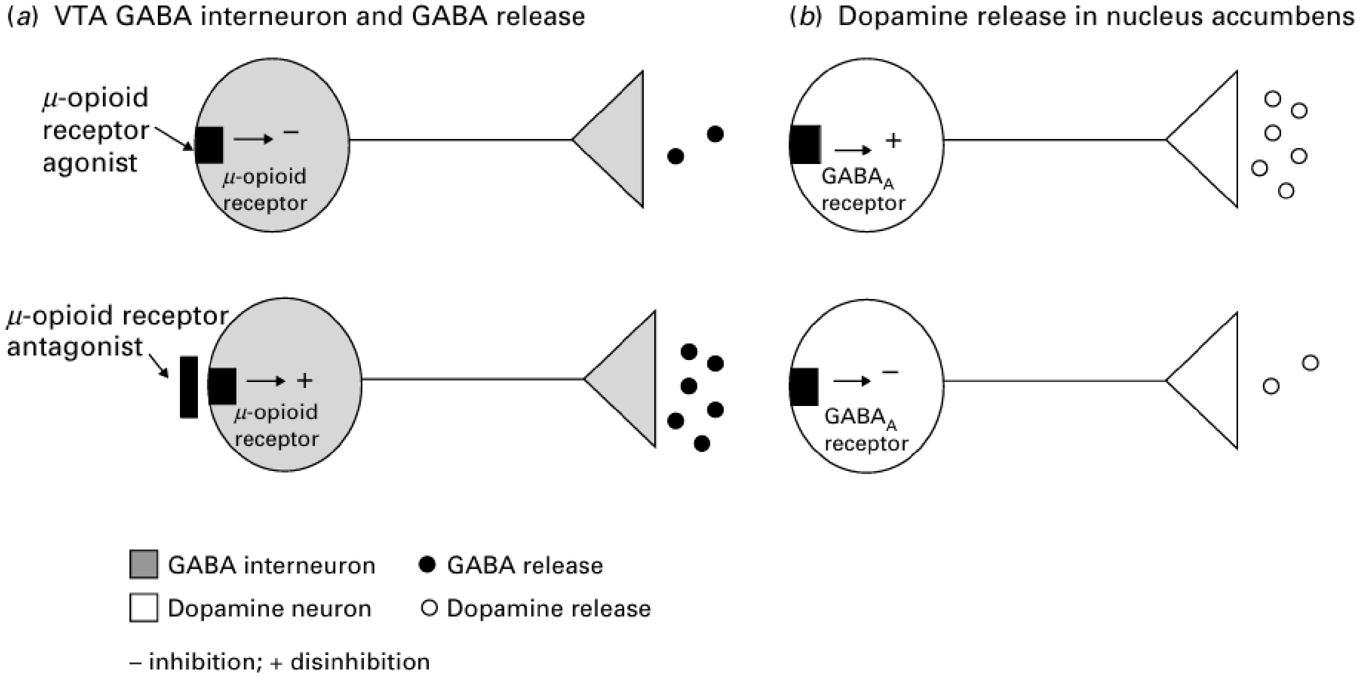
The mechanism by which endorphins mediate addiction

The distribution of μ-opioid receptors:

- the nucleus accumbens(伏隔核)
- the arcuate nucleus , ARC (弓状核)
- The lateral hypothalamus , LH（外侧下丘脑）



Structures of human opioid (阿片) receptor family



Wang Yue, and et al., Cell, 2022

Kalivas PW., *Brain Research Reviews*, 1993

Mathon DS, and *et al., European Journal of Neuroscience*, 2005

Mathon DS, and *et al., Neuroscience*, 2005

Pradeep J. Nathan, Edward T. Bullmore, *International Journal of Neuropsychopharmacology*, 2009

4. Benignly masochistic（良性自虐）

Hot bath

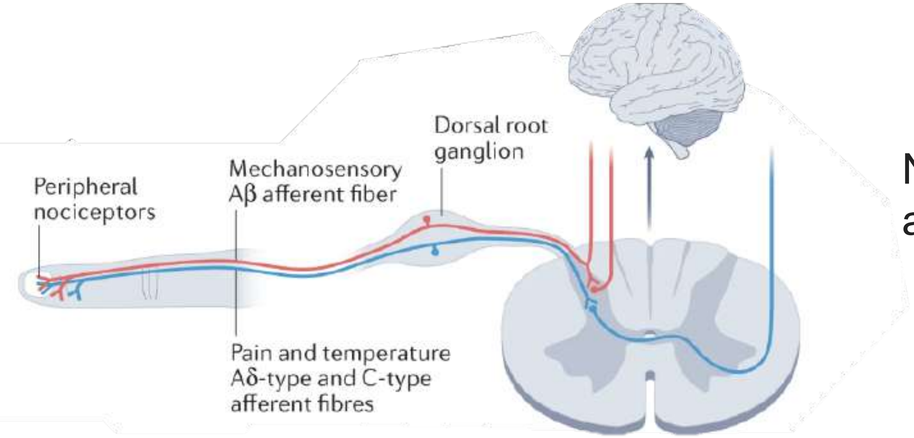
Roller coaster

Horror movie

Experiencing the thrill brought by danger in a safe situation.

Rozin, P., Schiller, D., *Motiv Emot,* 1980

Summary



Nociceptive pain arises from activation of Aδ myelinated nociceptors (sharp pain) and activation of C-type unmyelinated fibers (aching and dull pain).

→ TRPV1 activation → C-type fibers of trigeminal nerve activation → A release of neuropeptide mediators → Stimulation of effector

Calcium influx

CGRP
tachykinin family

vasodilation
nasal reactions
muscle contraction

Chili preference is the result of the combined effect of multiple factors involved physiological and psychological aspects.

- Taste quality and endorphins
- emotional desensitization and benignly masochistic

Thank you!

一个有趣的问题

同样一碗麻辣火锅，为什么有人面不改色，有人泪流满面？

淡定吃辣党：面不改色心不跳，直呼不够辣！

辣到投降党：涕泗横流满头汗，猛灌冰水也难救！

淡定吃辣党


点关注
不迷路
LOADING
兄弟团味觉新体验
尝尽酸甜苦辣咸
要挑到那个最辣的

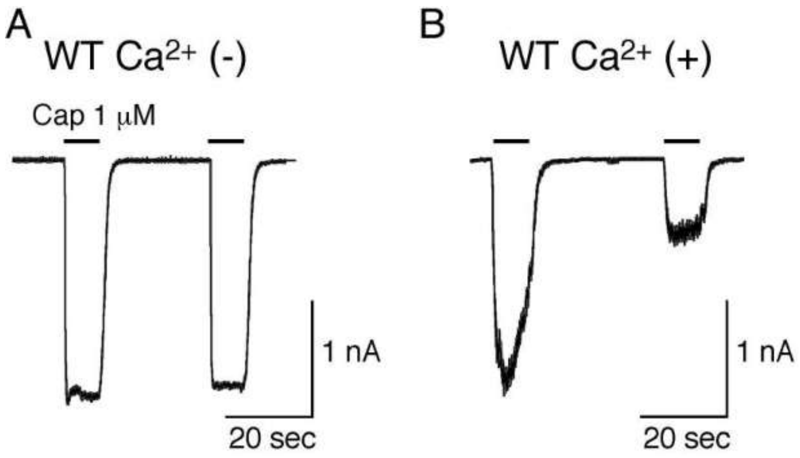
辣到投降党

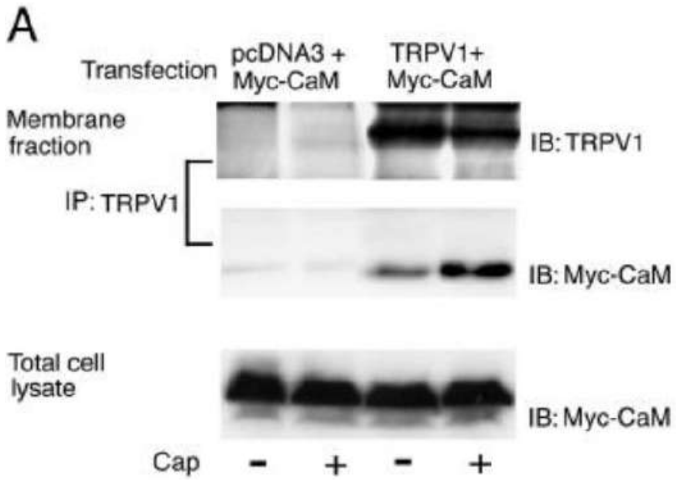

点关注
不迷路
LOADING
犹豫
犹豫
辣度2
兄弟团味觉新体验
尝尽酸甜苦辣咸

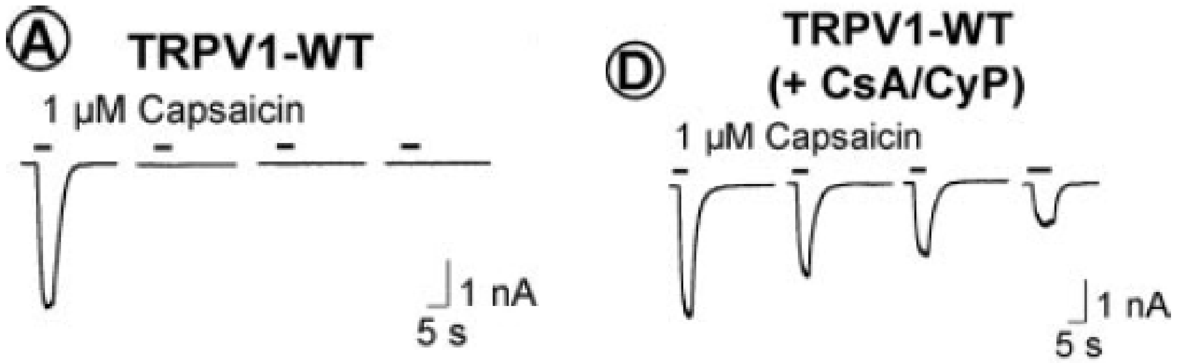

Why can some people eat spicy food but others can't?
Is it intate or can it be trained?
Why do Sichuan people love spicy food while Cantonese don't?
What's the best drink to relieve spiciness?
Why does spiciness seem to fade as eating a meal?
Is eating spicy food good or bad for health?
What are the medical applications of capsaicin?

Why are some people particularly able to tolerate spicy food?

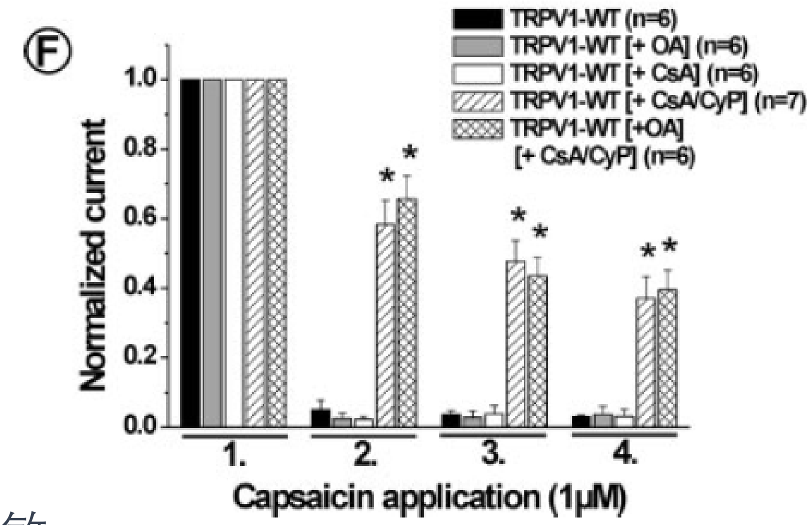
能吃辣的人并非天生“不怕痛”，而是刺激使神经系统对辣椒素的敏感度降低，产生了适应性脱敏。







· 重复辣椒素脉冲 → 电流快速递减（强脱敏）
· 加 CsA·CyP(钙调磷酸酶)：脱敏显著减弱，第2次脉冲电流保留 ~58%

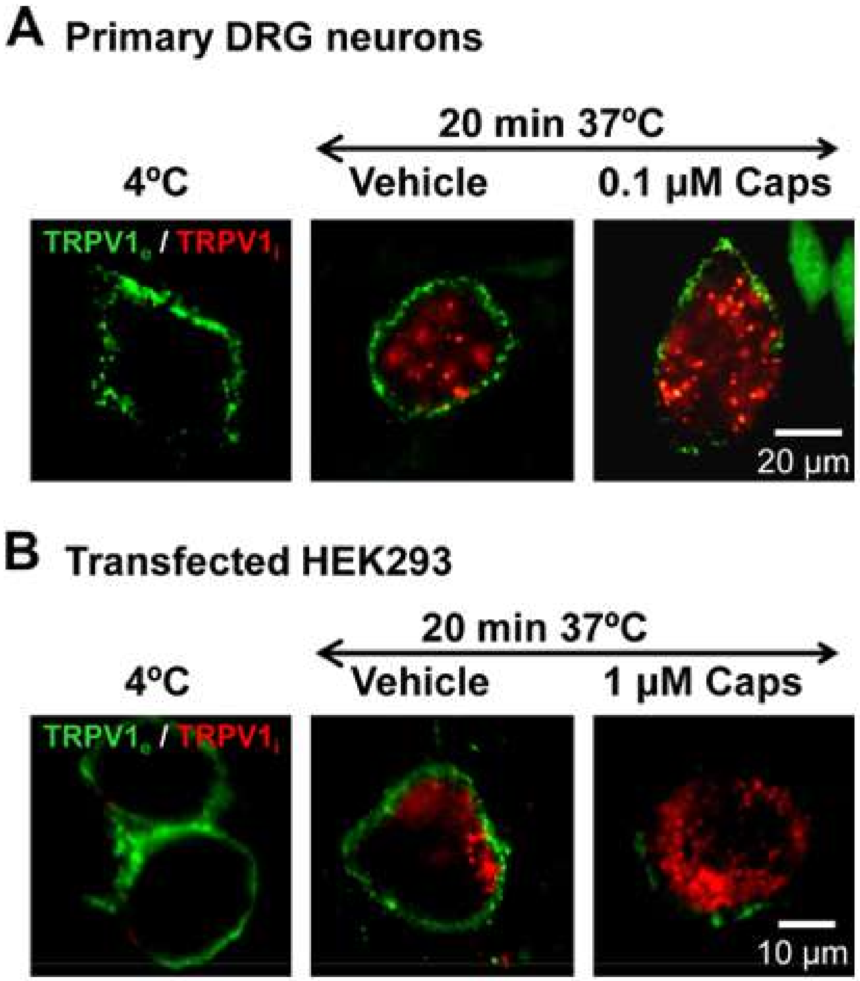


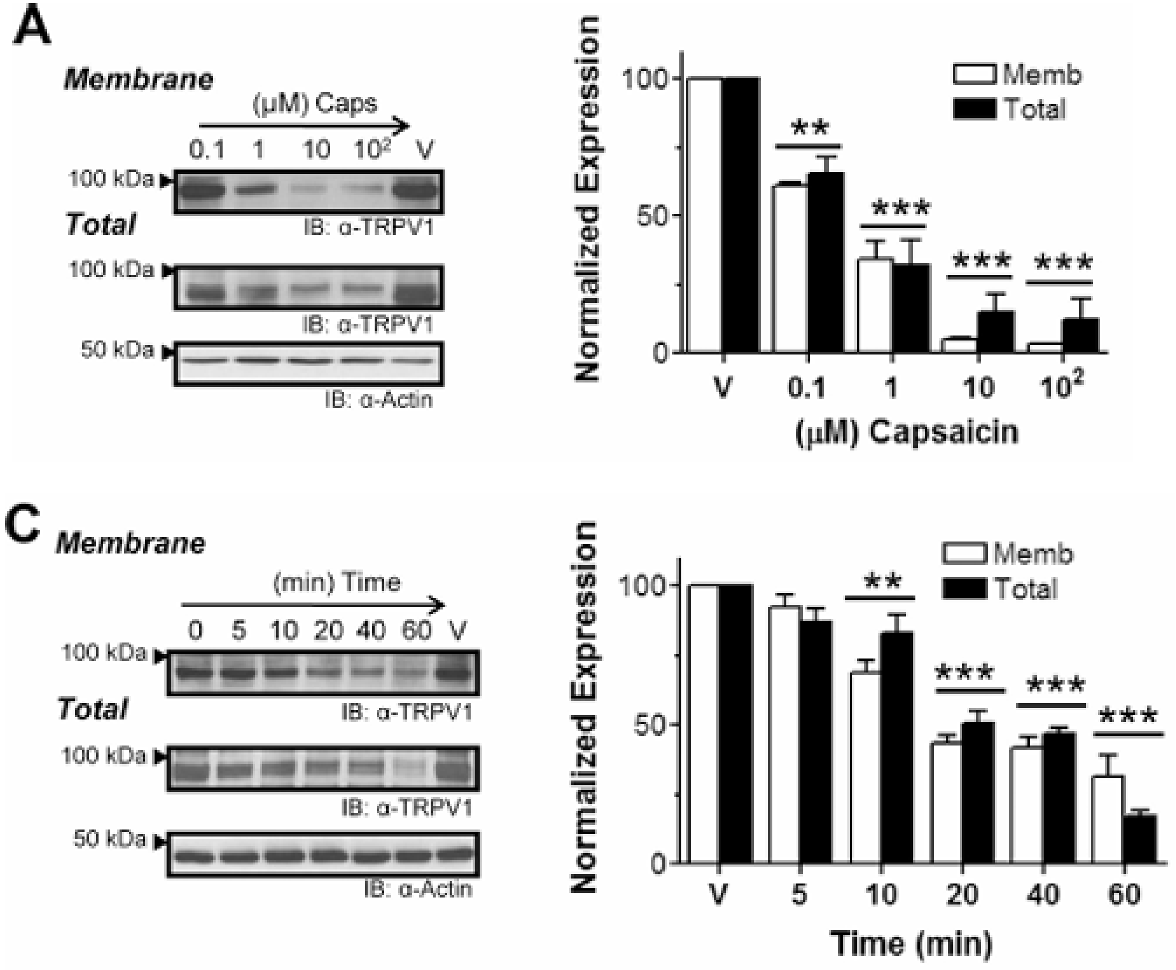
通过TRPV1增加的Ca2+内流会形成Ca2+/CaM复合物，从而导致TRPV1脱敏。

(Mitsuko Numazaki. Proc Natl Acad Sci U S A, 2003)

(Durga Prasanna Mohapatra. J Biol Chem, 2005)

Can the Ability to Eat Spicy Food Be Trained?

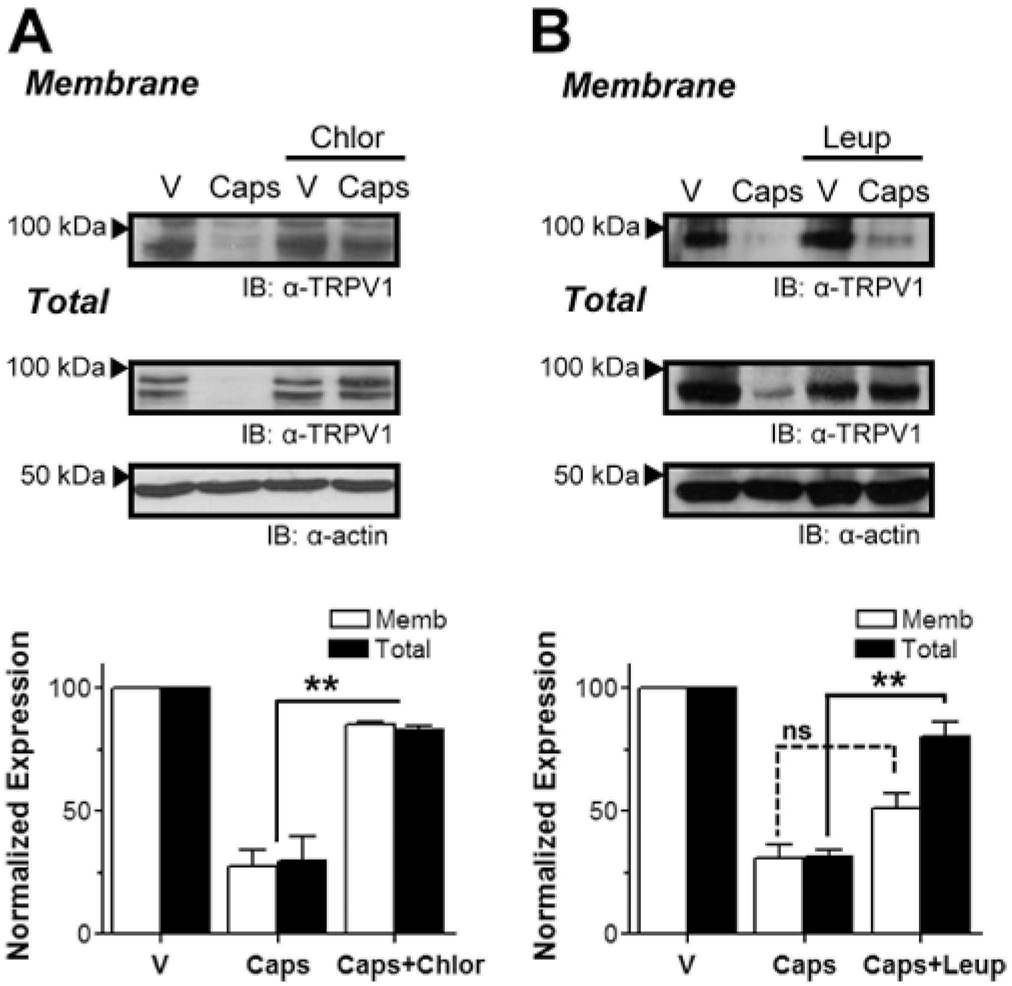




每次吃辣都"拆"掉一批受体，长期累积→膜上受体越来越少→自然就越来越不怕辣了。

(Lucía Sanz-Salvador. J Biol Chem, 2012)

Can the Ability to Eat Spicy Food Be Trained?

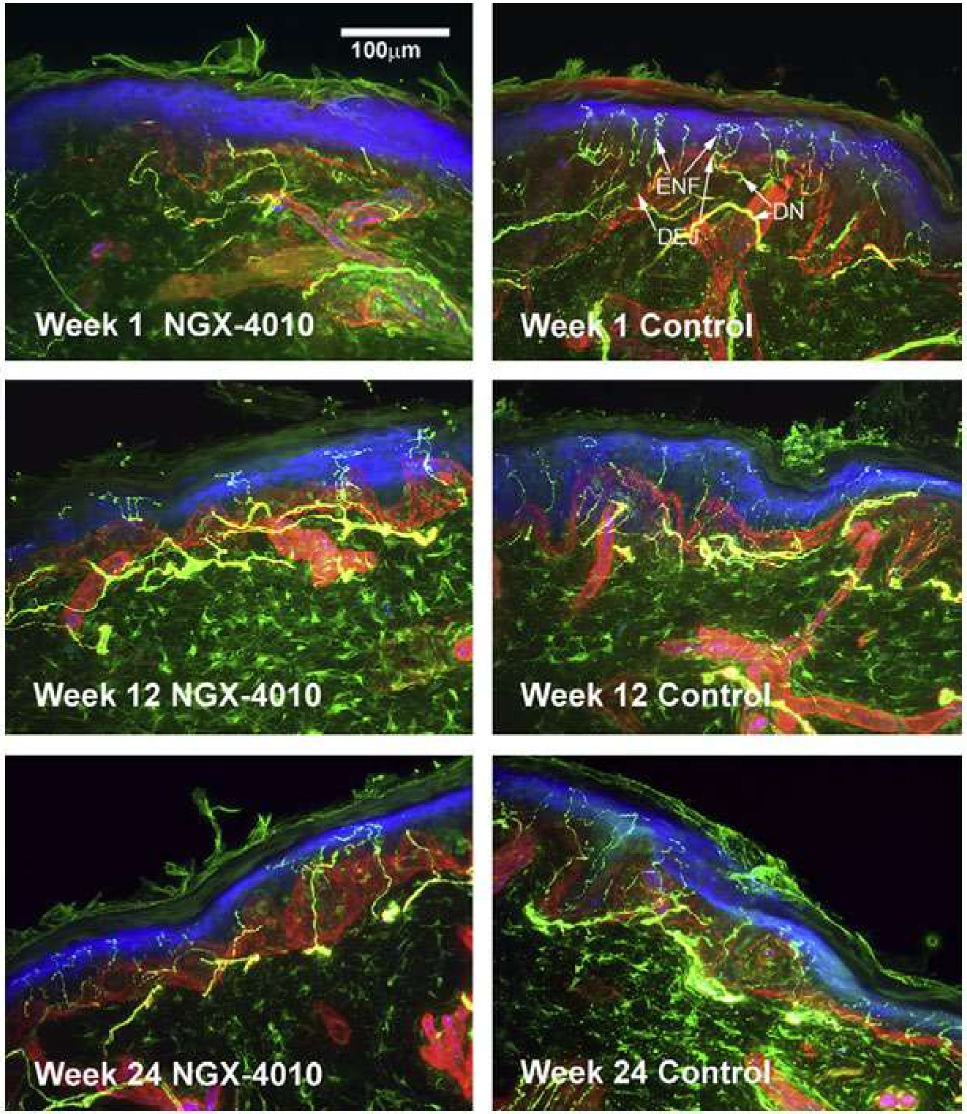


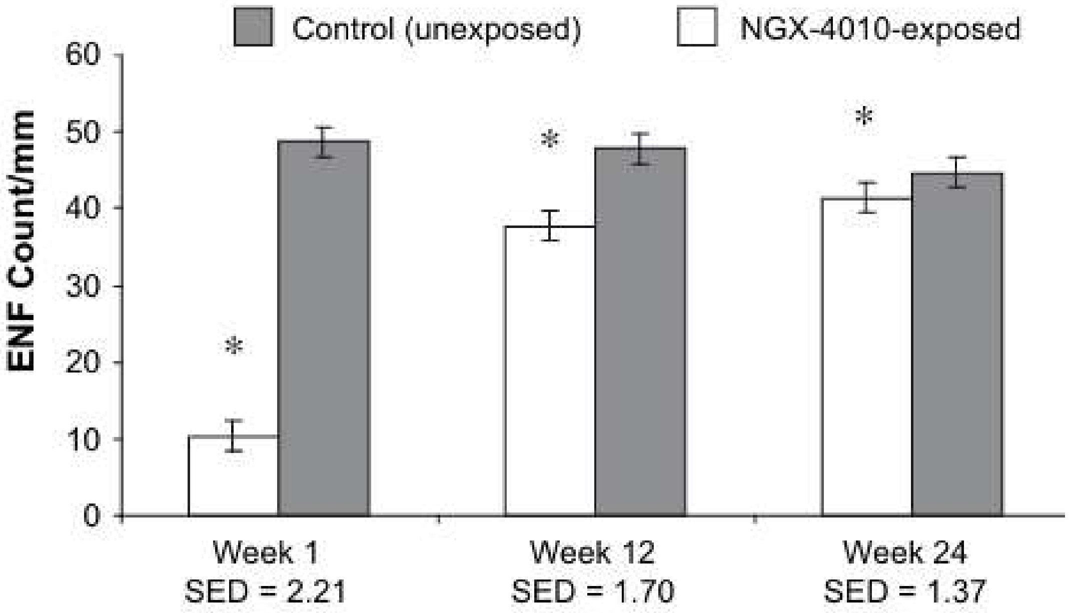
两种溶酶体抑制剂:
氯喹（Chloroquine）
亮肽素（Leupeptin）

当溶酶体蛋白酶被抑制后，
TRPV1 蛋白不再被降解，证明
TRPV1 被送到溶酶体里消化

(Lucía Sanz-Salvador. J Biol Chem, 2012)

Can the Ability to Eat Spicy Food Be Trained?





辣椒素可以让皮肤里的痛觉神经末梢**物理性地退化消失**，但不持续吃就长回来了！

(William R Kennedy. J Pain, 2010)

Acute desensitization vs Chronic tolerance

01 钙调蛋白结合

02 磷酸化/去磷酸化

03 受体内吞降解

04 神经结构重塑

单次摄入 (即时)
受体暂时失敏，辣味减轻

持续刺激 (数日)
适应开始累积，反应变缓

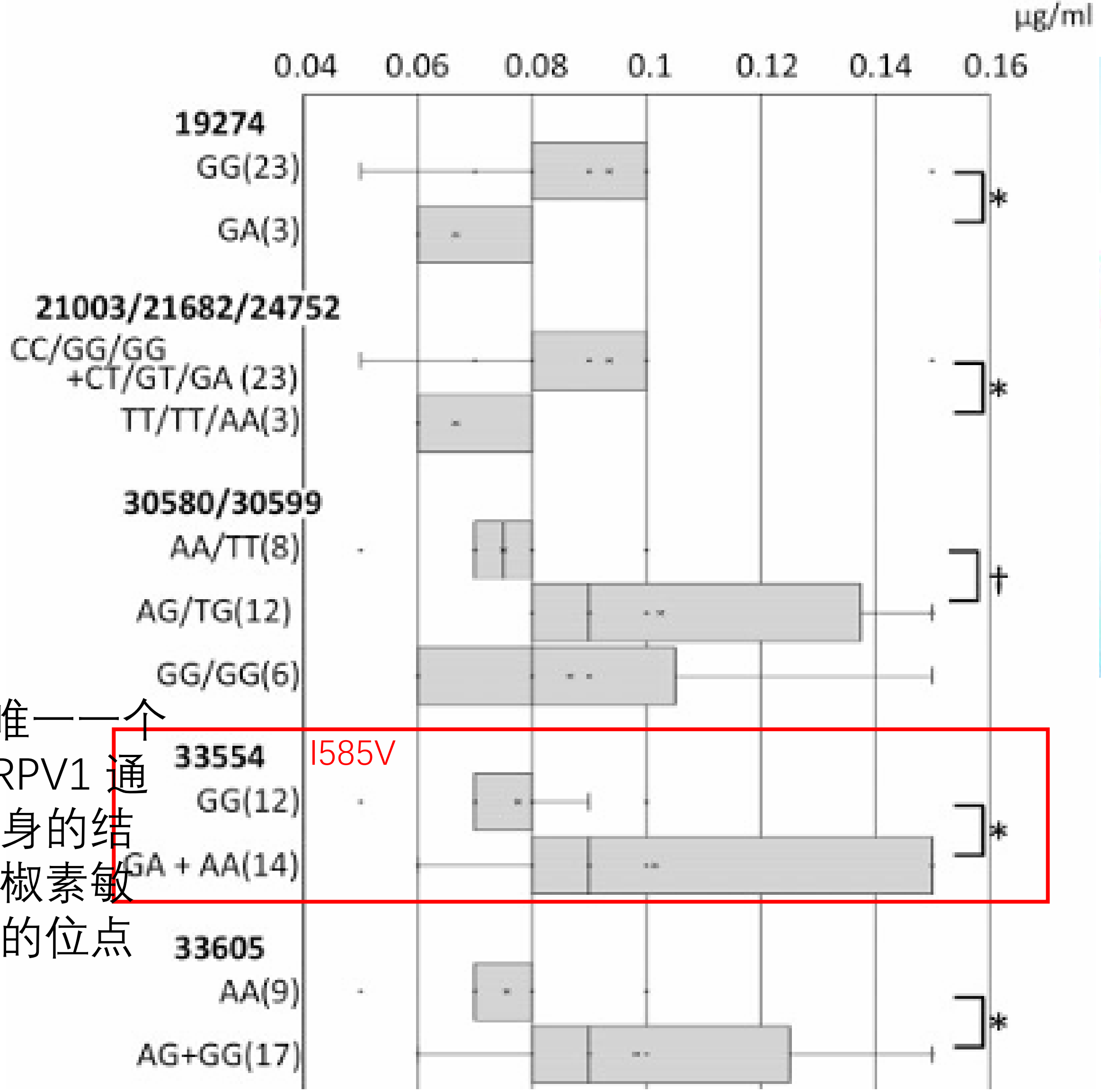
习惯养成 (数月)
受体表达下调，辣阈提升

阈值重塑 (长期)
神经结构重塑，稳定耐受

Acute desensitization: Highly reversible—Sensitivity recovers shortly after stopping spicy food intake.

Chronic tolerance: Stable physiological adaptation- Requires long-term intake to maintain.

Innate difference: TRPV1 gene polymorphism

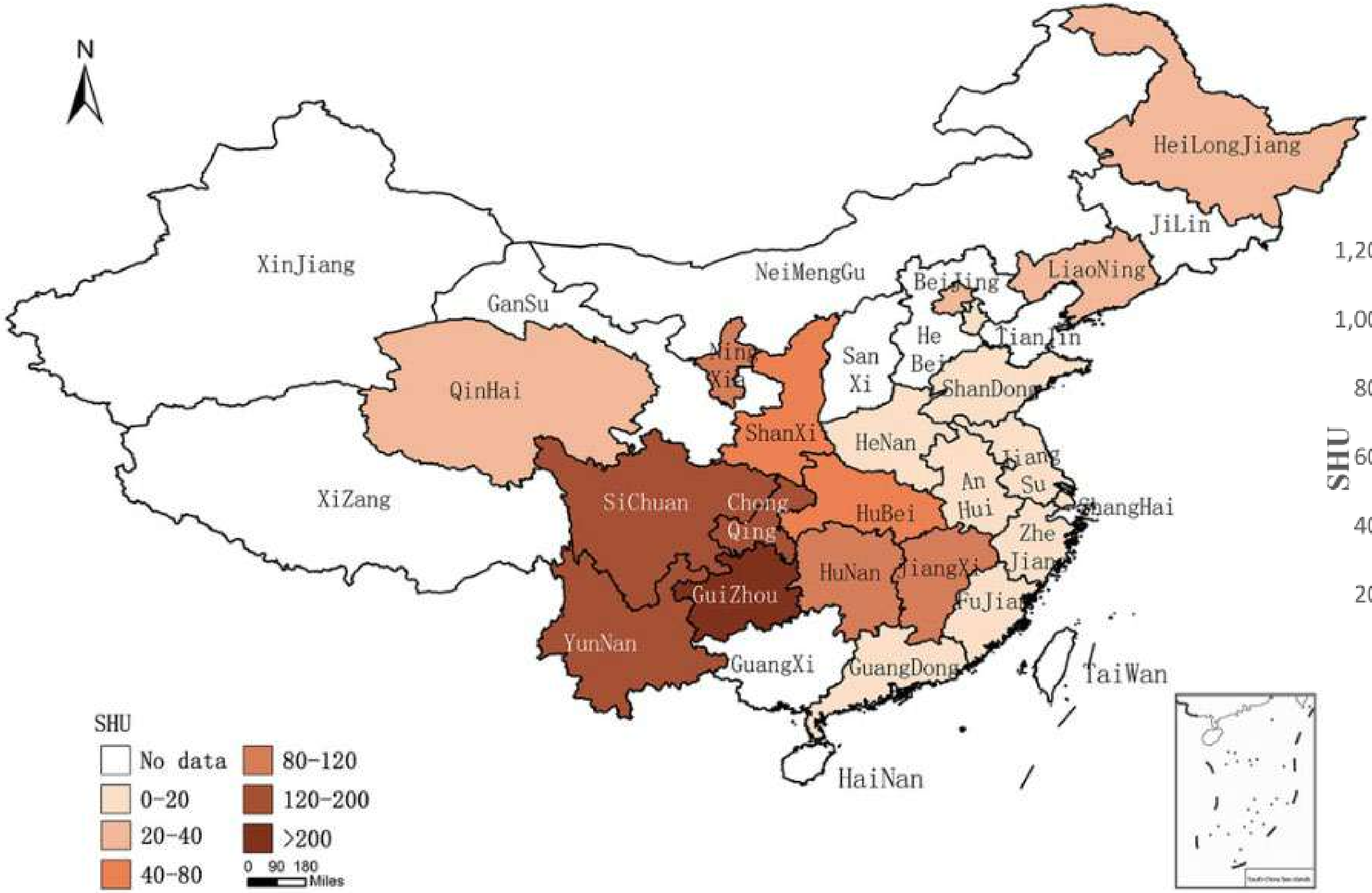


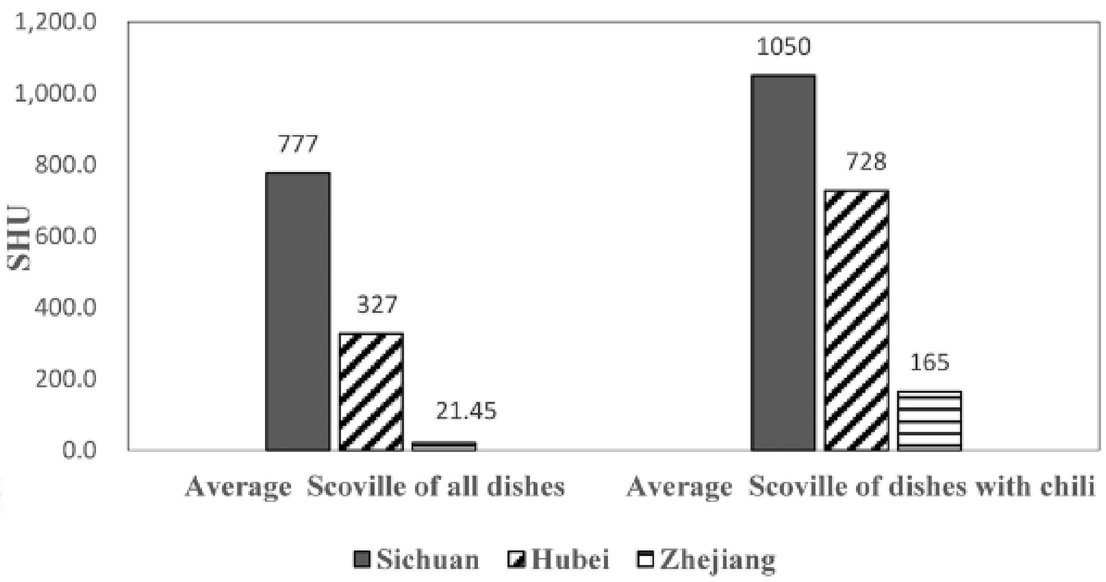
I585V： 唯一一个改变了 TRPV1 通道蛋白本身的结构且与辣椒素敏感度相关的位点

TRPV1基因的单核苷酸多态性（SNP）中，I585V突变与更高的辣椒素敏感性显著相关，携带该突变的个体对相同辣度刺激会产生更强的生理反应

(Nozomu Okamoto, et al. Mol Pain, 2018)

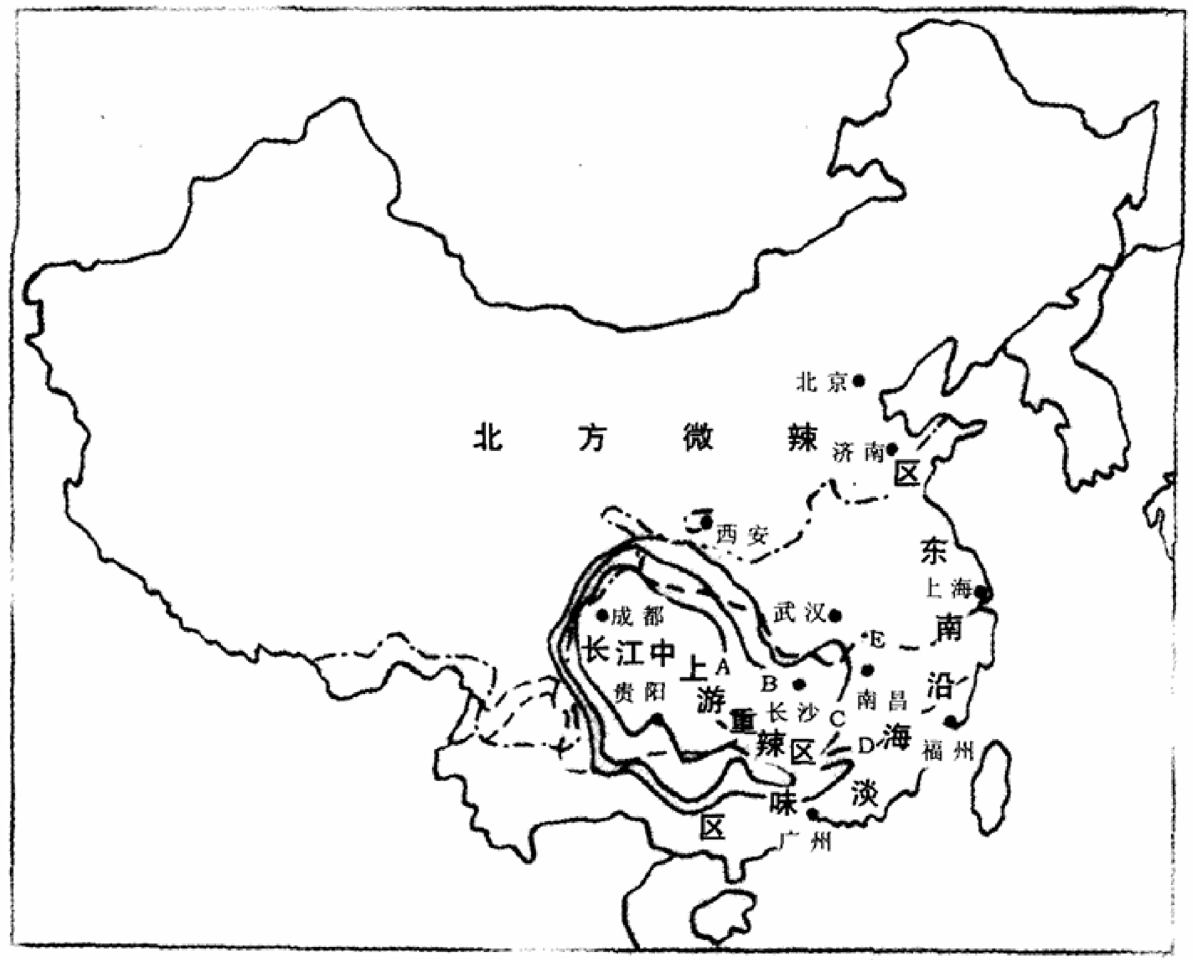
The pungency degree distribution of 21 regions is shown on the map





(Siyuan Wang, et al. Journal of Food Science, 2018)

The less sunlight, the spicier the food



A：1400 的年日照时数线　B：1600 的年日照时数线　C：1800 的年日照时数线
D：一月 8 度平均气温线　E：一月 4 度平均气温线　F：70%年平均相对湿度线

图 1　中国现代饮食辛辣地区示意图

Dependent variable	Independent variable	Regression coefficients	Standardized regression coefficient
Pungency degree of dishes in 21 regions	Intercept	1422.709	
	Average sunshine duration	−96.674	−1.084
	Average barometric pressure	−7.041	−0.527
	Average daily precipitation	−51.544	−0.583
Pungency degree of dishes in sampled cities	Intercept	6624.481	
	Average sunshine duration	−411.246	−1.096
	Average relative humidity	−58.951	−0.376

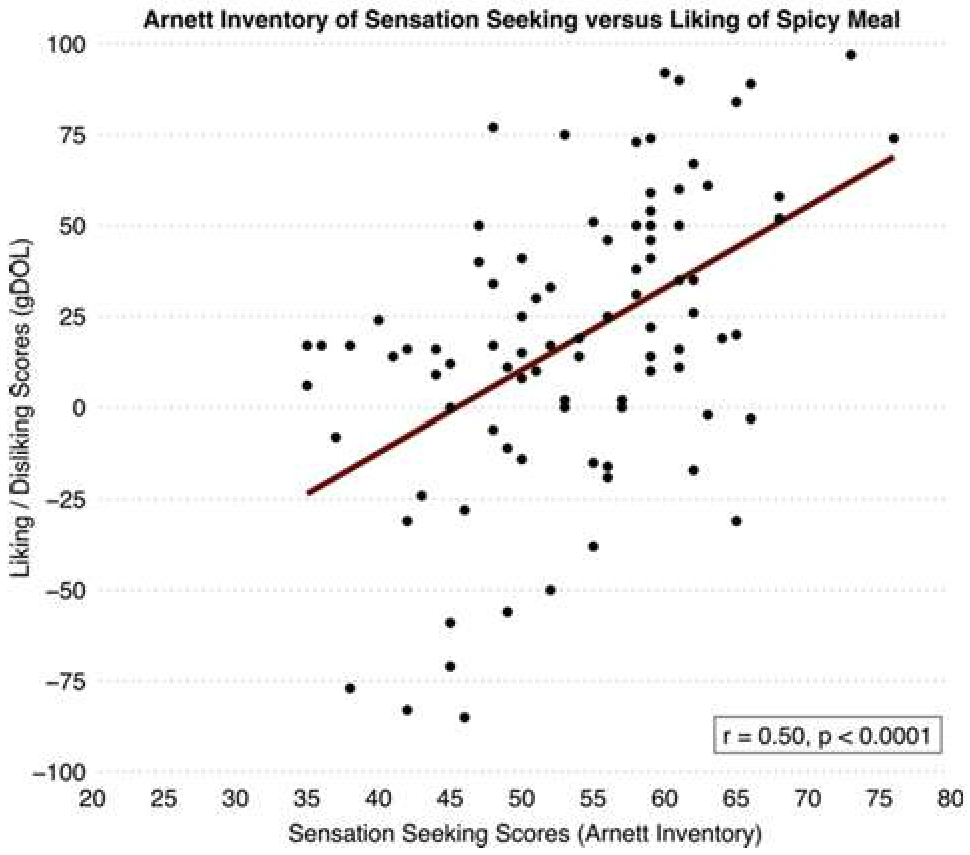
地区	日照	降水	湿度	辣度
四川/贵州	少	多	高	高
江浙/广东	多	多	高	低

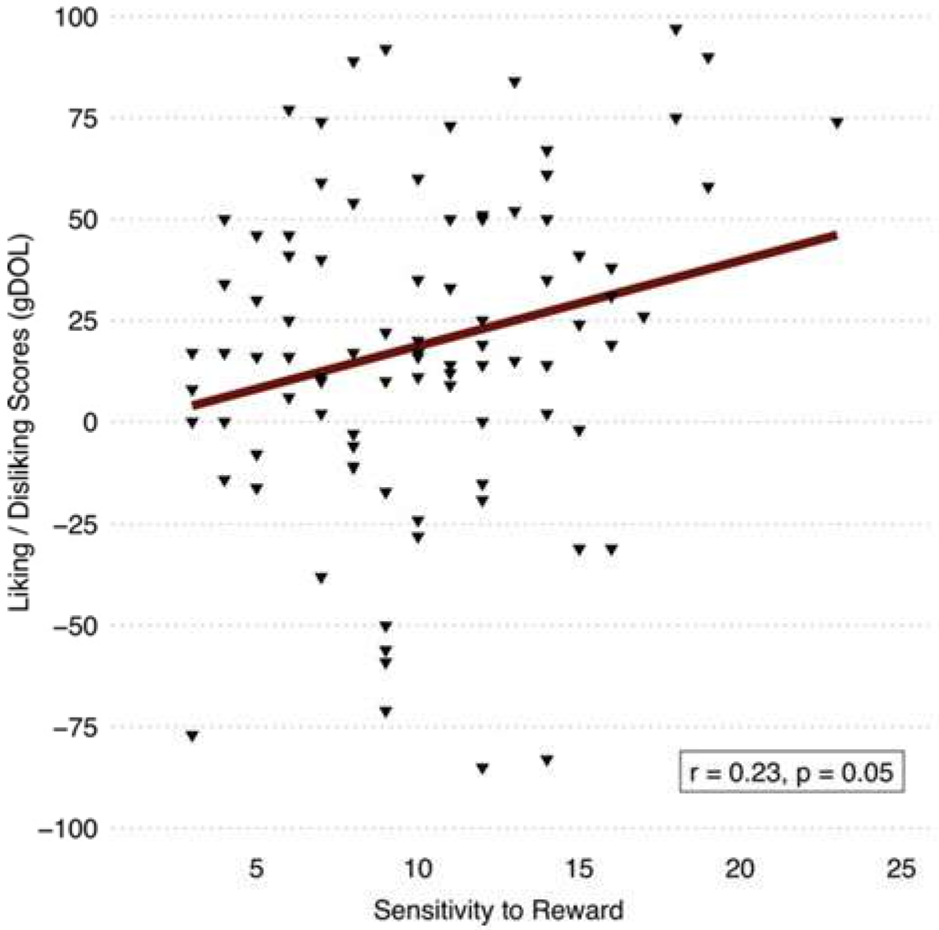
四川盆地多雾、日照少、湿度极高——传统中医讲究"祛湿发汗"，辣椒正好通过激活TRPV1受体促进排汗，这在当地湿热（非闷热）气候下有实际生理调节功能。

(兰勇, 关于中国饮食中辛辣风味的原因及分布[J]。人文地理学。2001)

"不怕辣、辣不怕"

社会认同和群体归属的驱动——吃辣在饭桌上是一种社交展示





(Nadia K. Byrnes, et al. Food Quality and Preference 2013)

为什么乳制品是“解辣神器”？

01 脂肪溶解机制

牛奶中的脂肪是辣椒素的“天然溶剂”。辣椒素具有亲脂性，脂肪能将其从口腔神经受体上有效“冲刷”并带走，从而切断灼烧感的持续刺激，实现快速解辣。

02 酪蛋白结合作用

牛奶中的酪蛋白（casein）能与辣椒素分子发生特异性结合，形成稳定的复合物，显著降低口腔内游离辣椒素的浓度。这一化学机制被多项食品科学研究证实（Farah et al., 2022）。

03 低温物理缓解

冷藏乳制品的低温特性可直接抑制口腔内TRPV1受体的活性——这是感知辣椒素和高温的关键通道。低温能物理性地减缓受体向大脑传递的灼热信号，实现即时的降温镇痛。

04 甜味心理安抚

乳制品中天然的乳糖等糖分，能激活大脑的多巴胺奖赏通路，产生愉悦感和满足感。这种甜味带来的正向反馈，能从心理与生理层面中和辣味带来的不适，起到情绪上的安抚作用。

实用解辣排行榜

01 冰全脂牛奶

脂肪+蛋白+低温三重buff，能快速包裹并带走辣椒素（化学性质：香草酰胺类化合物，长疏水侧链），解辣效果堪称天花板，是吃辣人士的首选。

02 原味酸奶/冰淇淋

乳脂有效包裹辣椒素，冰凉质感瞬间降低口腔灼热感，酸甜的口感更能进一步舒缓味蕾不适。

03 花生奶/坚果奶

植物蛋白与油脂在口腔形成天然保护膜，温润不刺激，解辣的同时还能补充优质植物能量。

04 食用油 / 花生酱

利用“相似相溶”原理，油脂能直接溶解辣椒素（检测阈值：油中11.75 mg/L，水中0.31 mg/L (Lawless et al., 2000)）。应急时只需一勺，就能快速中和口腔的灼烧感，是餐桌上的隐藏解辣神器。

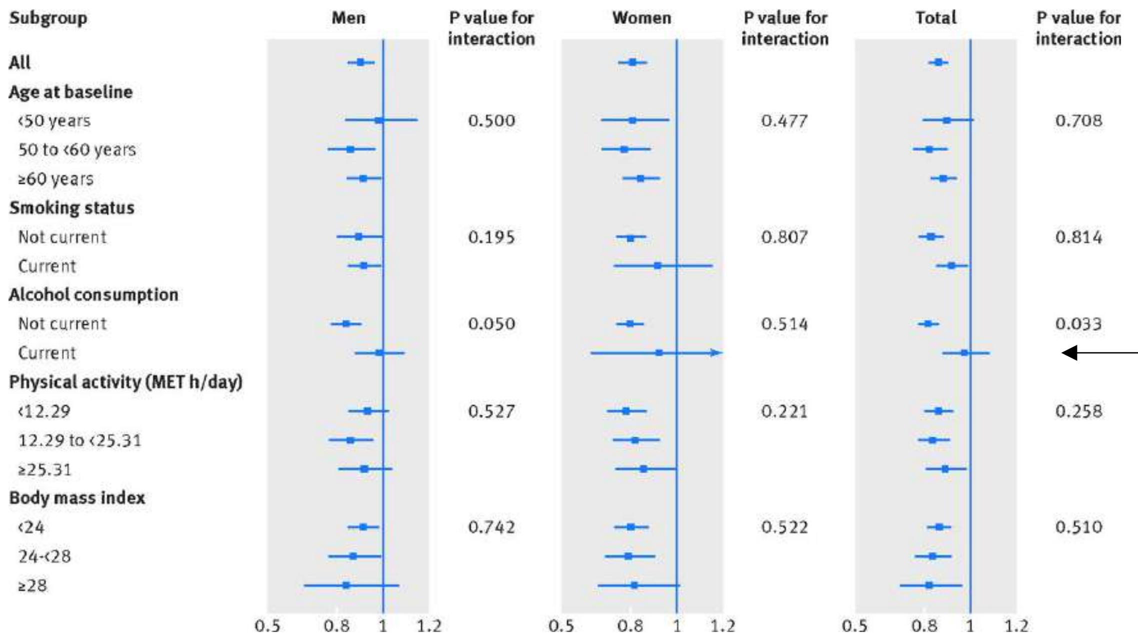
05 白糖 / 蜂蜜

高糖分能吸收口腔内多余水分，中和辣椒素的碱性刺激，快速舒缓黏膜的刺痛感，清甜的味道也能瞬间缓解味蕾的不适。

实用小技巧：解辣时切勿猛灌（水会将辣椒素带到口腔更多区域，扩大刺激面积）！小口含漱并让液体在口腔内停留数秒，使其充分接触黏膜，这样中和辣椒素的效果会比直接吞咽好得多。

Moderate intake may have health benefits

Cause of death	No of participants	Frequency of spicy food consumption			
		Less than once a week*	1 or 2 days	3-5 days	6 or 7 days
No of participants	487 375	278 491	31 740	28 549	148 595
No of person years	3 500 004	1 990 589	228 112	204 972	1 076 330
All causes:					
No of deaths†	20 224	12 145	1014	876	6189
Model 1		1.00	0.90 (0.84 to 0.96)	0.85 (0.79 to 0.91)	0.83 (0.79 to 0.86)
Model 2		1.00	0.89 (0.83 to 0.95)	0.84 (0.79 to 0.90)	0.82 (0.79 to 0.86)
Model 3		1.00	0.90 (0.84 to 0.96)	0.86 (0.80 to 0.92)	0.86 (0.82 to 0.90)

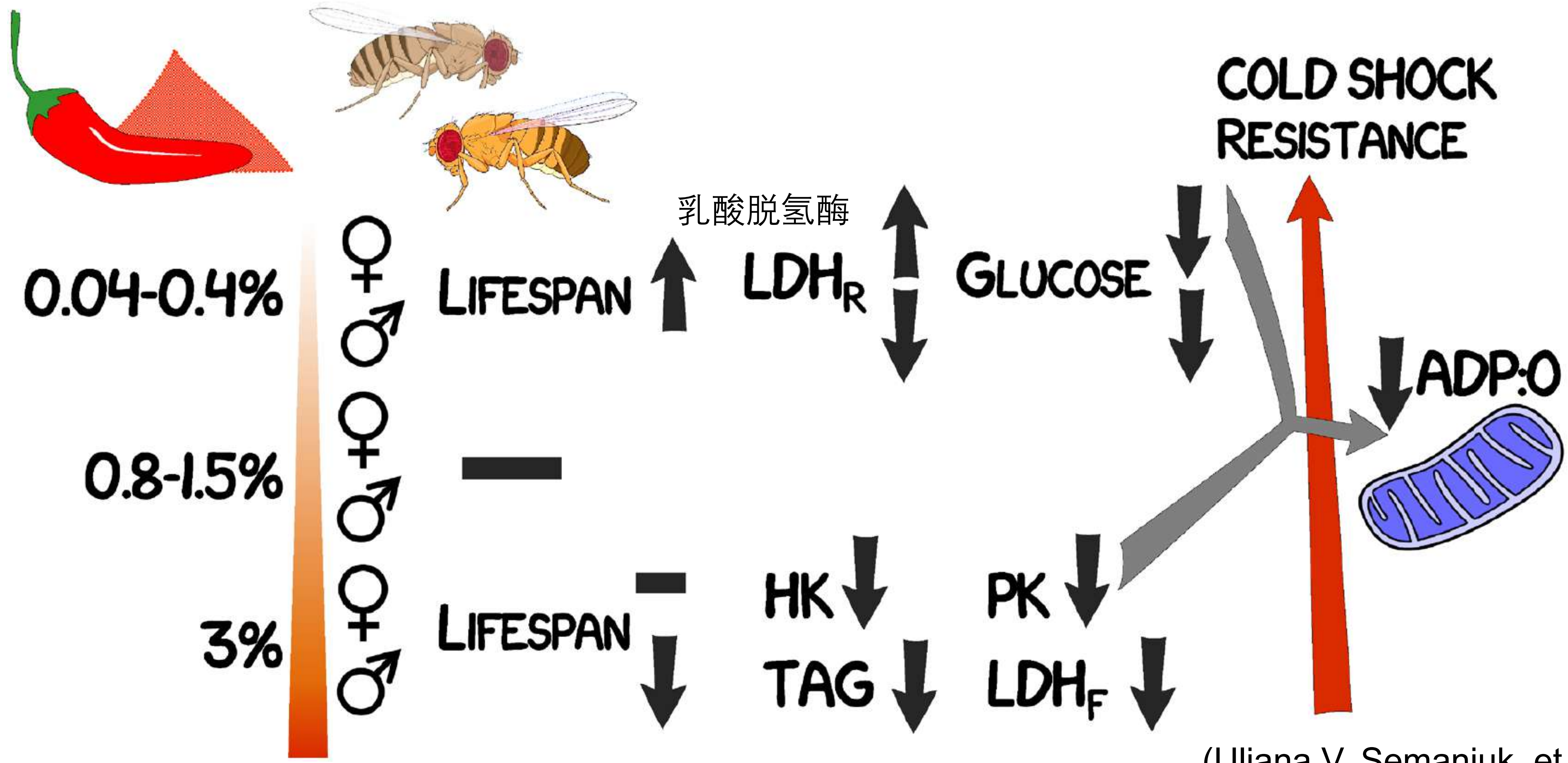


死因	HR（95% CI）	风险降低	统计显著?
总死亡	0.86（0.82–0.90）	14%	✅
癌症	0.92（0.85–0.99）	8%	✅（勉强显著）
缺血性心脏病	0.78（0.67–0.89）	22%	✅
呼吸系统疾病	0.71（0.62–0.81）	29%	✅
糖尿病	0.82（0.63–1.05）	18%	❌（不显著，CI 跨越 1）
脑血管疾病	0.96（0.87–1.07）	4%	❌
感染	0.83（0.60–1.15）	17%	❌

吃辣对不喝酒的人保护效果更强。

(Jun Lv, et al. BMJ, 2015)

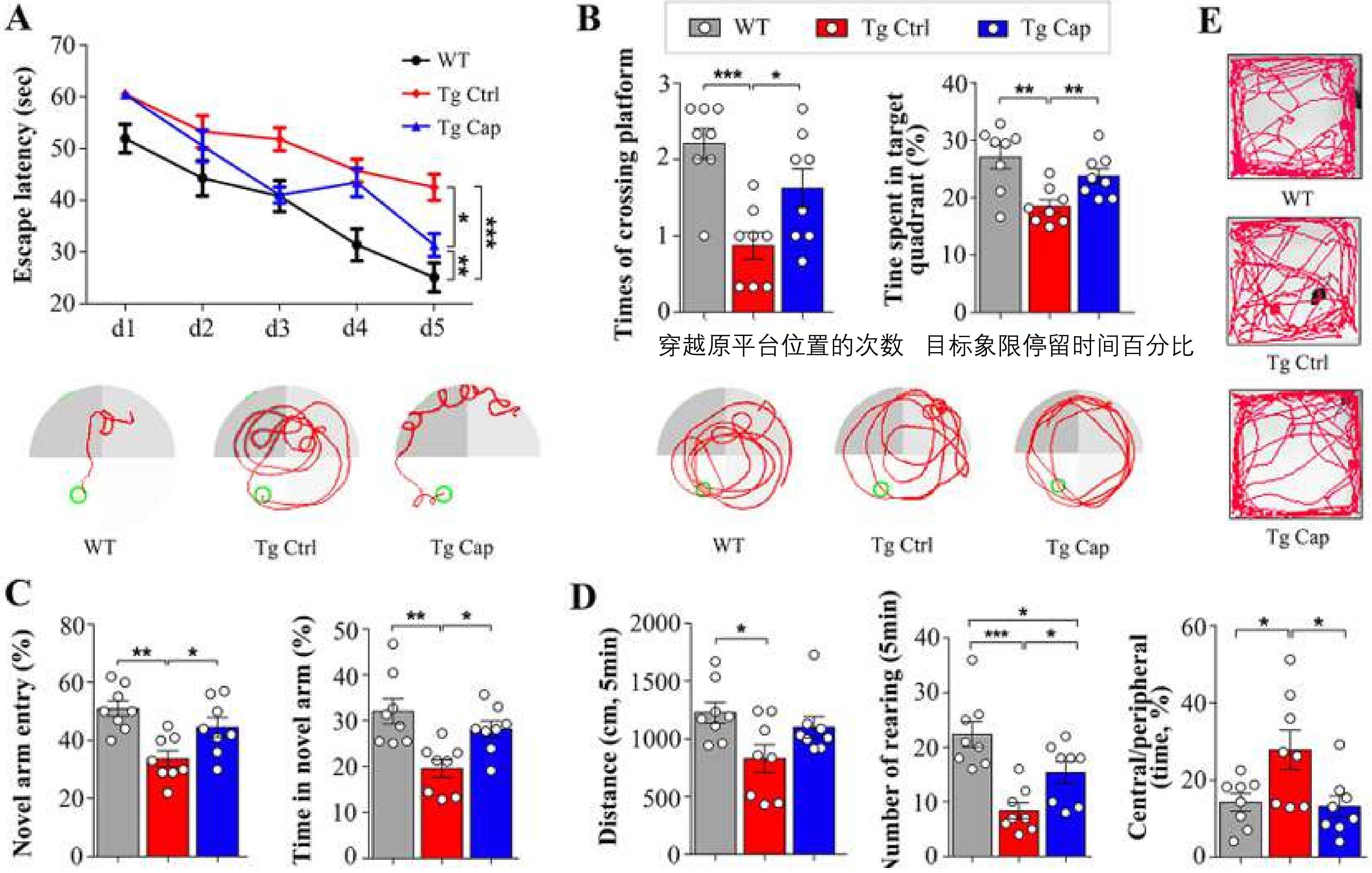
Eating moderately spicy food can extend lifespan by 13%.



(Uliana V. Semaniuk, et al. Food Funct, 2022)

Capsaicin significantly improves the cognitive deficits in mice

水迷宫游泳

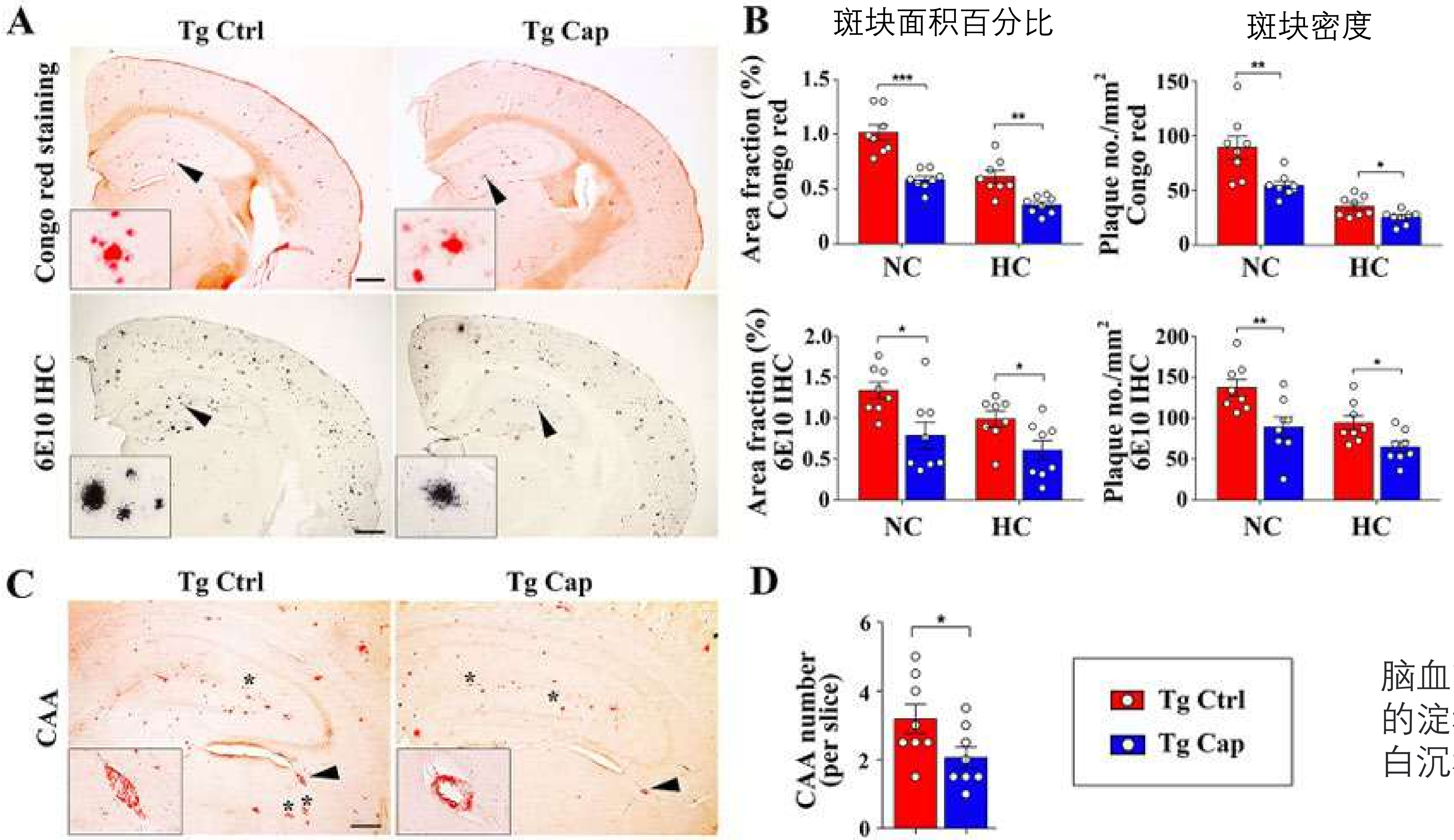


Y迷宫试验
（空间识别记忆）

旷场试验（运动能力和焦虑样行为）

(Jun Wang, et al. Transl Psychiatry, 2020)

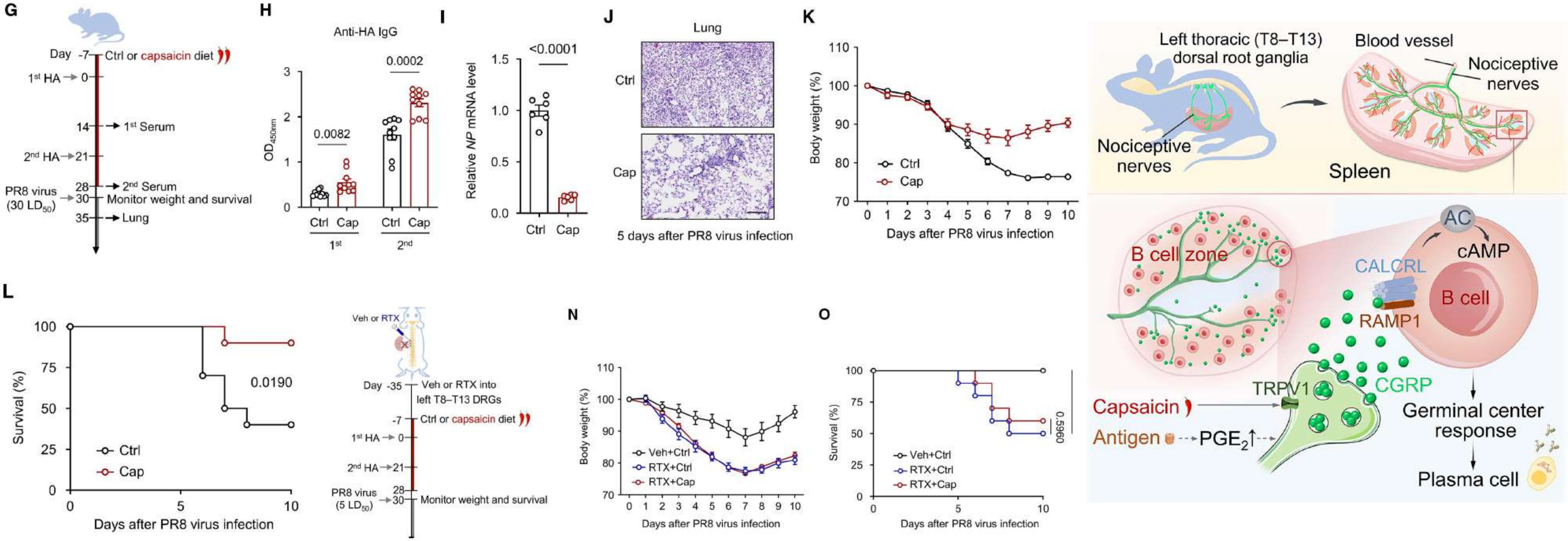
Capsaicin ameliorates amyloid deposition in mice



脑血管壁中的淀粉样蛋白沉积减少

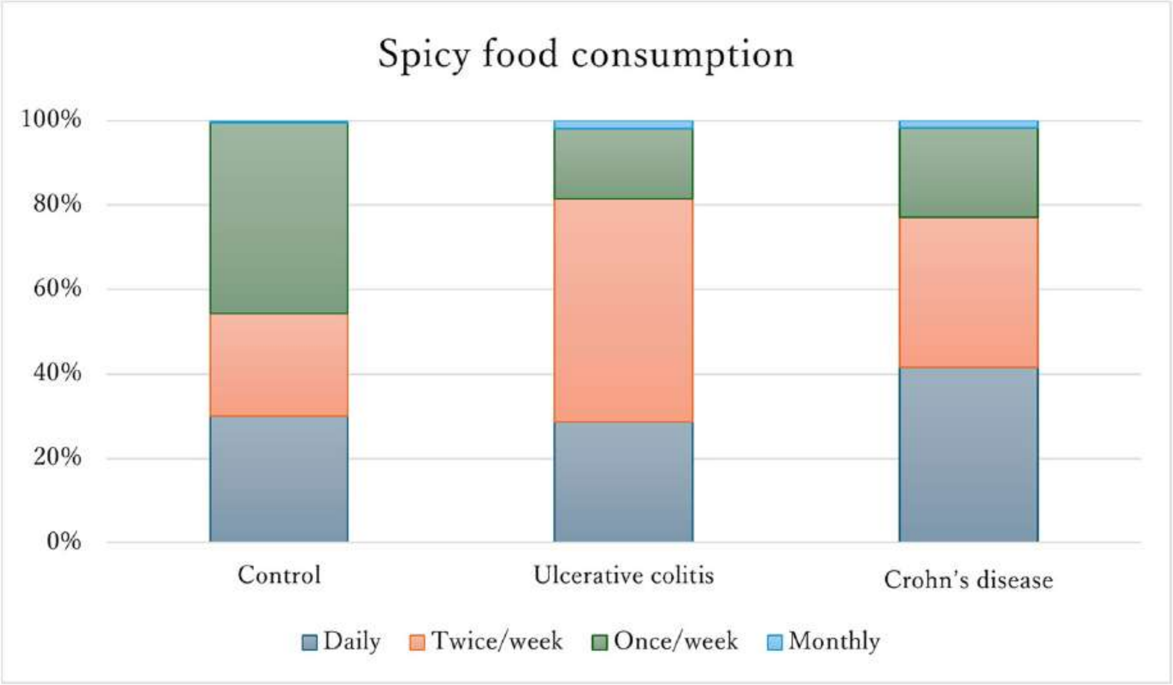
(Jun Wang, et al. Transl Psychiatry, 2020)

Eating spicy food can enhance immunity



(Min Wu, et al. Cell, 2024)

Eating spicy food can also be "harmful"



(Anas Almofarreh M.D, et al. Nutrition, 2026)

01. 胃食管反流 (GERD) 患者

辣椒素会降低食管下括约肌压力，无法有效阻挡胃酸反流，加重烧心、反酸及胸骨后灼痛感。

02. 活动期胃溃疡/胃炎

辛辣成分直接刺激受损的胃黏膜，破坏黏膜保护屏障，加剧胃痛、灼热感，甚至增加胃出血风险。

03. 痔疮与肛裂患者

辣椒素刺激肛周血管扩张充血，导致静脉回流不畅，加重排便疼痛、便血，易诱发症状急性发作。

04. 口腔溃疡与口腔炎症期

破损的口腔黏膜对辣椒素极其敏感，会加剧灼痛，延缓溃疡愈合速度，甚至引发继发感染。

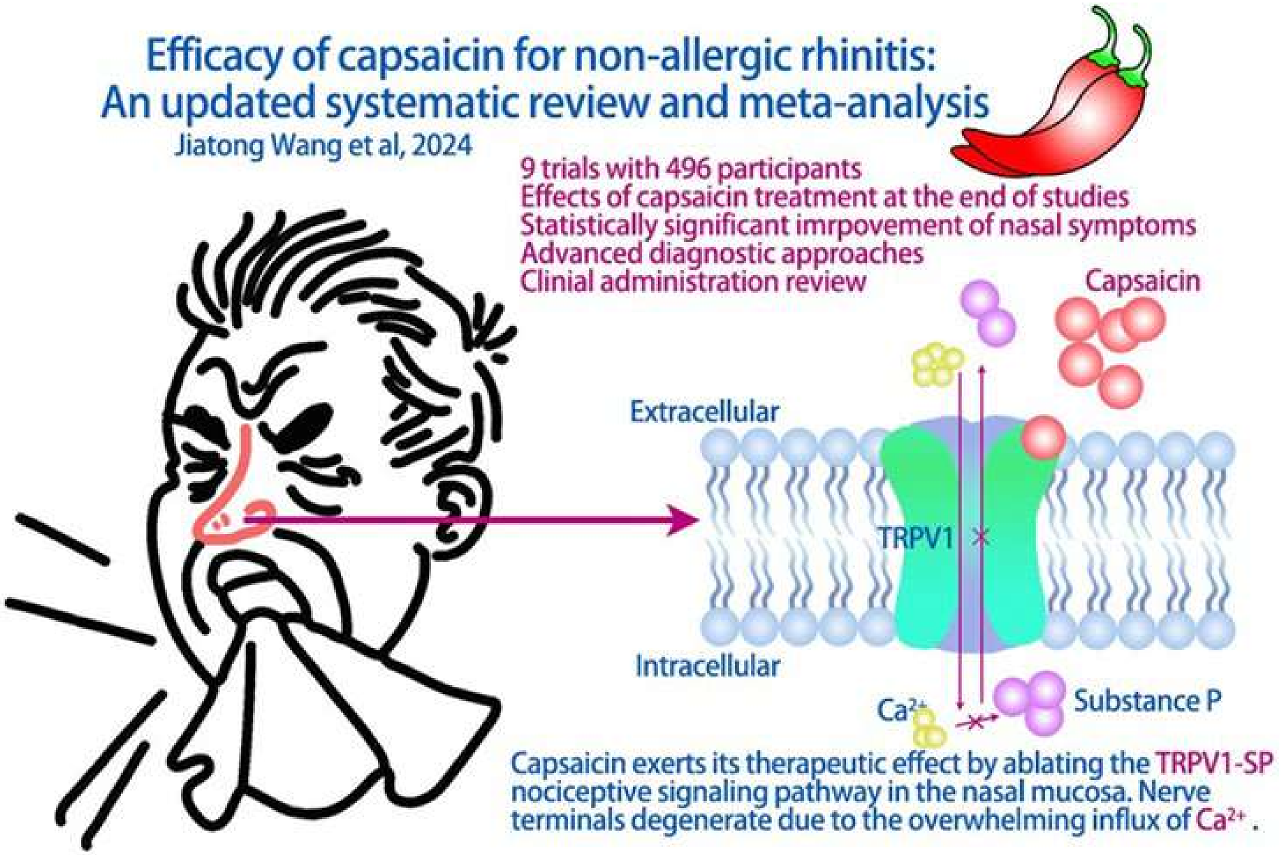
05. 肠易激综合征 (IBS)

辛辣刺激易诱发肠道平滑肌痉挛，导致肠道蠕动紊乱，引发或加重腹痛、腹泻及腹胀症状。

06. 手术后恢复期人群

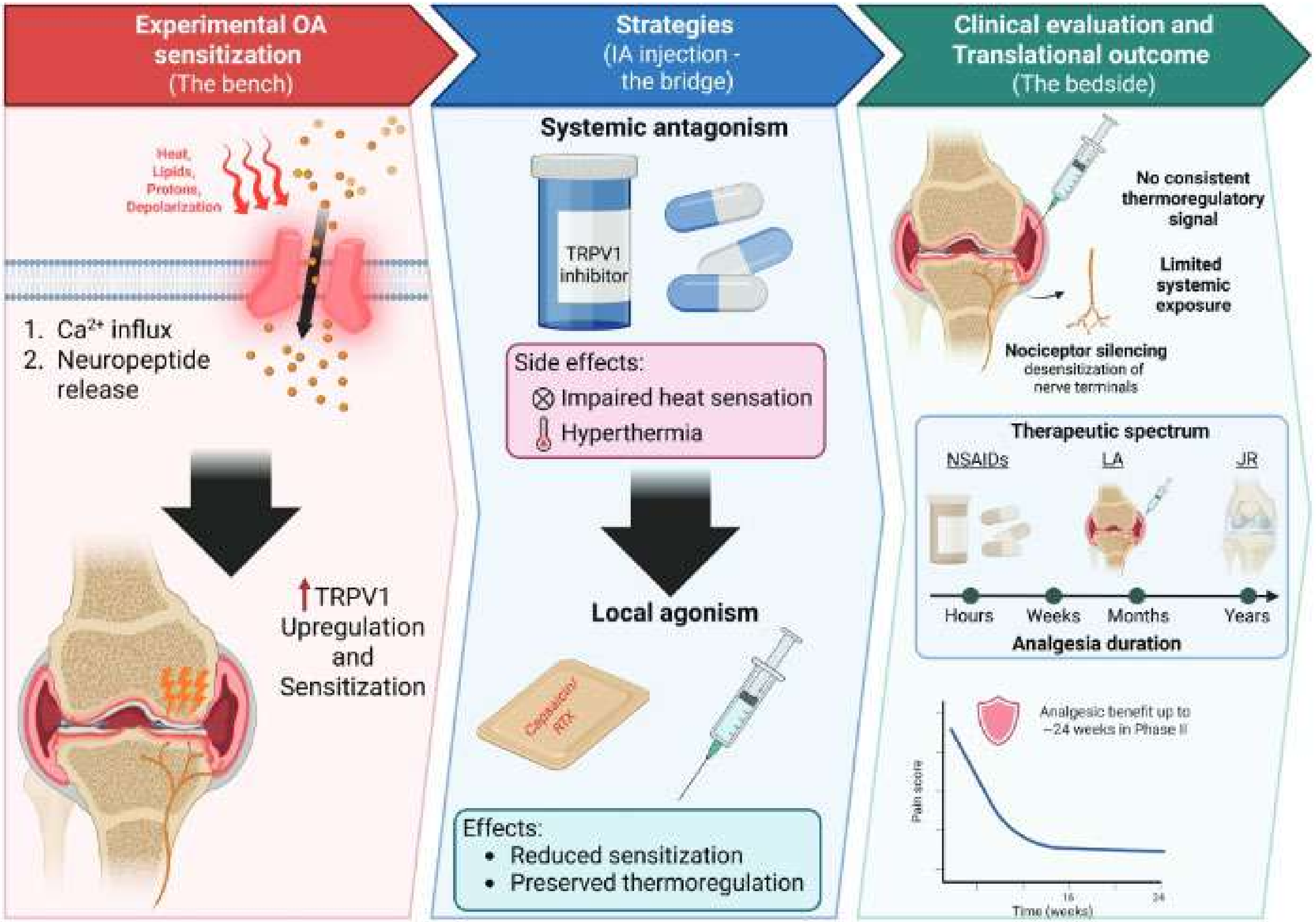
术后身体处于应激修复状态，辛辣食物易引发炎症反应，干扰伤口愈合，增加感染可能性。

Eating spicy food to cure a cold - is it true or not?



(Jiatong Wang, et al. Clin Rev Allergy Immunol, 2024)

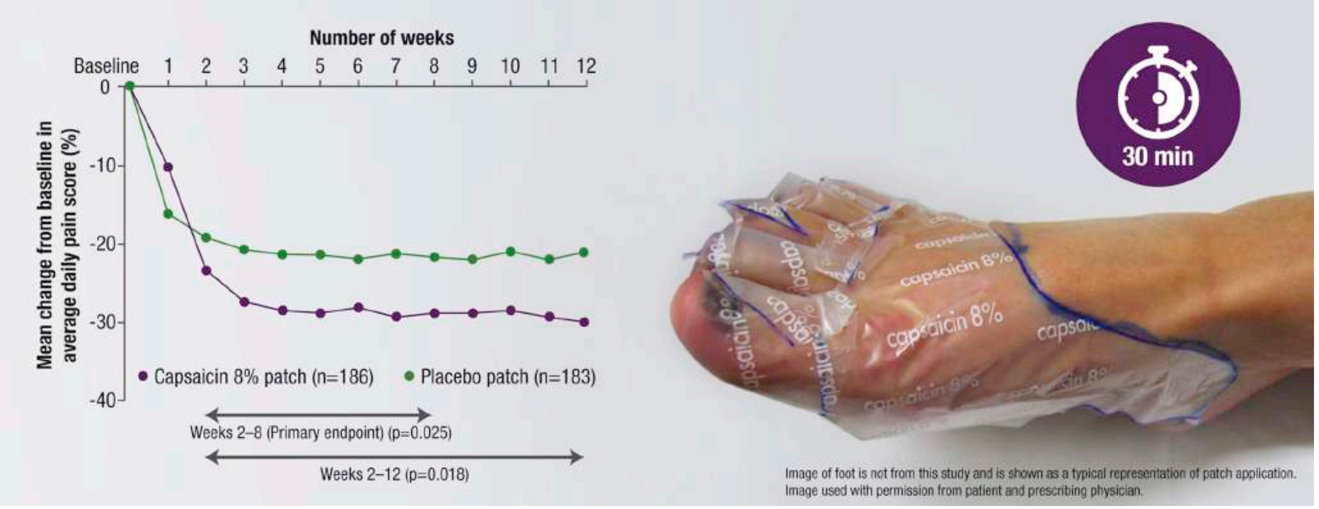
The Rise and Fall of Painkillers

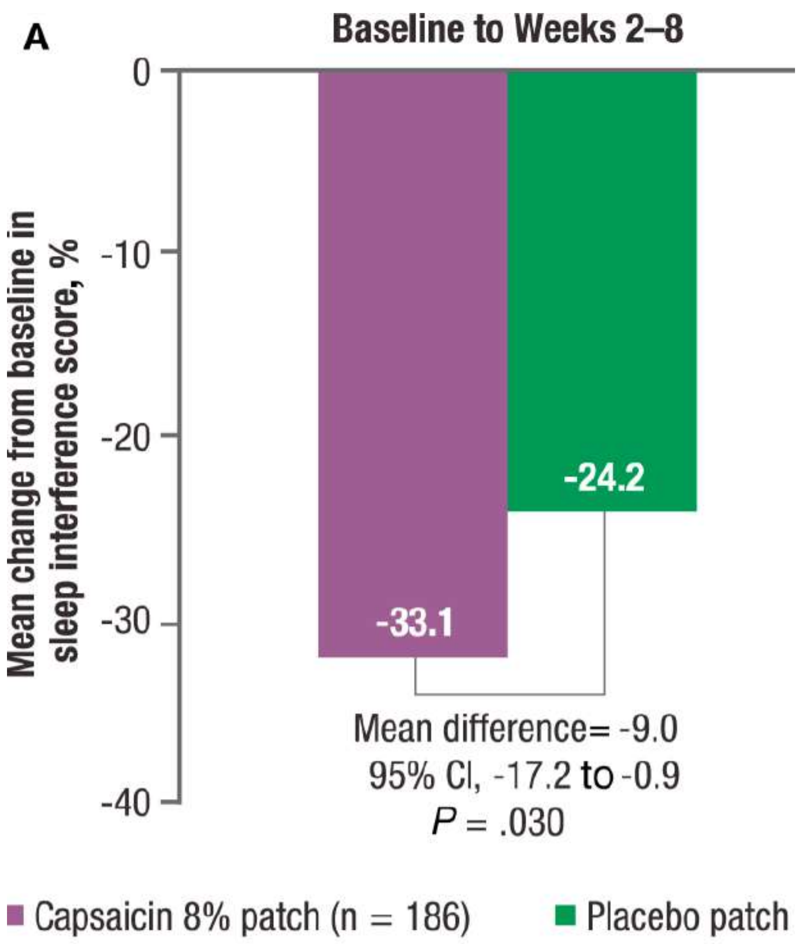


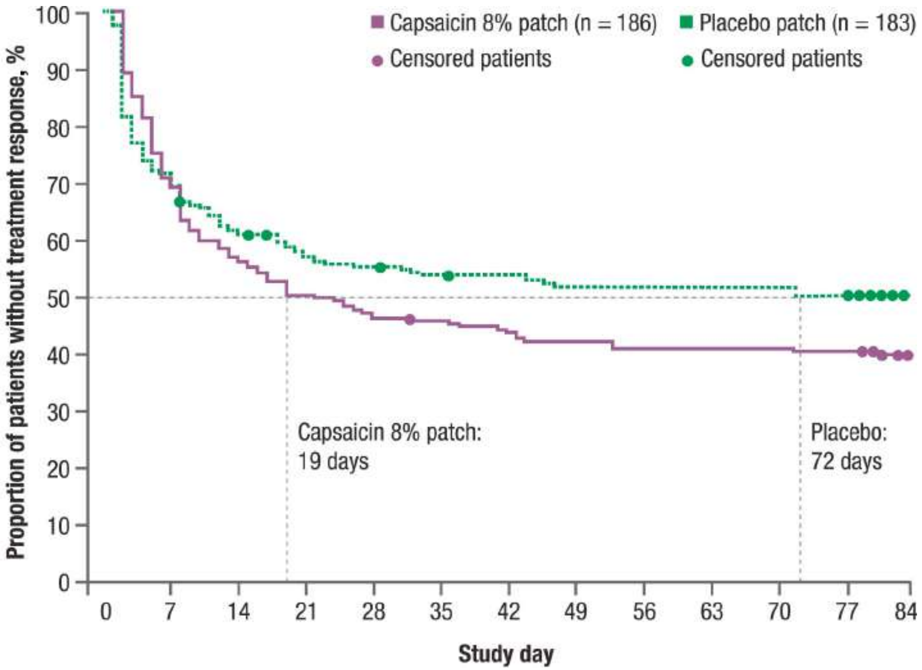
系统性TRPV1拮抗剂虽然止痛，但副作用（体温升高、热感知受损）导致多个三期临床试验失败。

(Csaba Matta, et al. Expert Opinion on Pharmacotherapy, 2026)

8% capsaicin patch - A long-lasting analgesic weapon







(David M. Simpson, et al. The Journal of Pain, 2017)

8% capsaicin patch - A long-lasting analgesic weapon

01 核心适应症

针对多种顽固性神经病理性疼痛，作为局部外用疗法，直接作用于病灶：

- **带状疱疹后神经痛 (PHN)**
- **糖尿病周围神经痛 (DPN)**
- **HIV相关神经痛**

02 临床获益显著

便捷给药，长效持久，安全性良好：

单次敷用60分钟，镇痛效果可持续约12周

疗效相当，起效更快，全身副作用更少， 但过量刺激胃肠黏膜，加重反流和痔疮

03 独特作用机制

特异性调控伤害性感觉神经纤维，实现源头镇痛：

- **神经纤维密度下调约80%**，阻断痛觉信号传导
- **可逆性恢复**：24周后神经纤维逐渐恢复

临床价值总结：Qutenza®（8%辣椒素贴剂）为神经病理性疼痛患者提供了一种非系统性、长效的治疗选择，尤其适用于对口服药物不耐受或疗效不佳的患者，是临床多模式镇痛管理的重要补充方案。

(Sharma et al. 2013; Appendino et al. 2005; Leung 2008等多篇综述)

Summary

1. 吃辣可以训练——TRPV1 受体脱敏

反复接触辣椒素会让神经系统逐渐适应，“辣”并非完全由基因决定，而是可以通过后天训练习得的能力，基因只是初始起点。

2. 爱吃辣不只是生理——环境与文化认同

“辣椒的魅力在于它不仅是味蕾的刺激，更是可训练的能力、文化的载体与需要理性对待的健康选择。”

3. [illegible]

牛奶中的酪蛋白可结合脂溶性辣椒素并将其剥离口腔黏膜，同时乳脂辅助溶解辣椒素、低温抑制 TRPV1 通道激活，纯水无法结合脂溶性辣椒素，难以缓解灼痛。

4. 吃辣？健康？因人而异——适量与个体适配

对健康人群而言，适量摄入辣椒素通常无害甚至有益；但对于患有胃肠疾病、痔疮或处于炎症期的人群，需严格节制。关键在于根据自身的身体状态，把握摄入的剂量与频率。

Wishing a happy, long and healthy life!