A Novel Sodium Channel in the Mammalian Taste System

Melissa N. Fillmore (Department of Biology, **Dane Hansen** (Mentor), **Tim Gilbertson** (Mentor)

Utah State University
DEPARTMENT OF BIOLOGY

ABSTRACT

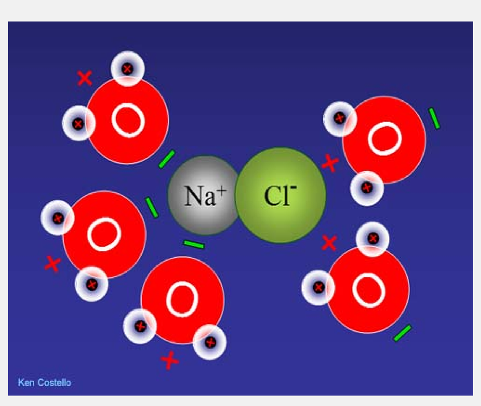
Salty taste, one of the five taste qualities recognized in the mammalian peripheral gustatory system is thought to be mediated by an ion channel receptor. The epithelial sodium channel, ENaC, is thought to be the channel for salt taste transduction. ENaC is crucial in regulating salt reabsorption, helps control overall salt and water homeostasis in an organism, and contributes to blood pressure. While ENaC plays an important role in salt taste perception, it is responsible for only part of the total sodium transduction pathway in humans, suggesting that there may be another component in the salt transduction mechanism. We have been investigating a novel sodium-permeable channel involved in the resting leak permeability of Na^+ that may contribute to salt transduction in the mammalian taste system. Understanding the salt taste transduction pathway in animals would improve our ability to diagnose and advise people who suffer from high blood pressure or heart disease. To test for the role of this other channel in salt taste, both a behavioral assay to determine how it is involved in innate salt preference and a molecular biological approach to determine what type of taste cell this putative salt transduction channel is expressed in will be used.

HYPOTHESIS

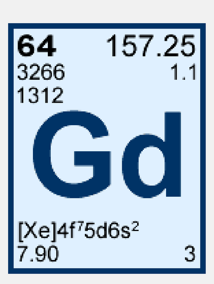
There is another mechanism in salt taste reception; it is an amiloride-insensitive channel.

RESEARCH PLAN

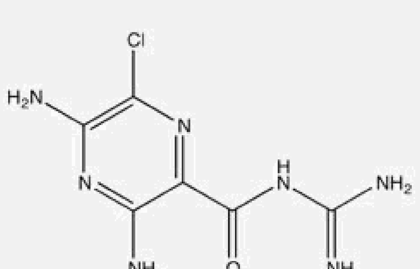
48h Preference Tests



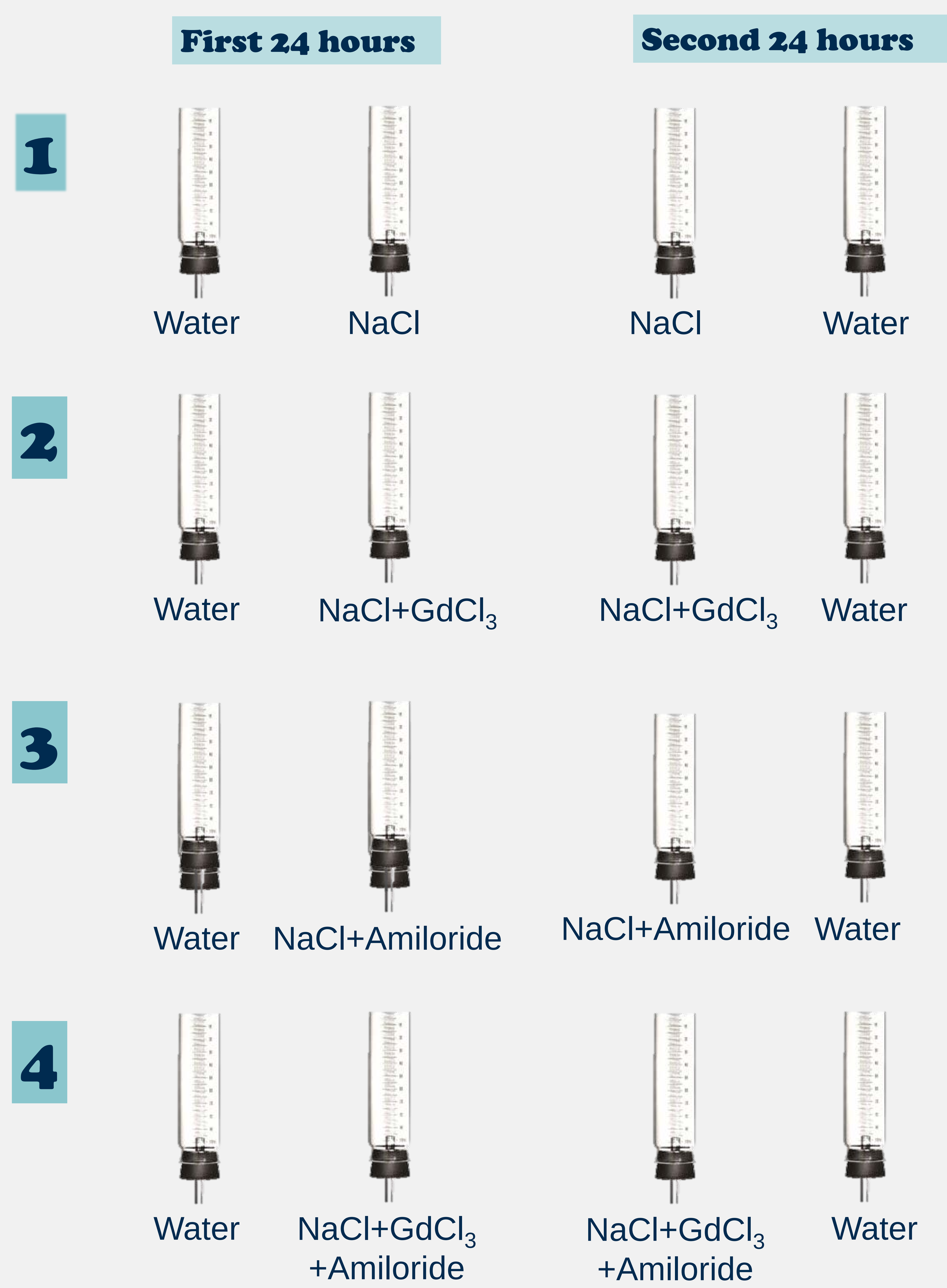
75 mM NaCl



10 µM gadolinium ion (novel channel inhibitor)

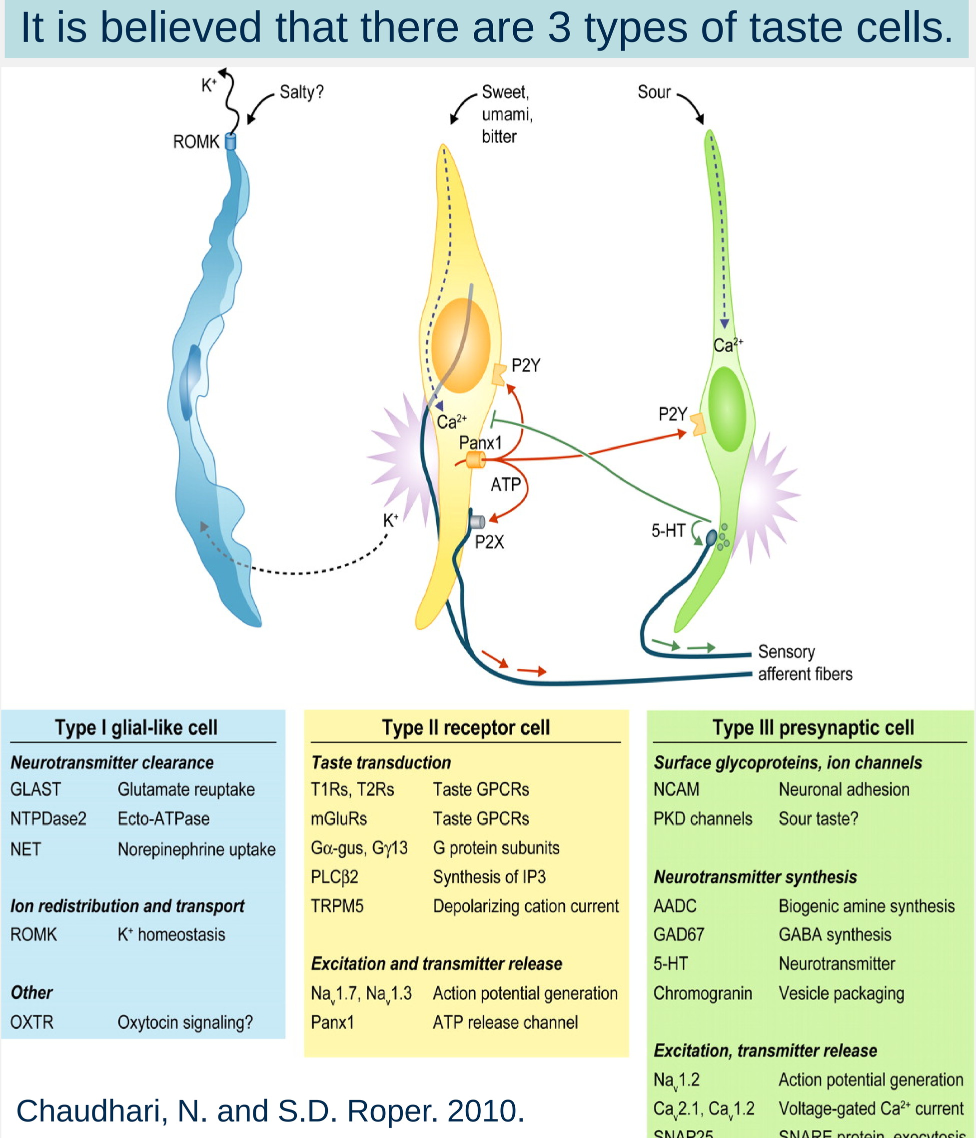


30 µM amiloride ion (ENaC inhibitor)



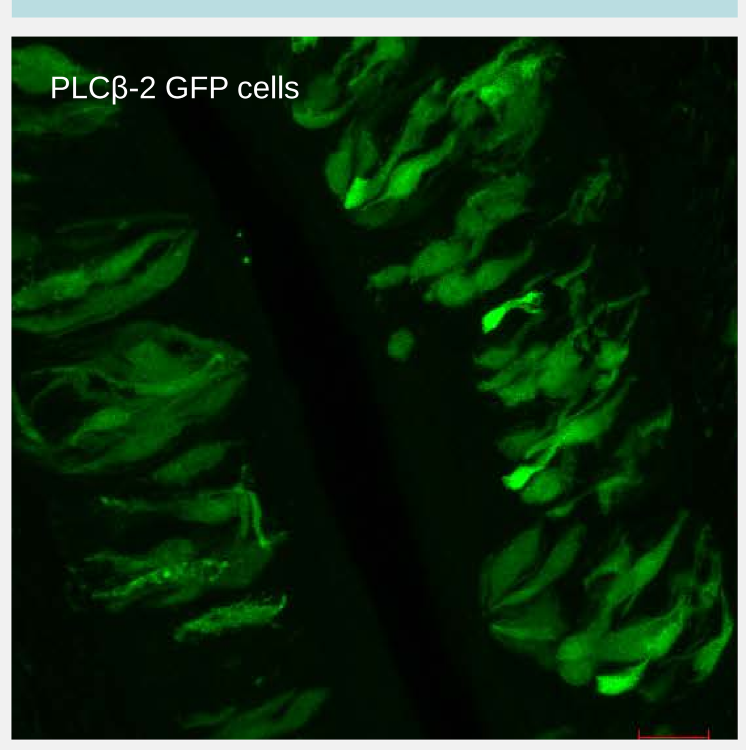
Molecular Assay

It is believed that there are 3 types of taste cells.



Chaudhari, N. and S.D. Roper. 2010.

GFP labeled cells will be collected from transgenic mice and assayed for expression of ENaC and the novel sodium channel

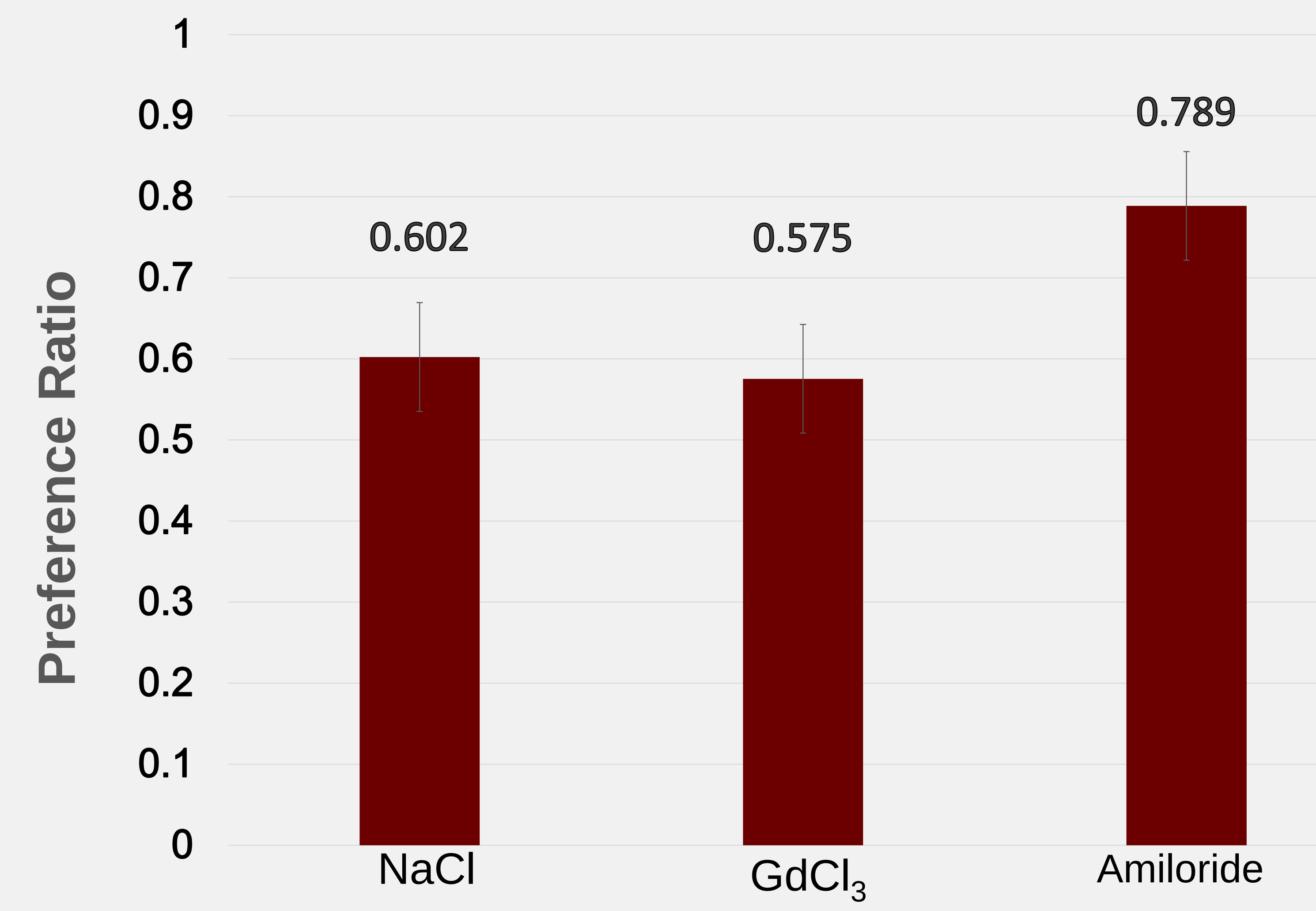


RESULTS

Innate Side Preference Test

* In the Innate Side Preference Test, both left and right side tubes had water. This test was done to determine if mice had an innate side preference.

Solution Preference



CONCLUSIONS

- From the results of the Innate Side Preference Test, it appears that the mice had no significant side preference.
- Results from the Solution Preference tests indicate that the mice do have a preference for salt (NaCl).
- There appears to be a slight but insignificant difference between salt preference for the NaCl solution and the [NaCl + $GdCl_3$] solution.
- Preference for NaCl appears to be increased in the presence of amiloride. This is contrary to my hypothesis because amiloride is an inhibitor of the ENaC and should block, to some degree, the preference for salt. This may reflect that some mice find 75 mM NaCl to be slightly aversive.

FUTURE PLANS

I plan on completing the rest of the behavioral study as outlined in the preference test section. After completion of that, I will move on to the molecular analysis portion. Using the methods outlined above, I plan to determine if ENaC and the novel sodium channel are expressed in a specific cell type. Understanding the ways our bodies respond to food, and salt specifically, will have significant implications for future health.

REFERENCES

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