TRPM8-neurons mediate the inhibition of itch at cold temperatures

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Introduction

Sensory itch is a common experience that is regulated by different sensory neurons. The transient receptor potential channel TRPM8 is a molecular sensor of cold stimuli. Therefore, the primary sensory neurons expressing TRPM8 are required for detecting noxious cold sensations. My hypothesis is that cooling inhibits serotonin-induced itch by activating TRPM8-neurons. Therefore, TRPM8-neuron ablated mice injected with serotonin should not show reduced itch behaviors at cold temperatures.

Hypothesis

If cooling inhibits serotonin-induced itch by activating TRPM8-neurons, then TRPM8-neuron ablated mice injected with serotonin should not show reduced itch behaviors at cold temperatures.

Methods

• 30µg of Serotonin was injected into one hind paws TRPM8-neuron ablated mice.
• Mice were placed on a plate set to 24°C or 17°C.
• Duration of itch from the injected paw was measured over 30 minutes post-injection.

My hypothesis is that cooling inhibits serotonin-induced itch by activating TRPM8-neurons. Therefore, TRPM8-neuron ablated mice injected with serotonin should not show reduced itch behaviors at cold temperatures.

Results

Figure 1. Cooling inhibits serotonin-induced itch
The wild-type animals placed at 24°C itched for xx +/- yy seconds. (blue bar) This is statistically significantly more than the behavior displayed by mice at 17°C in the same time (aa +/- bb seconds, student’s t-test: p<0.05, red bars).

Figure 2. Cooling-mediated inhibition of itch needs TRPM8-neurons
1. M8-neuron ablated animals placed at 24°C display yy +/- rr seconds of itch-behavior. These numbers are not significantly different from wildtype mice placed at 24°C (aa +/- bb seconds, student’s t-test: p>0.05, red bars).
2. M8-neuron ablated animals however, continued to itch at 17°C (ee +/- ff seconds). Their behavior was not statistically significantly different from either ablated-mice or wildtype mice placed at 24°C.

Conclusion

My results showed that at the control temperature of 24°C wild mice and ablated mice do not show a significant difference in the duration of itch. Comparing the results of wild type mice at 24°C vs. wild type mice at 17°C shows that serotonin-induced itch is reduced in wild type mice at 17°C. When comparing wild type mice with ablated mice, Ablated mice don’t have TRPM8-neurons and therefore do not show a reduction in itch at cold temperatures. My results indicate that TRPM8-neurons are required to inhibit serotonin-induced itch at 17°C.

Next Step

1. Test the effects of painfully cold temperatures such as (10°C)
2. Test other itch-inducing compounds such as histamine, bam8-22 and SLIGRL-NH2
3. Determine if variation of temperatures inhibit chronic itch
4. Reduce error - test on more mice

References

1. McKemy, David D. Chapter 13 TRPM8: The Cold and Menthol Receptor. 2007

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