

# THE CHILI PEPPER - *Capsicum annuum*

John Oehninger

Botanical Garden of the University of Zurich

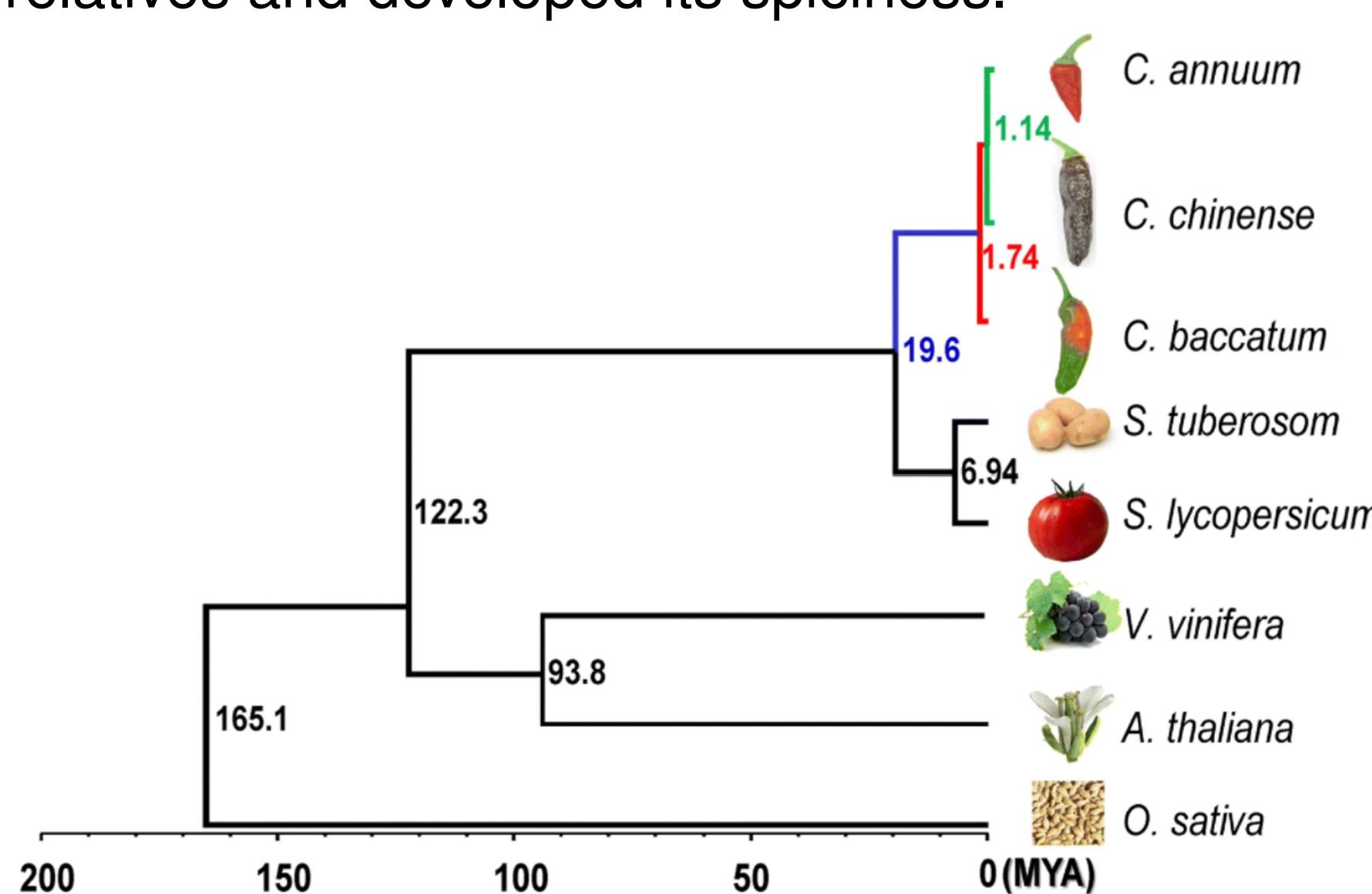
## What makes the chili pepper so interesting?



- Long Cultural History
- Domesticated about 6'500 ya
  - Oldest domesticated spice?
- Evolutionary adaption
- Pungency (a.k.a. spiciness)
- Medicinal use
- Human-Chili interaction never meant to be?
- Capsaicin - The spicy molecule
- Extreme breeding

## Evolution

The story of chili began in the **Miocene** epoch (ca. 20 Mya), where the genus *Capsicum*, which is part of the family Solanaceae, broke off from its closest relatives and developed its spiciness.

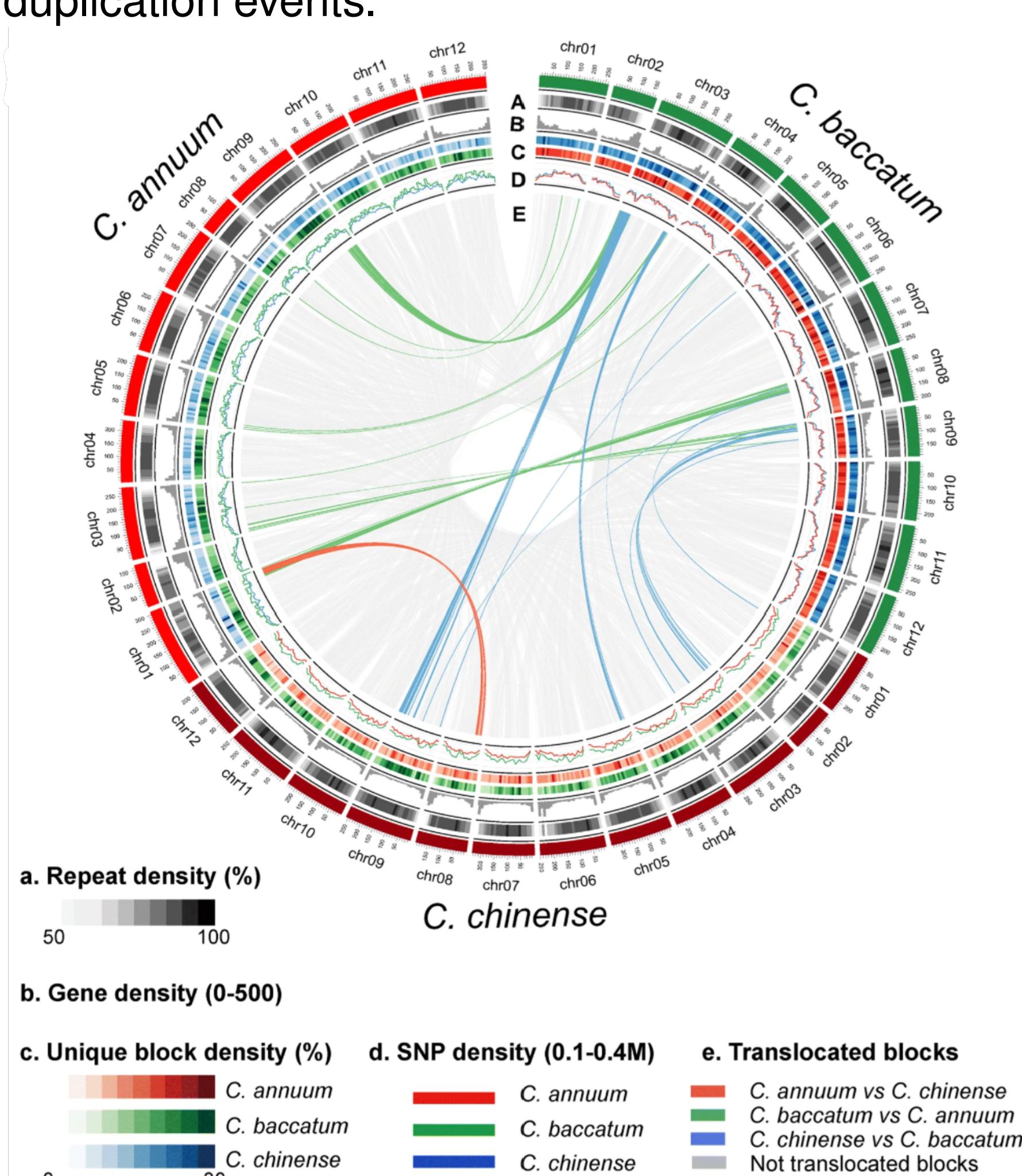


Capsicum originated from the regions of Peru, Ecuador and Columbia.

### Why did chilies become spicy at all?

Capsaicin is unique to the genus, but it is not understood how they got this trait.

**Genetic evidence:** structural rearrangements and duplication events.



## Advantages > Disadvantages

- Protection from insect pests and plant pathogens  
→ *Fusarium* (Fungus)
- Spicy chili plants are less drought tolerant than non spicy plants  
→ *Fusarium* thrives in wet regions
- *C. annuum* can grow better in wetlands and is more resistant against *Fusarium*
- Protection from mammals

*C. annuum* and *Fusarium* are spread across the entire world today and their regions overlap with each other almost perfectly. Spicy chili plants are at a clear advantage today!

It also seems highly probable that developing spiciness was to keep mammals away, as when they consume seeds, they digest them entirely, whereas birds do not digest them and therefore are best at spreading them.

### Evolutionary Fun fact!

The Tree Shrew was able to widen its pallet when it got a point mutation in its transient receptor potential vanilloid type-1 (TRPV1) ion channel (tsV1), which lowers its sensitivity to capsaicinoids.

## Diversity



Peppers come in a variety of **shapes**, **sizes**, **colors** and **spice levels**.

**Shapes** range from thick to slim and long to short.  
**Colors** range from red, orange, yellow to green and purple.

Five pepper species account for 50'000 pepper varieties, most of which are of the species *C. annuum*.

Species	Common pepper	Pungency [SHU]
<i>C. annuum</i>	Jalapeño	0-50k
<i>C. chinense</i>	Habanero	100k-350k
<i>C. frutescens</i>	Thai pepper	50k-100k
<i>C. baccatum</i>	Tabasco pepper	30k-50k
<i>C. pubescens</i>	Bishops crown	50k-250k

### Spiciest bred chilies:

Pepper	Ø Pungency [SHU]
Pepper X	3.18M
Dragon's Breath	2.48M
Carolina Reaper	2.2M
Trinidad moruga scorpion	2.0M



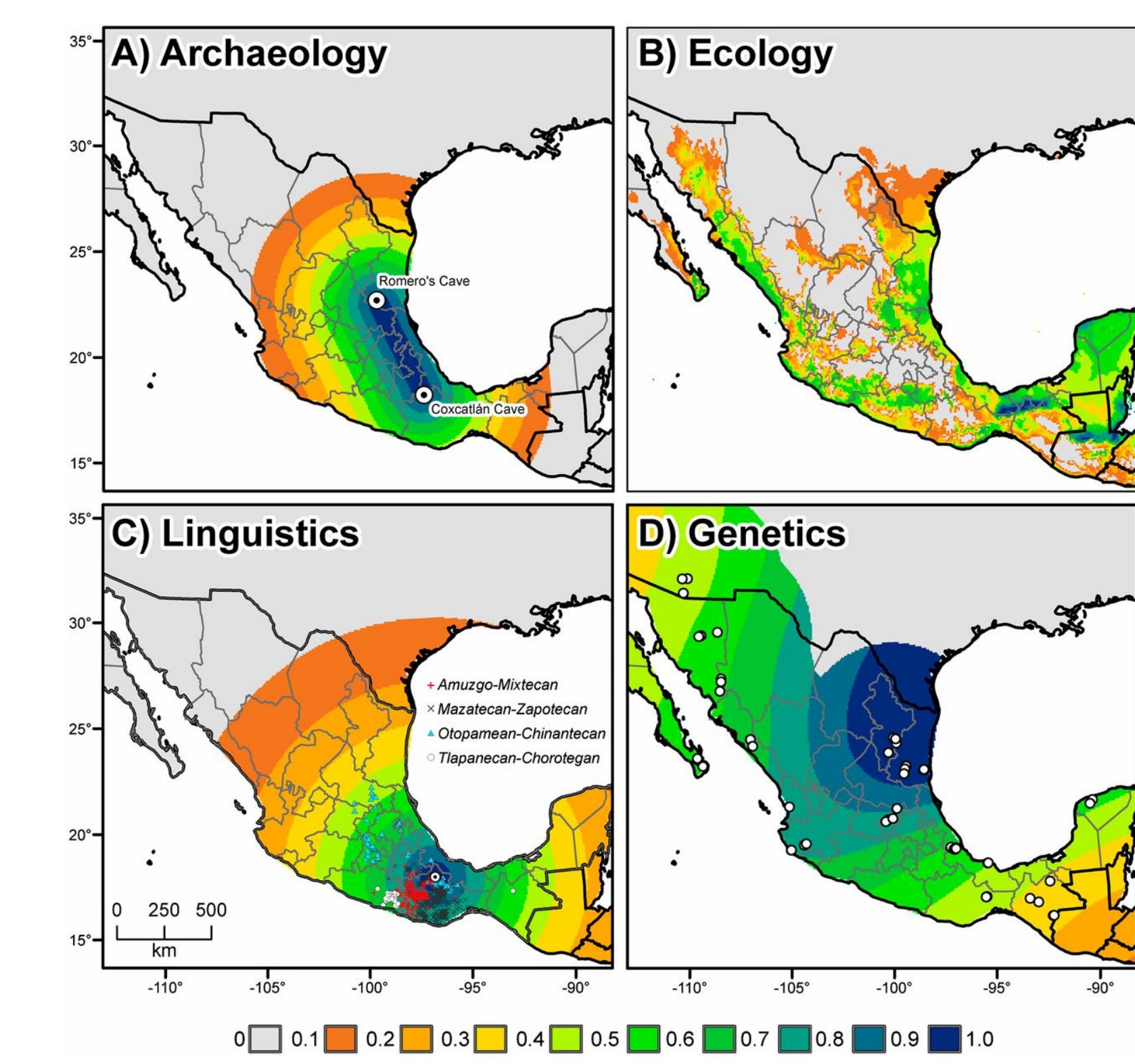
Pepper X, Dragon's Breath & Trinidad Scorpion

## Medicinal applications

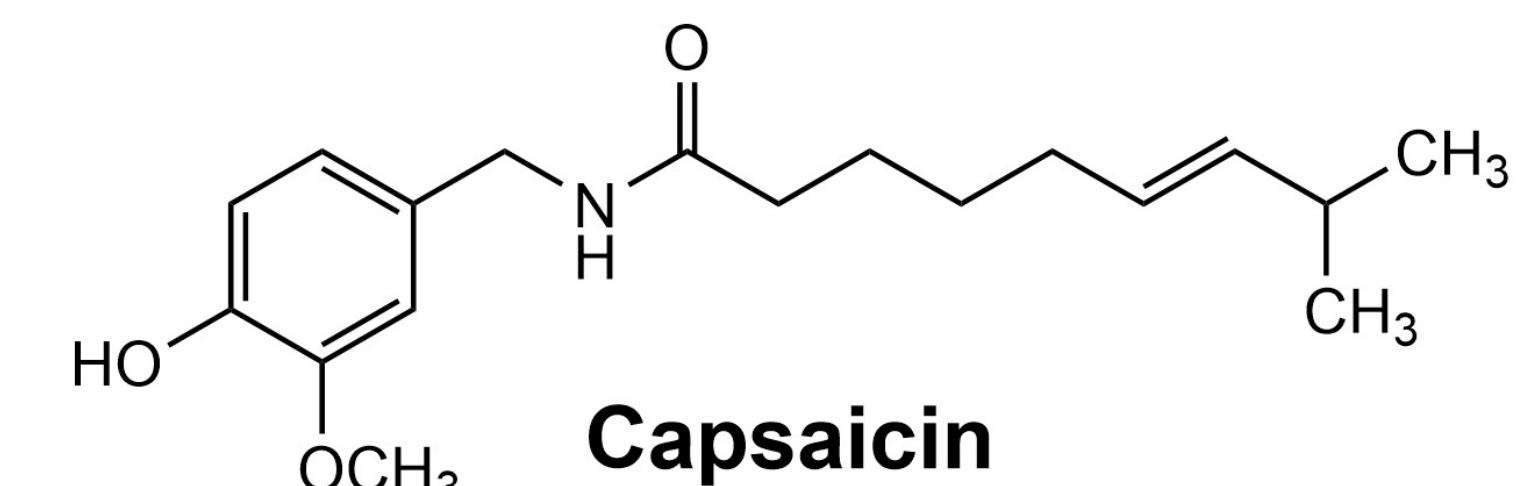
Used to help relieve pain by first stimulating and then decreasing the intensity of pain signals in the body. Is used for pain disorders, nervous system problems, cluster headaches, joint problems, skin conditions, mouth sores and many other disorders.

## Domestication

Study (2014) analysed the origin of Capsicum with species distribution modeling and paleobiolinguistics, with microsatellite genetic data and archaeobotanical data.



## Molecular aspects



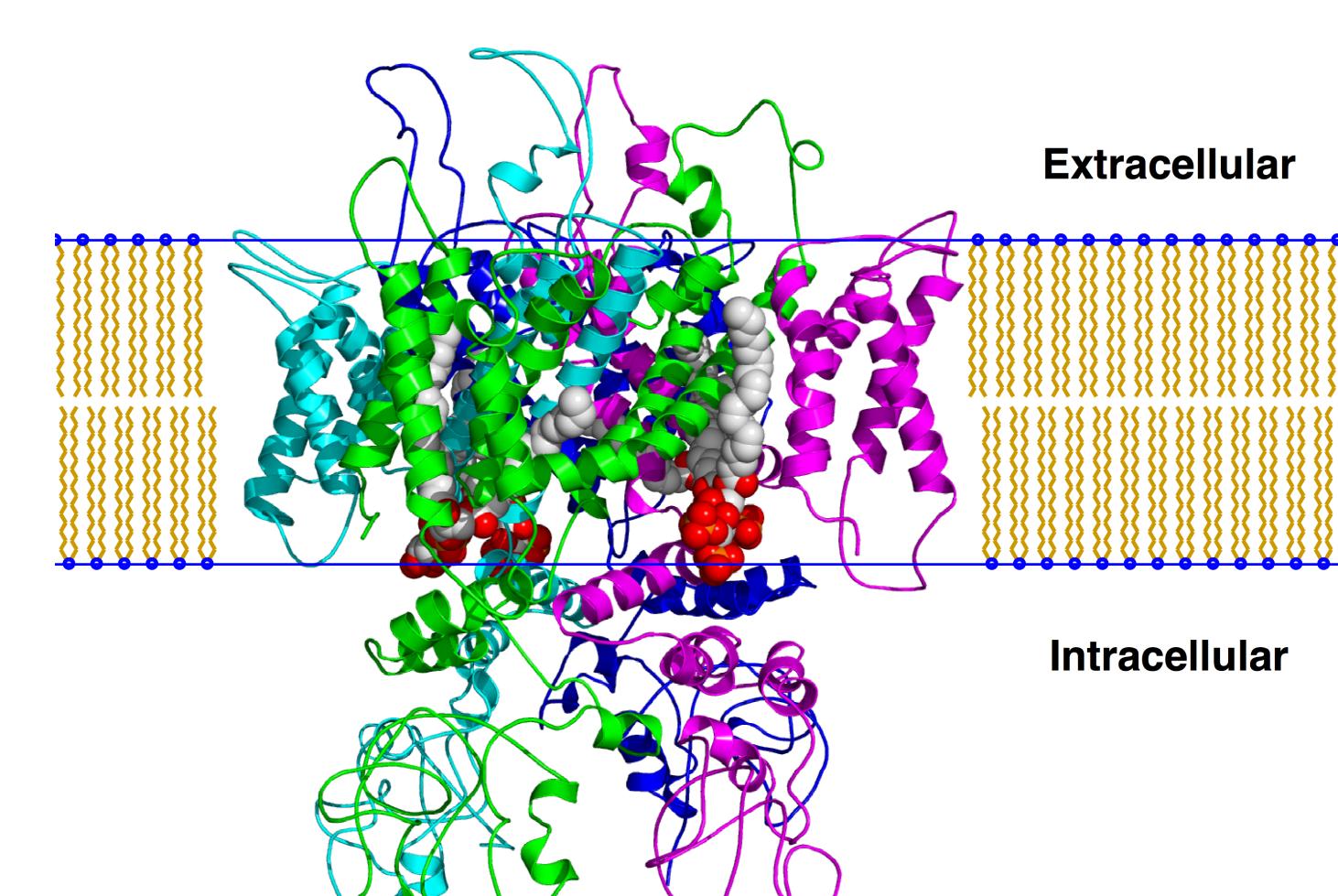
The infamous *spicy* molecule.

- Hydrophobic tail → can pass lipid membrane
- Can bind to the TRPV1 transmembrane receptor.
- TRPV1 is heat activated, but Capsaicin can activate it as well!

Capsaicin can penetrate the lipid bilayer, allowing it access to the transmembrane binding site of the TRPV1 receptor.

### TRPV1 receptor

Ancient receptor that appeared early in the evolution of vertebrates approx. 400 Mya. Function is to warn the organism of high levels of heat.



References