Why do we itch and scratch?

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Introduction

Most of us experience itch multiple times a day and a quick scratch usually abolishes it[1]. This everyday itching and scratching is useful (e.g. in removing harmful stimuli[2]) and can also be enjoyable[3]. Unfortunately, itching and scratching can also be debilitating problems.

Itching and scratching are common and reduce quality of life

Chronic itching has both dermatological and non-dermatological causes and is the dominating skin complaint at the population level[4]. As well as being widespread, itching and scratching have been associated with anxiety, depression and suicidal ideation[5–7]. Thus, they have a major impact on population quality of life.

The physiology of itch

Although itch is felt as a skin sensation, it is a product of the activity of the central nervous system. This essay presents an overview of the different stages of itch signalling, including mechanisms underlying chronic itch.

Itch signalling in the skin

Itch signalling in the skin stimulates itch-sensitive nerve fibres. Various signals stimulate these nerves, including chemicals from outside or inside the body and mechanical signals. Skin itch signalling is not a linear process but involves interactions between many

cell types and positive feedback loops. Chronic itch occurs when inflammatory itch signalling continues long-term, for example due to a defective epidermal barrier[8].

Itch signalling by sensory nerves

Itch-sensitive sensory neurons receive signals from the skin and transmit them to the spinal cord. Any changes in sensory neurons that increase their firing could mediate chronic itch. Examples include a reduced activation threshold or aberrant firing due to nerve damage[9,10].

Itch signalling in the spinal cord

The neurons of the spinal cord process the itch signal and relay it to the brain. Their role gives them the potential to modify itch signals. Damage or dysfunction can influence chronic itch. For example, aberrant itch processing can evoke itch in response to normally non-itchy stimuli, such as light stroking[11].

Itch processing in the brain

The brain is the final processing centre of itch, where activation of specific areas leads to itch perception[12]. Numerous brain regions are activated, including areas involved in sensation as well as motor actions, emotion and motivation[13,14].

The brain itself can underlie chronic itch. One demonstration of this is the disorder of delusional parasitosis[15], but brain processing is also altered in patients with other chronic itchy diseases, suggesting changes in how they perceive and respond to itch[16].

The physiology of scratch

Itching and scratching may have evolved together, allowing itching to sense and scratching to remove harmful stimuli from the skin[2]. Scratching uses slightly painful stimuli

to inhibit itch at the level of the spinal cord[1,12,17]. However, chronic scratching promotes itch. For example, scratching causes skin inflammation and also activates pain pathways that facilitate itch transmission in the spinal cord[18]. The perceived pleasure of scratching is addictive and prolongs the problem[13,16]. Scratching can therefore make chronic itching worse.

Therapeutic approaches for chronic itching and scratching

Therapies for chronic itching and scratching can target processes in all areas of the itch pathway. Current therapies can target cutaneous or neural mechanisms, treating important aspects of specific diseases[19]. New therapies such as monoclonal antibodies are being developed to target specific sites in the pathway[20].

Conclusion

Itching and scratching are important problems which reduce quality of life. Chronic itch can be generated anywhere in a complex pathway between skin and brain, while scratching makes it worse and can seem unavoidable. Understanding the processes which occur at each stage suggests multiple possible interventions. New therapies are improving the range of treatment options and combining these will allow us to tackle the debilitating problems of itching and scratching from multiple directions.

Word count: 599

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