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Why do we itch and scratch? - Synopsis

Itch was described in 1660 as 'an unpleasant sensation eliciting urge to scratch', and this definition appears to still hold true[1]. It is a common sensation but when chronic can be debilitating. This essay discusses the non-pathological and pathological mechanisms of itch; why it may have evolved; and why we continue to scratch when some treatments are available.

Mechanisms

i) Periphery

Stimuli for itch are known as pruritogens. These can be chemical, mechanical, electrical and thermal and from exogenous and endogenous sources. The process of sensory transduction converts the physical presence of the stimulus into an electrical signal in the sensory nerve, usually via binding to receptors. This occurs in non-pathological scenarios such as after insect bites. It also occurs pathologically in dermatological conditions - atopic dermatitis (AD) and psoriasis - and systemic conditions - chronic kidney disease (CKD), liver disease and malignancy (diagram 1[2,3,4]). The mechanisms in each vary but there are some shared features including: the release of pruritogens by immune cells; interactions between skin, immune and nerve cells; and a vicious itch-scratch cycle[2,3,4]. Many current therapies target these peripheral mechanisms.

ii) Spinal cord

There are a range of sensory neurones involved, including C and Aδ fibres, and it is unclear if any are specific for itch. These enter the spinal cord and synapse with second-order neurones. Here there are more receptors including the μ-opioid receptor, which may be involved in itch in liver failure and CKD (diagram 2[2,3,4,5,6]). There are also spinal interneurons that inhibit the signal when scratch occurs. These neurones then ascend in the lateral spinothalamic tract, in a manner currently best explained in the 'population coding theory'[5,6]. Nerve damage anywhere can cause neurological itch, including after trauma, compression (brachioradial pruritus),

strokes, tumours and multiple sclerosis. Mechanisms may include neuropathic inflammation; increased nerve excitation; and loss of inhibitory circuits[2,3,4].

iii) Brain

Third-order neurones then project into the brain. Many areas process the itch signal into a complex multidimensional sensation, with the scratch being the output back through the motor systems. Areas of particular interest are those of craving, perception and reward[3,4]. Changes here have been found in AD and in CKD, which could form another neurological contribution to itch[2]. There has been some debate about the distinction between this and psychogenic itch, but there are probably some exclusively psychogenic causes[2]. Uniquely compared to other sensations, itch has a 'contagious' nature and the central production of it offers interesting future therapeutic interventions[7].

Evolutionary Reasons

A question asking 'why' merits an evolutionary perspective. There is much evidence to support that itch and scratch may have been useful in rapidly removing threats from the skin. However a spinal reflex would be sufficient, so more explanation for the higher processing is needed: one is that contagious itch may prevent group parasite infestations. This may also be a primitive form of empathy, with major social implications[8].

Current Reasons

Despite some treatments, many patients continue to itch and scratch. This is often due to poor optimisation of treatment, particularly with steroids and emollients[9]. This in itself may be due to how patients understand their condition, and how they perceive treatment options[10,11].

Conclusion

Originally itch and scratch probably evolved as a protective mechanism, but it is now often pathological. There are many contributory mechanisms shared across broad pathological conditions. This means there is some blurring between the IFSI

groupings[12]. There are also some mechanisms shared with pain sensation, but itch is arguably more distinct than previously recognised. With increased research has also come the development of new therapies, making it an exciting field. Ultimately we also need to remember the patient perspective.

Words: 600

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Diagram 1: Peripheral Mechanisms of Itch. Not to scale and different receptors may be found

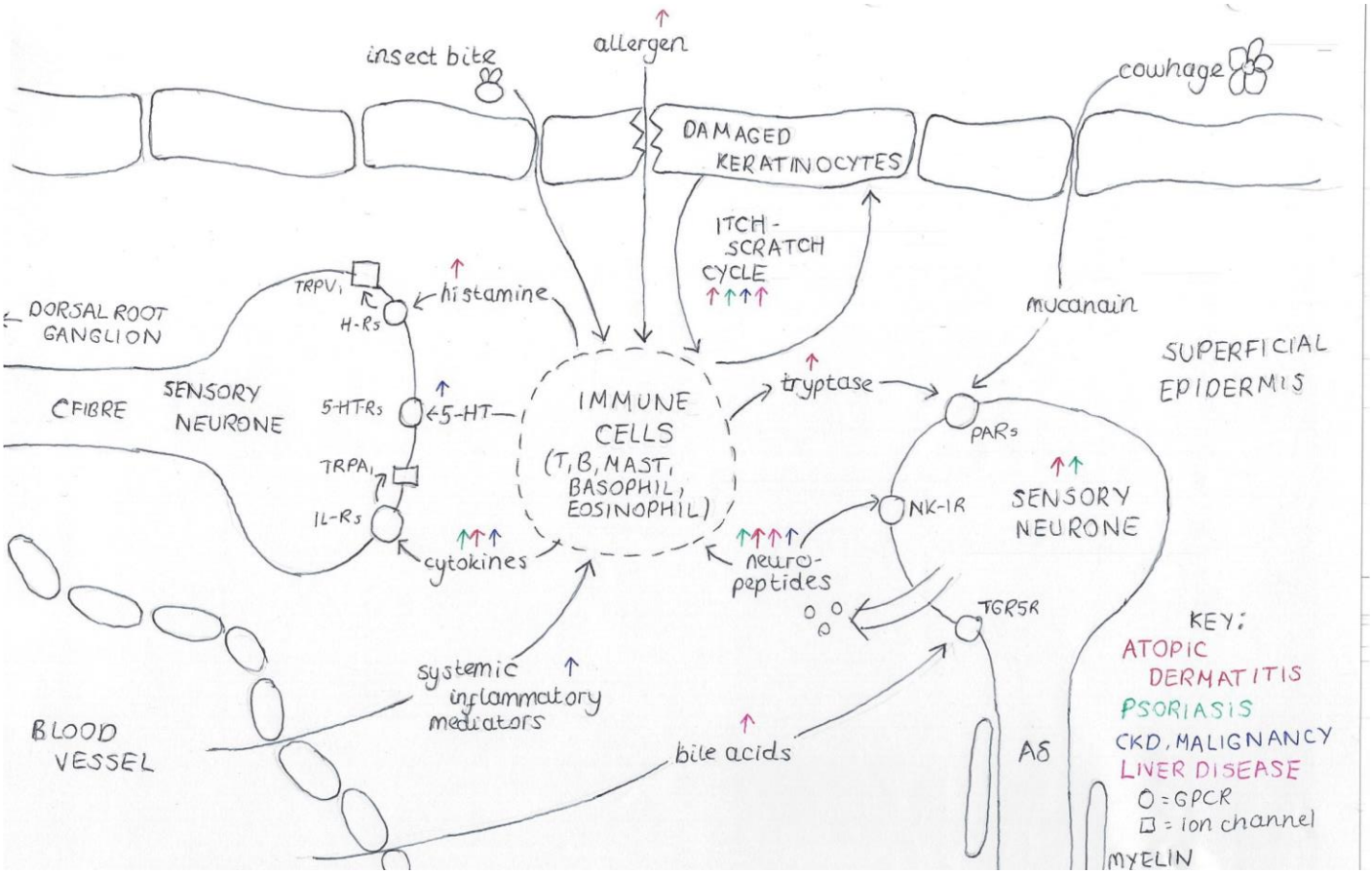

Diagram 2: Population Coding Theory. Not to scale and different receptors may be found