Sensory clues unlock molecular mysteries

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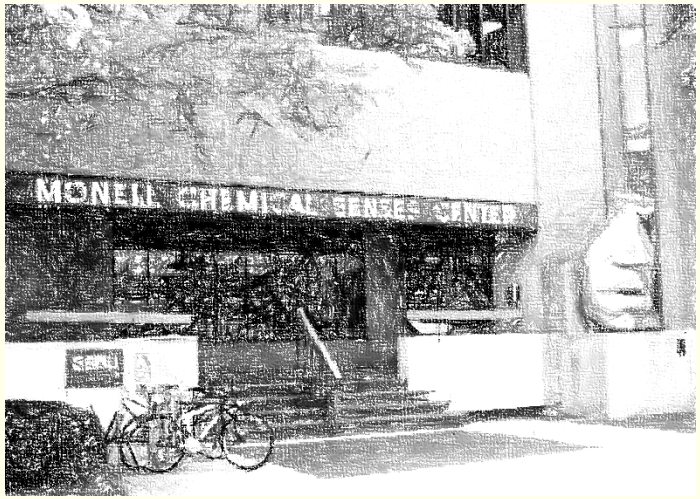
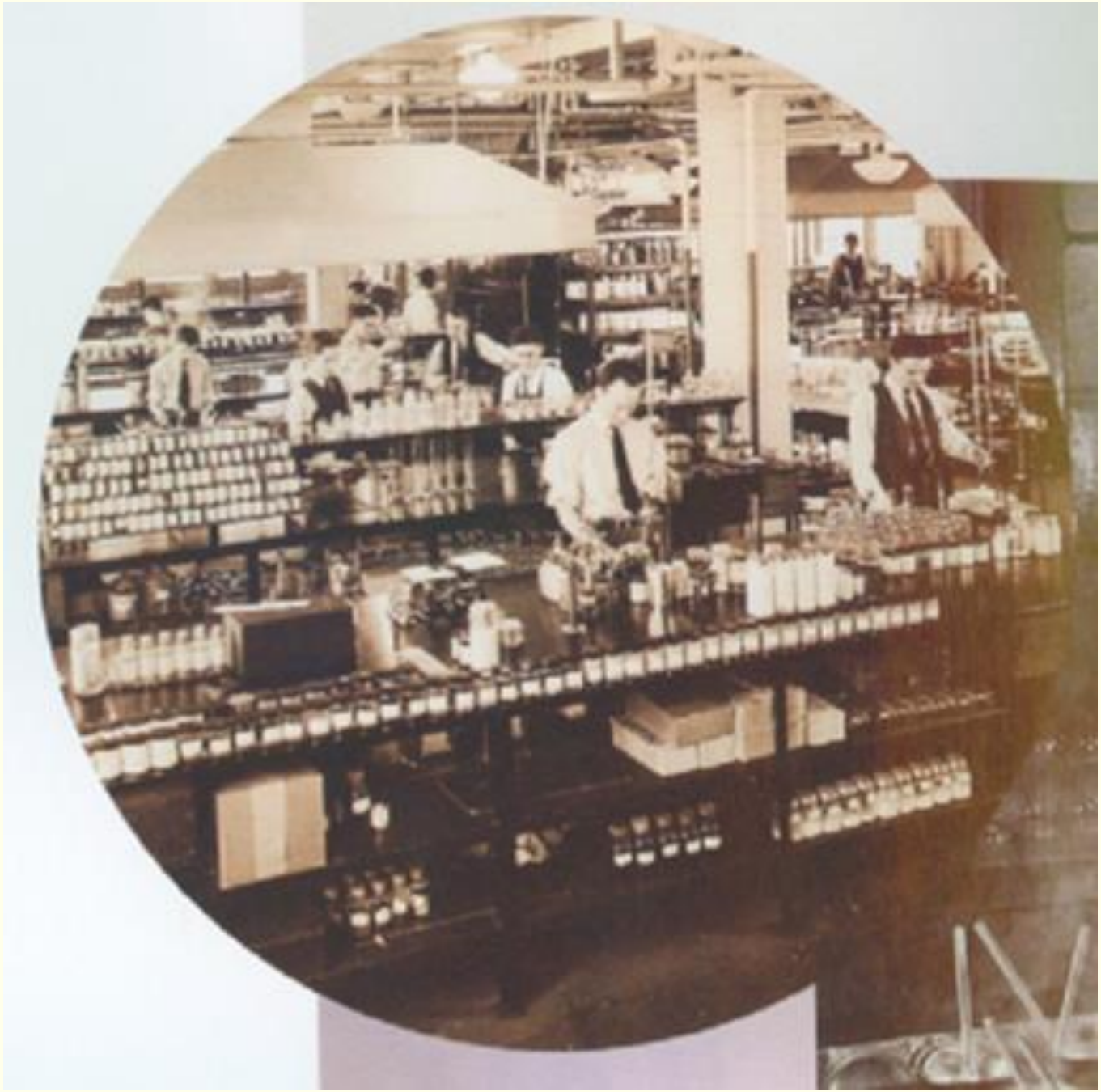




CHEMISTRY

Six In Ten "Tasteblind" To Bitter Chemical

"TASTEBLINDNESS" is the only term that can be found to describe the reaction of a fortunate forty per cent. of folk who cannot taste para-ethoxy-phenyl-thio-urea. For the other sixty per cent. find it intensely bitter—bitter as gall, bitter as quinine, bitter enough to make them go round sticking out their tongues and making wry faces for an hour.

This curious difference in perception has been discovered by Dr. Arthur L. Fox, of the laboratories of E. I. du Pont de Nemours and Company at Wilmington, Del. He has tried this very complex organic compound on everybody who would volunteer to taste it, and has found that approximately three-fifths of his "victims" declare it intensely bitter, while the rest say that it "has no more taste than sand."

Science News Letter, April 18, 1931



AAAS Convention, 1938.
(Cold Spring Harbor Laboratory Research Archives)

PTC - phenylthiocarbamide

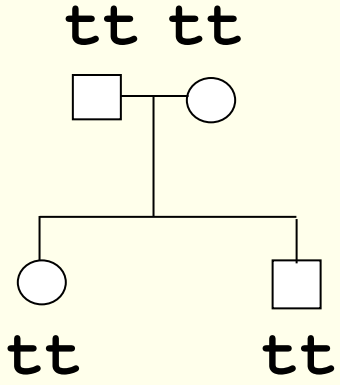
PTC T=Taster; t=non-taster

	T	T
T	TT	TT
T	TT	TT

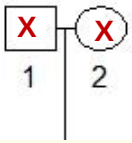
	T	t
T	TT	Tt
t	Tt	tt

	t	t
t	tt	tt
t	tt	tt

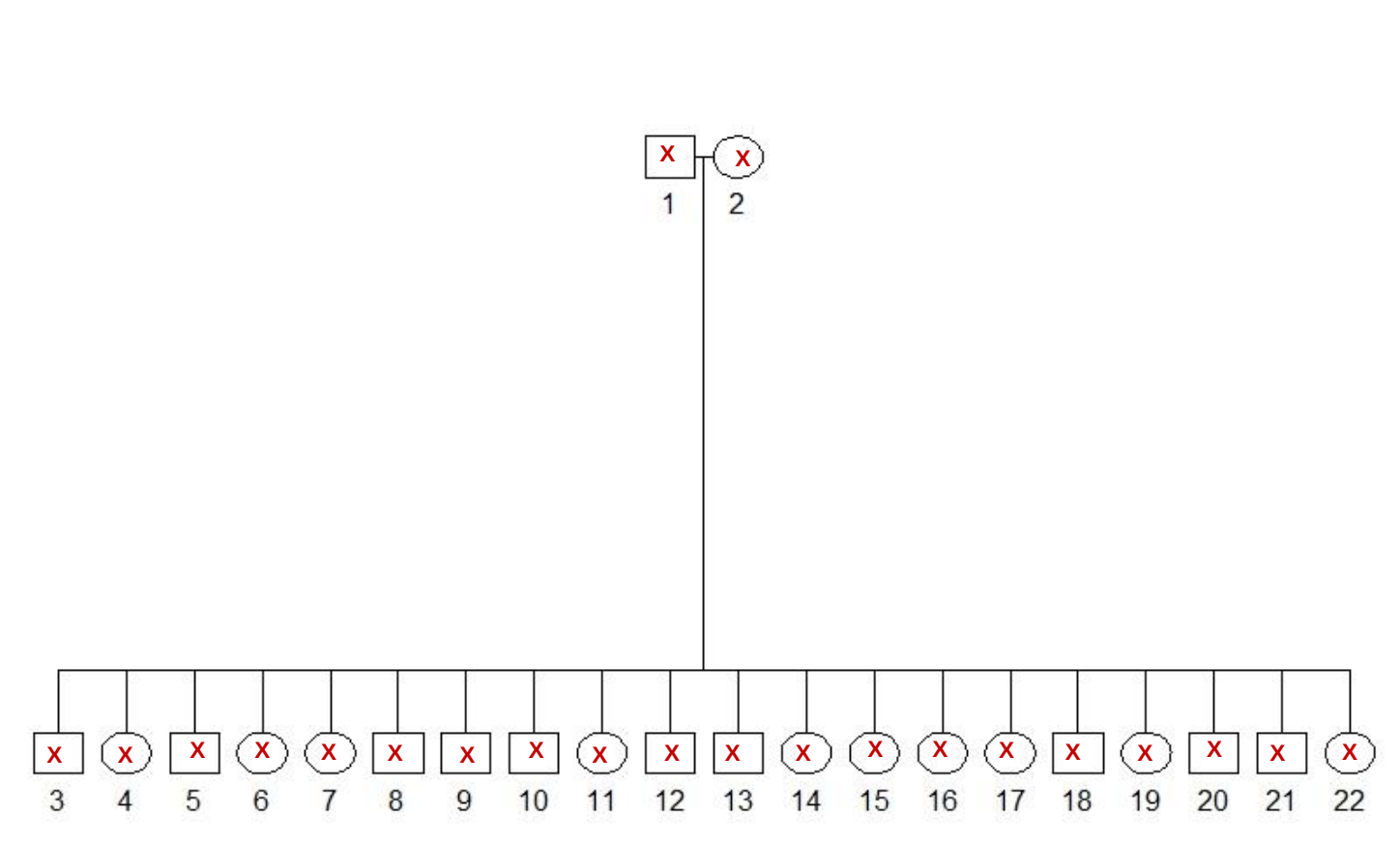




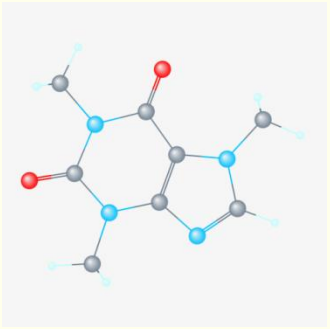
If the mother and father are PTC non-tasters



If the mother and father are PTC non-tasters, all children are PTC non-tasters too!

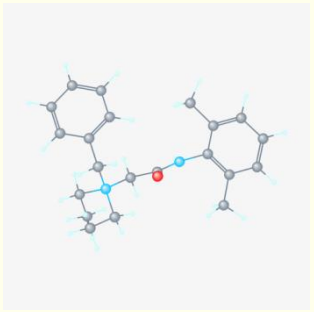


Sensory clue – selective insensitivity



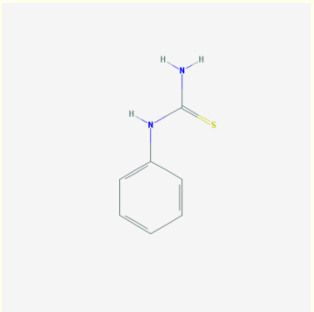
Caffeine

√



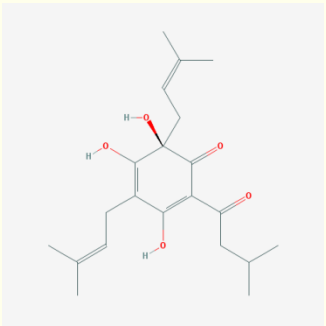
Denatonium benzoate

√



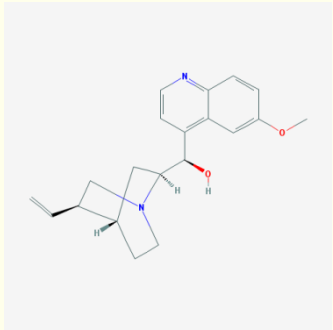
PTC

X



Humalone

√



Quinine

√

Two clues:

1. **PTC Non-taster inherited from parent to child**
2. **Selective to PTC**

Deduction:

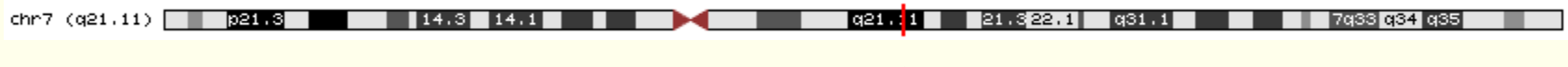
1. **DNA based gene difference**
2. **Multiple bitter receptors**
3. **PTC receptor is broken in some people**

DNA sequences from 10 people

```
Person 1  AATTAATTAATTGCAGCACCACGTGTGCA
Person 2  AATTAATTAATTCCAGCACCACGTGTGCA
Person 3  AATTAATTAATTCCAGCACCACGTGTGCA
Person 4  AATTAATTAATTCCAGCACCACGTGTGCA
Person 5  AATTAATTAATTGCAGCACCACGTGTGCA
Person 6  AATTAATTAATTCCAGCACCACGTGTGCA
Person 7  AATTAATTAATTGCAGCACCACGTGTGCA
Person 8  AATTAATTAATTGCAGCACCACGTGTGCA
Person 9  AATTAATTAATTCCAGCACCACGTGTGCA
Person 10 AATTAATTAATTGCAGCACCACGTGTGCA
```

DNA sequences from 10 people

```
Person 1   AATTAATTAATTGCAGCACCACGTGTGCA
Person 2   AATTAATTAATTCCAGCACCACGTGTGCA
Person 3   AATTAATTAATTCCAGCACCACGTGTGCA
Person 4   AATTAATTAATTCCAGCACCACGTGTGCA
Person 5   AATTAATTAATTGCAGCACCACGTGTGCA
Person 6   AATTAATTAATTCCAGCACCACGTGTGCA
Person 7   AATTAATTAATTGCAGCACCACGTGTGCA
Person 8   AATTAATTAATTGCAGCACCACGTGTGCA
Person 9   AATTAATTAATTCCAGCACCACGTGTGCA
Person 10  AATTAATTAATTGCAGCACCACGTGTGCA
```



PTC Tasters

```
Person 1   AATTAATTAATTGCAGCACCACGTGTGCA

Person 5   AATTAATTAATTGCAGCACCACGTGTGCA

Person 7   AATTAATTAATTGCAGCACCACGTGTGCA

Person 8   AATTAATTAATTGCAGCACCACGTGTGCA

Person 10  AATTAATTAATTGCAGCACCACGTGTGCA
```

PTC Non-tasters

```
Person 3   AATTAATTAATTCCAGCACCACGTGTGCA

Person 6   AATTAATTAATTCCAGCACCACGTGTGCA

Person 9   AATTAATTAATTCCAGCACCACGTGTGCA

Person 4   AATTAATTAATTCCAGCACCACGTGTGCA

Person 2   AATTAATTAATTCCAGCACCACGTGTGCA
```

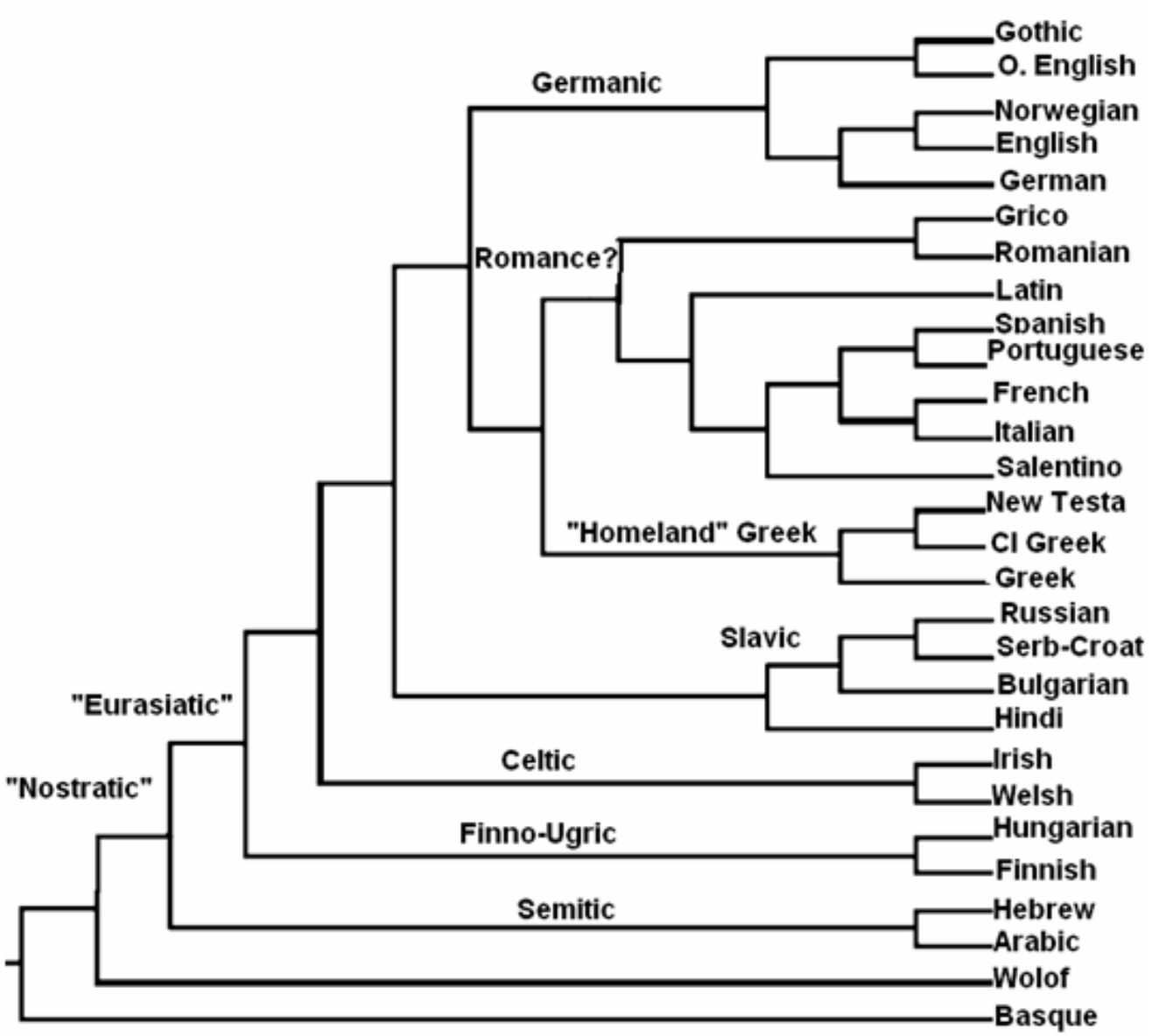
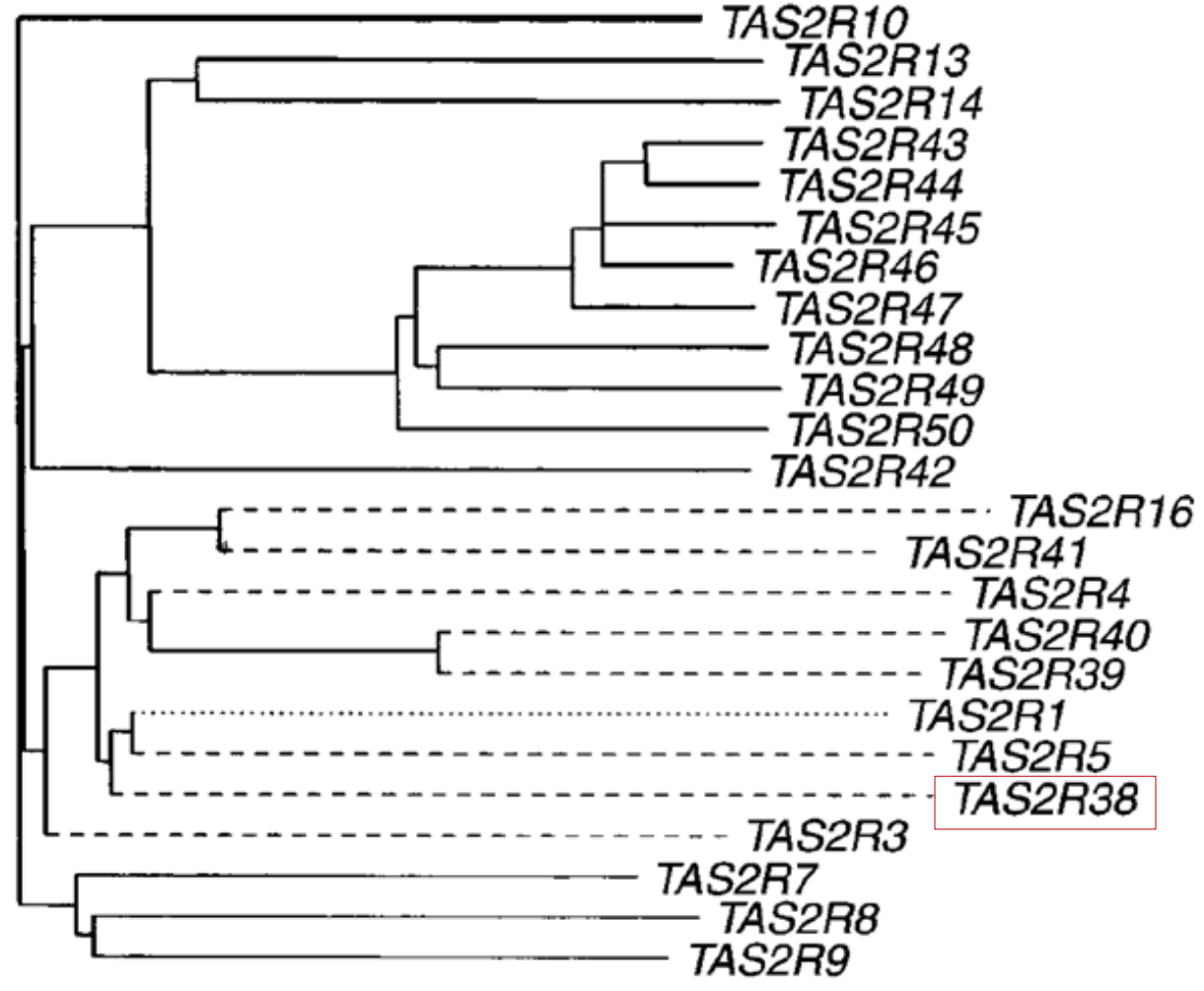


Fig. 6. Phylogenetic tree of 28 languages, adapted from Longobardi and Guardiano (2009)



AATTAATTAATTCCAGCACCACGTGTGCA



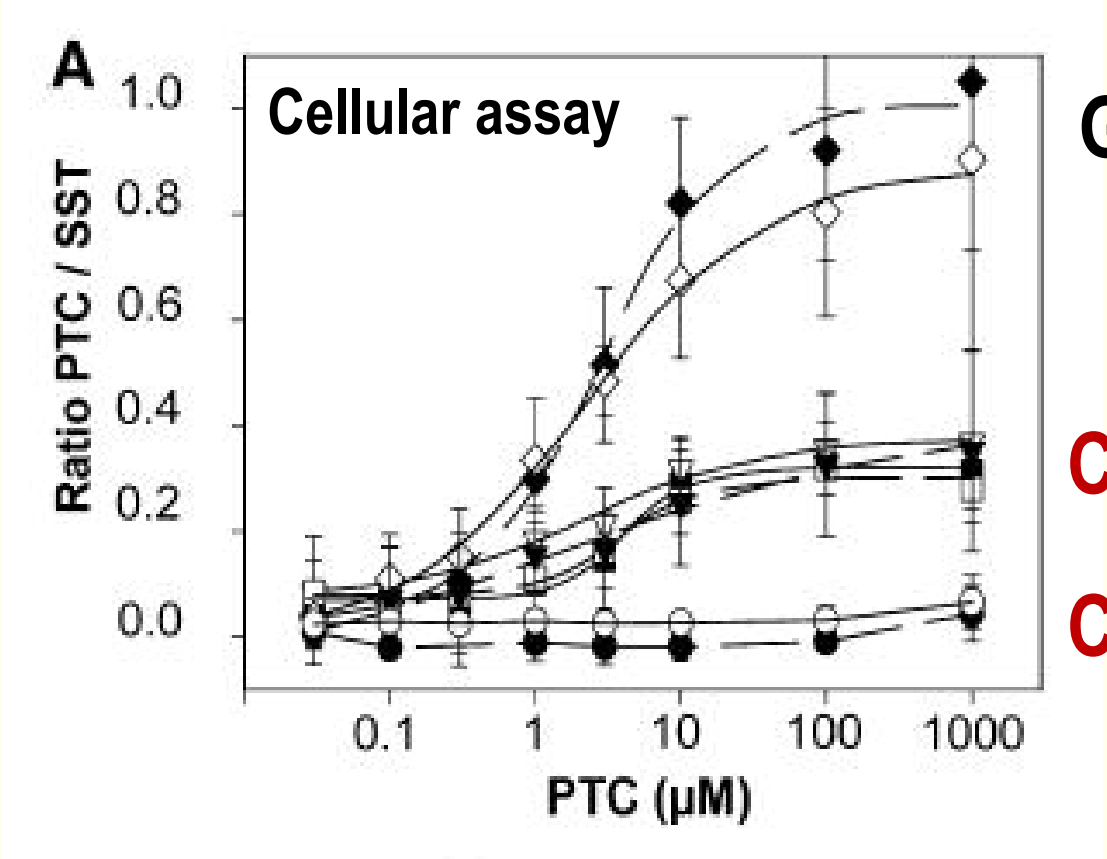
Bufe et al 2003

PTC Tasters

Person 1 AATTAATTAATTGCAGCACCACGTGTGCA

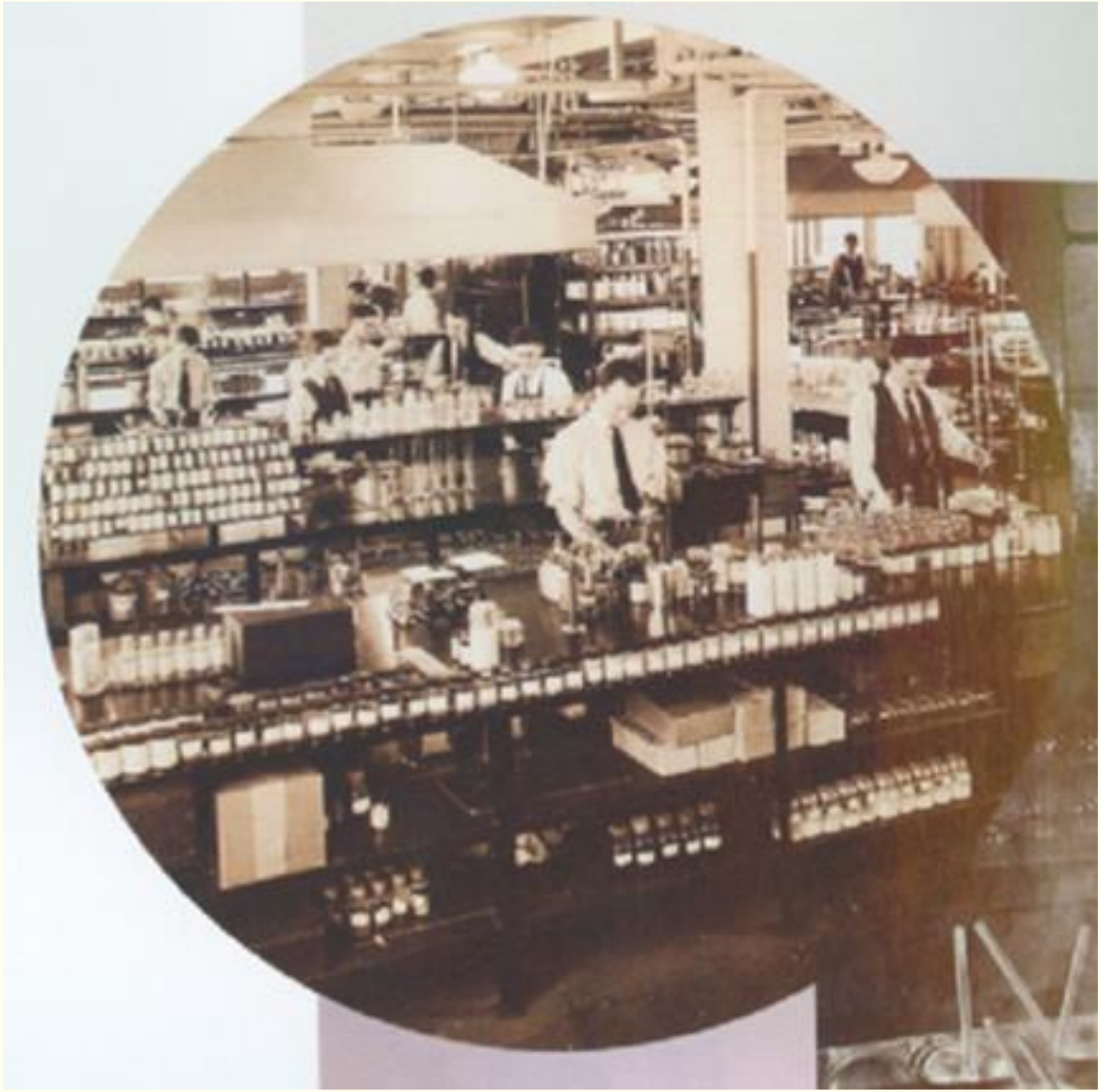
PTC Non-tasters

Person 2 AATTAATTAATTCCAGCACCACGTGTGCA



TAS2R38 genotype

PTC = bitter compound
SST = control condition
Bufe et al 2005



Two clues:

1. **PTC Non-taster inherited from parent to child**
2. **Selective to PTC**

Confirmed:

1. **DNA based gene difference**
2. **Multiple bitter receptors**
3. **PTC receptor is broken in some people**

Practical uses of sensory genotype data?

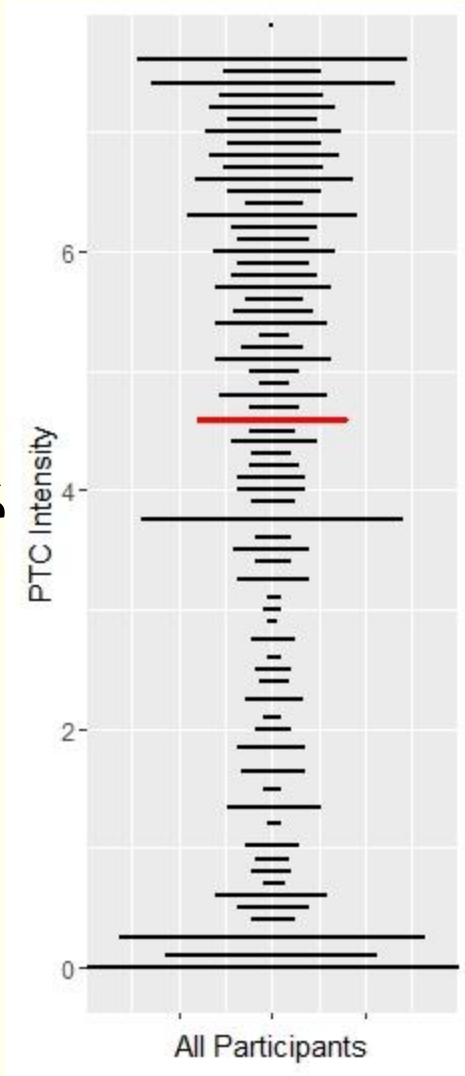
Evaluate:

Personnel

testers – those who collect sensory data
panelist – person providing data

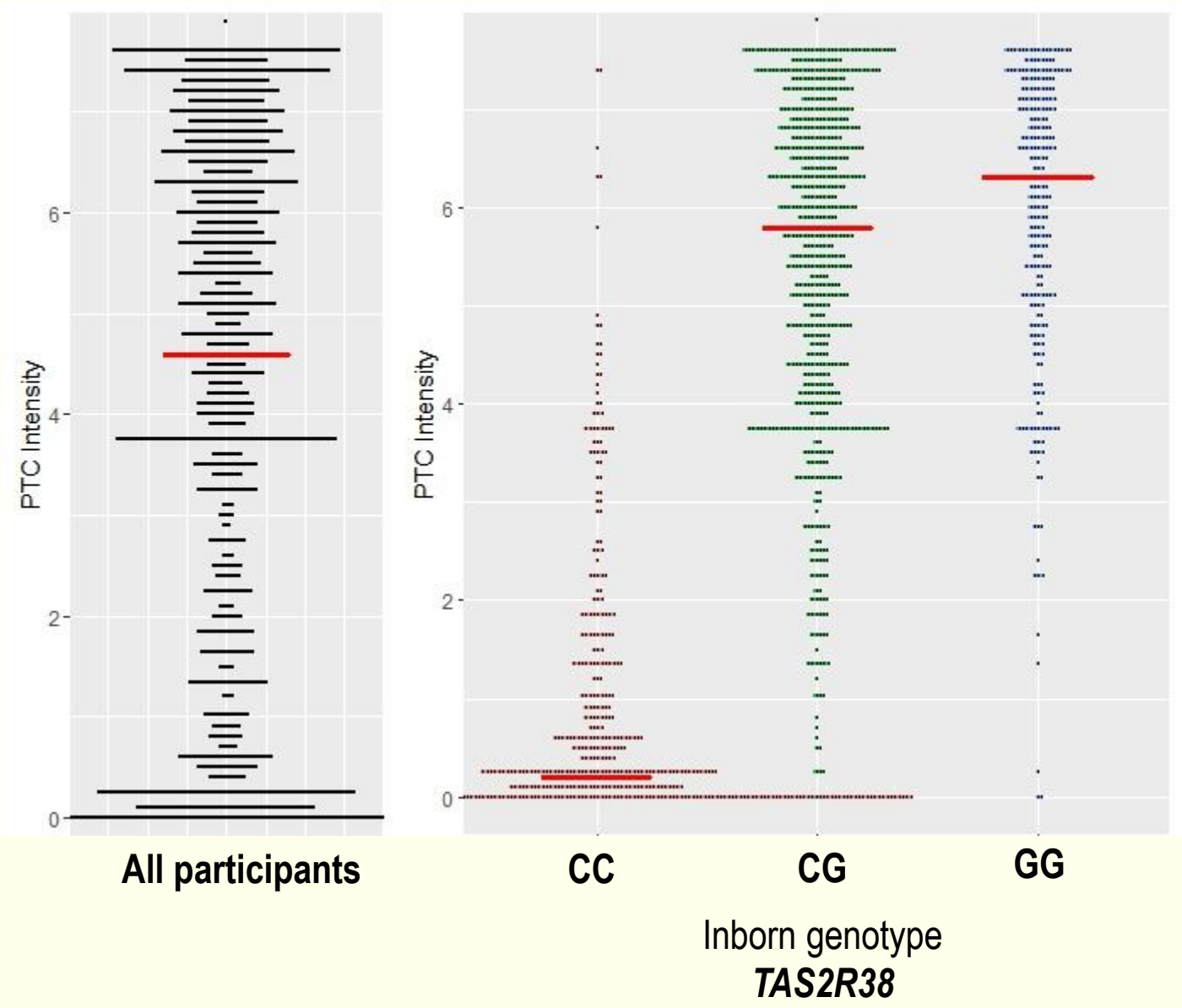
Testing methods

PTC intensity, scale units



About 70% of variation due to genotype

PTC intensity, scale units

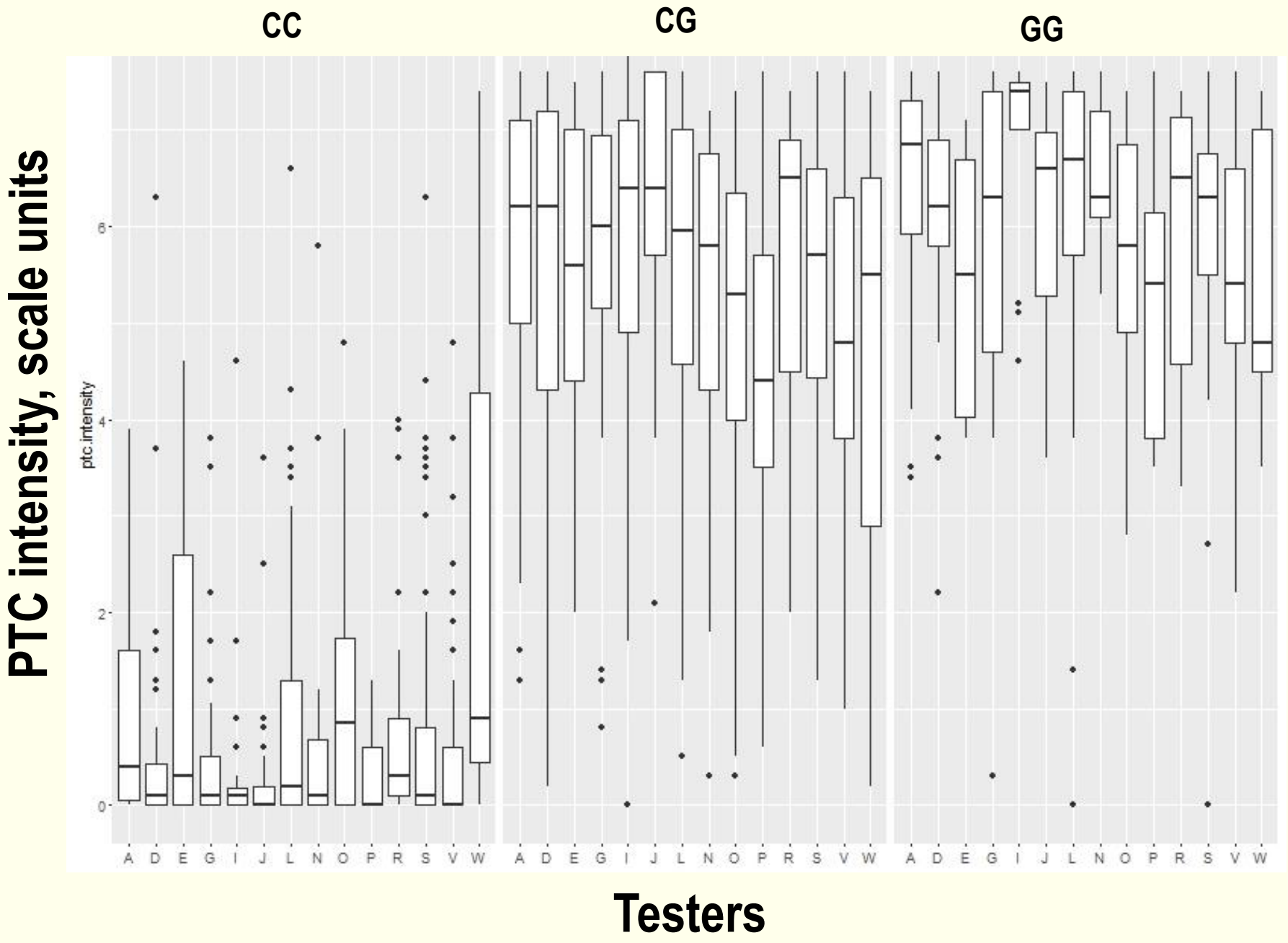


Tester effects



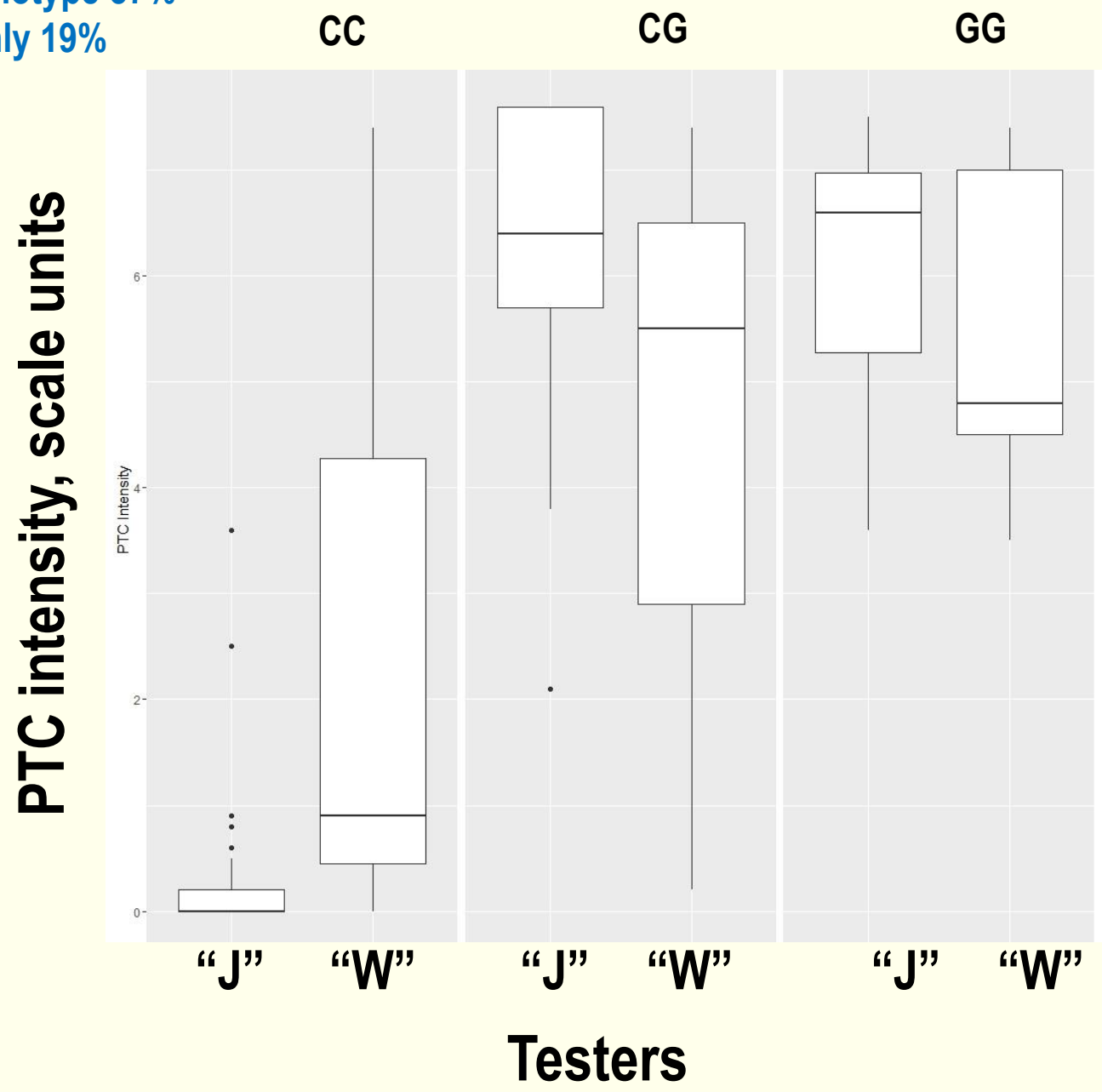
Overall, genotype explains 70% of variance across all testers

Inborn genotype
TAS2R38

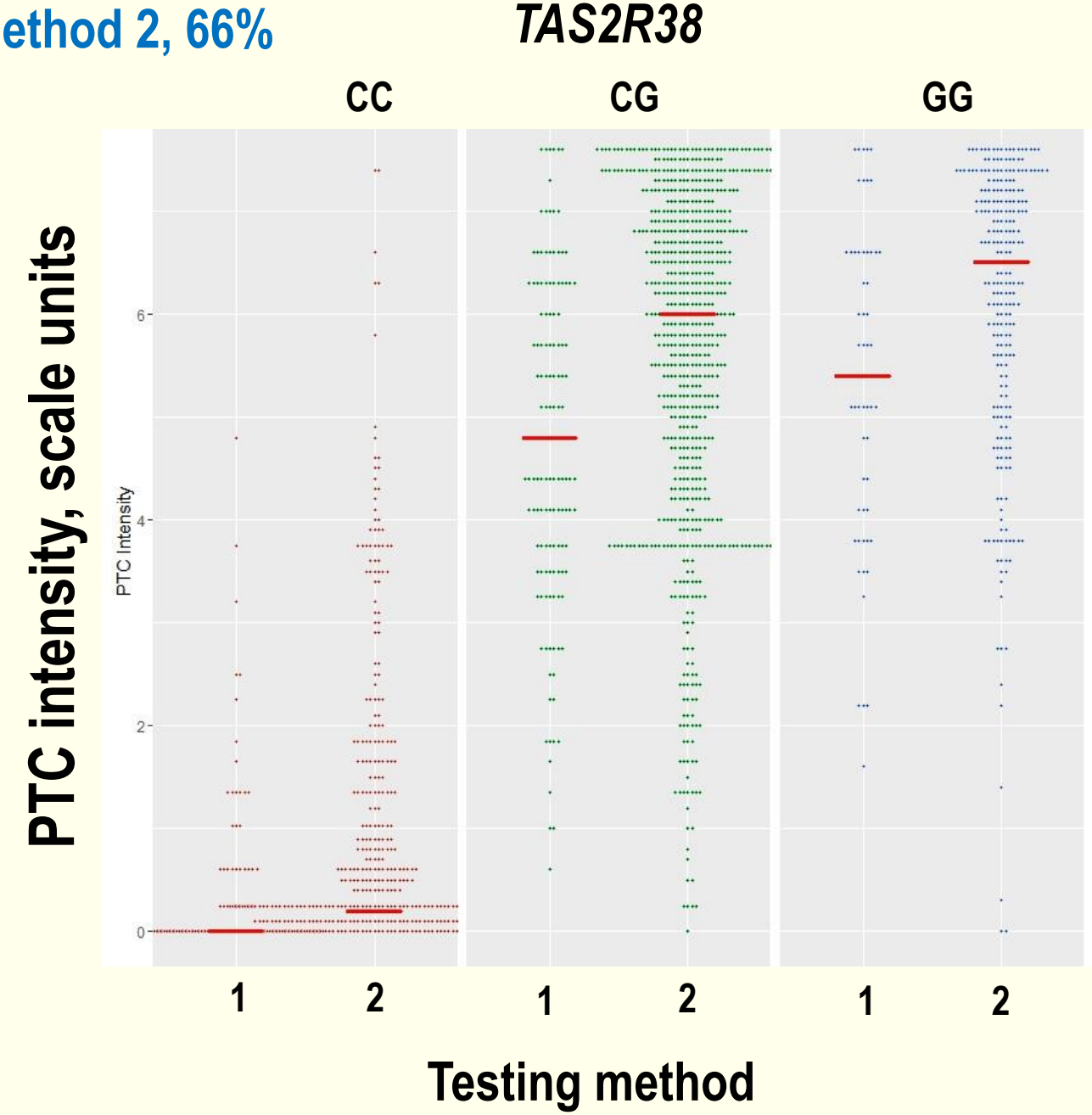


Inborn genotype
TAS2R38

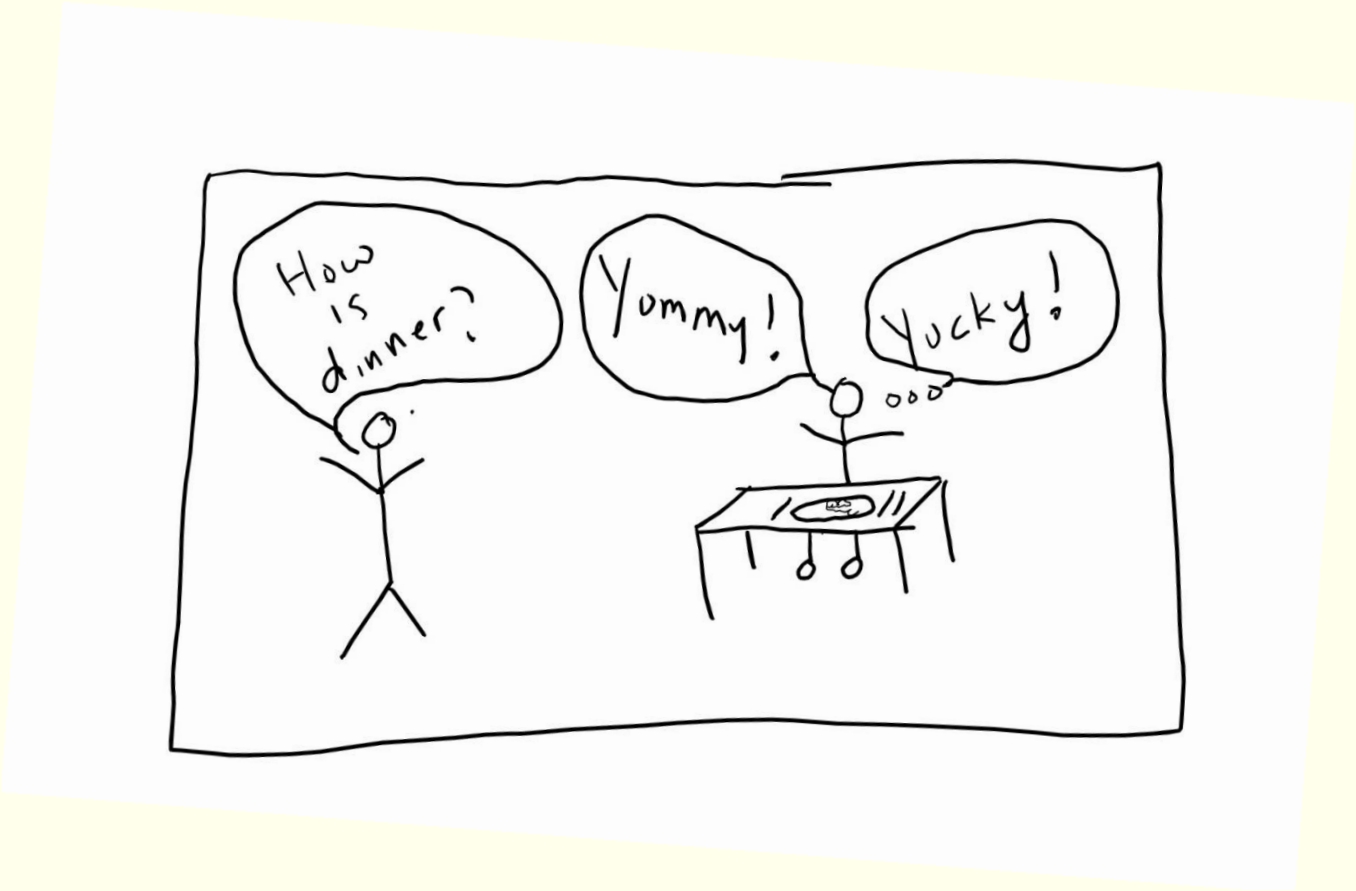
Tester J, genotype 87%
Tester W, only 19%



Testing method 1, 70%
Testing method 2, 66%



Genotype (e.g., GG) can validate in part: sensory self-report, testers and methods



Sensory Forensics?

