

All itches not created equal -- Different parts of brain activated depending on cause

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Intense itching and the urge to scratch are symptoms of many chronic skin ailments. A new study conducted by Oxford University researchers has found that different reactions in the brain to two common allergy triggers -- allergens (pollen and dust) and histamine (allergy cells within the body caused by foods, drugs or infection) -- may shed some light on the itch-scratch cycle.

The Study

The study is entitled *Itch and Motivation to Scratch: An Investigation of the Central and Peripheral Correlates of Allergen- and Histamine-Induced Itch in Humans*. The research team was comprised of Siri G. Leknes, Susanna Bantick, Richard G. Wise and Irene Tracey, all of the Department of Physiology, Anatomy and Genetics, Oxford University, Oxford, UK and Centre for Functional Magnetic Resonance Imaging of the Brain (FMRIB), Clinical Neurology, Oxford University, Oxford, UK; and Carolyn M. Willis and John D. Wilkinson, both of the Department of Dermatology, Amersham Hospital, Amersham, UK.

The results of the study are published in the online edition of the *Journal of Neurophysiology* (<http://jn.physiology.org/>). The journal is one of the 14 scientific publications published by the American Physiological Society (APS) every month.

Methodology Overview Laser Doppler Study

Twenty eight female volunteers were recruited for the study, of which 14 tested positive (atopic cohort) for type I allergens (grass pollen and/or house dust mite) and 14 did not (non-atopic cohort). Over three consecutive days the atopic cohort was challenged with either their specific allergen or histamine, along with the saline control group, by applying a skin prick to the forearm. Non-atopic subjects were challenged with histamine and saline on two consecutive days.

The subjects rated itch intensity continuously on a scale of 0 (no itch) to 10 (worst itch imaginable). Itch related skin blood flow changes for both groups were measured by laser Doppler. Data points from the laser Doppler were summated and mean values and standard deviations were calculated for each cohort.

fMRI Imaging Study

Sixteen males and females comprised a second group of atopic and non-atopic individuals. As part of the study participants laid down in an fMRI (functional magnetic resonance imaging) scanner. A standard whole-brain gradient echo-planar imaging sequence was used to obtain the functional scans. Sixty seconds after participants reclined they received a skin challenge to the toe area.

The volunteers were presented with a screen showing a simplified itch rating scale of 0 (no itch) to 5 (worst itch imaginable). Subjects pressed a button to rate the itch they felt when the scale was presented. Following the test each subject's mean rated itch intensity was computed and the differences between types of itch were explored using a t-test. Correlations between mean itch ratings in the two groups were investigated using SPSS.

Results

After examining the data obtained at the different itch sites, the different itch scales, and the gender differences between the study populations, the researchers determined that extensive commonalities existed between allergen- and histamine-induced itch. Among them was the extensive involvement of the brain's motivation circuitry in response to both types of itches.

Researchers also observed differences, including:

- allergen-induced itch intensity ratings were higher compared to histamine;
- perception of itch and changes in blood flow were significantly greater when allergen induced;
- itch intensity perception and the changes in blood flow occurred significantly later in response to allergen, and while the sensations took longer to appear, they were perceived to exist for significantly longer periods;
- itch elicited by allergens activated different parts of the brain, specifically the supplementary motor and posterior parietal areas; and
- the differences found in the orbitofrontal regions of the brain imply a compulsion to do something (i.e., scratch) that is very strong in the allergen group. This is presumably due to the heightened intensity of the itch. There are similarities to the activity in this area of the brain and other disorders that display compulsive behavior. This might help to explain why eczema sufferers scratch to the point of harm because they are compelled to do so and cannot help themselves.

Conclusions

While there are extensive commonalities between allergen- and histamine-

induced itch, perceptions about the intensity and the parts of the brain that are activated by allergens differ when compared to histamine. As a result, mothers who admonish their children to stop itching may now be rightly told “I can’t.” For mold and grass-related itches, it appears that science is on their side.

Source: American Physiological Society

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