**A person sitting at a desk with a computer

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alloknesis

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Summary of the protocol

This protocol describes the concept of alloknesis, a brief overview of the mechanism behind it and the assessment technique applied to quantify it.

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# Introduction

The term alloknesis, first coined by LaMotte et al. in 19881–4, represents one of the mechanical itch dysesthesias, that describe dysfunctional sensory states, in which itch is evoked by light tactile stimuli (e.g. from clothing or touch), or by stimuli which normally would only induce mild itching 1,5–8. Alloknesis (“allo”, and “knesis”, an ancient Greek word for itching) is described as a pruriceptive sensation or a scratching behavior evoked by a stimulus that is normally non itchy, such as light stroking of the skin with a cotton swab or a brush (Fig. 1) 1,9. This concept reflects a similar dysfunctional state evoked by pain and termed allodynia, in which pain is cause by a stimulus that normally does not provoke pain 10,11. Often, alloknesis represents a symptom in acute itch, chronic itch conditions such as neuropathic itch and atopic dermatitis but could also be induced experimentally in healthy volunteers 1,10,11. The primary cause of alloknesis is the sensitization of itch signaling pathways inducing amplified response to pruritogens and increased reactivity to other types of stimuli1,11–13. Moreover, also the dysregulation of the inhibitory systems in the spinal cord seems to contribute to alloknesis11. In humans, the intensity of alloknesis is often assessed by using brush strokes 1,14, as illustrated below under the section “protocol”.

A diagram of strength and strength

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Fig. 1: Graphical representation of the alloknesis phenomenon. The curve represents the stimulus-response curve, that is the association between the intensity of the applied stimulus (x-axis) and the itch response (Y-axis) under normal condi­tions and when dysesthesias are present. Created with BioRender.com and adapted from Andersen et al. 1with inspiration from Sandkühler J 13.

# Experimental Setup

Somedic SENSELab Brush no. 5 is used to determinate the intensity of alloknesis.

The NRS values are collected by LabBench program.

# Protocol

Alloknesis will be measured using a standardized sensory brush (SENSELab Brush-05, Somedic AB, Hörby, Sweden) exerting a force of in the range of 200 +/- 100 mN. The investigator should perform 3 stimulations, in different directions, along the diagonals of the area of interest. Each stimulation consists of a set of 3 brush strokes (2 cm in length) in short succession (approximately 1 s in between) over the treated/control areas. The strokes are applied by keeping the brush perpendicular to the skin with a speed of 3-6 cm/sec. After each set of 3 brush strokes, the participant rates the sensation induced by the brush on a NRS scale from 0 to 10 (0 = “no itch”; 10 = “worst imaginable itch”).

## Instruction to subjects

### Numerical Rating Scale

What to say to the subjects

### Decimal Numerical Rating Scale

What to say to the subjects

## INSTRUCTION to experimenter

# Analysis

To perform statistical analysis, a total average will be calculated. Data output documented in source as NRS value between 0 (no itch) and 10 (maximal itch). An integer value or a decimal value (one digit) can be selected and stored.

# Discussion

# REferences

1 Andersen HH, Akiyama T, Nattkemper LA, *et al.* Alloknesis and hyperknesis—mechanisms, assessment methodology, and clinical implications of itch sensitization. *Pain* 2018; **159**:1185–97.

2 Bickford RGL. Experiments relating to the itch sensation, it’s peripheral mechanism, and central pathays. *Clin Sci* 1938; **3**:377–86.

3 LaMotte RH. Subpopulations of “nocifensor neurons” contributing to pain and allodynia, itch and alloknesis. *APS Journal* 1992; **1**:115–26.

4 LaMotte RH. Psychophysical and neurophysiological studies of chemically induced cutaneous pain and itch: the case of the missing nociceptor. In: *Progress in brain research*. , Elsevier, 1988; 331–5.

5 Andersen HH, Elberling J, Sølvsten H, *et al.* Nonhistaminergic and mechanical itch sensitization in atopic dermatitis. *Pain* 2017; **158**:1780–91.

6 G. Atanassoff P, Brull SJ, Zhang J, *et al.* Enhancement of experimental pruritus and mechanically evoked dysesthesiae with local anesthesia. *Somatosens Mot Res* 1999; **16**:291–8.

7 Ikoma A, Fartasch M, Heyer G, *et al.* Painful stimuli evoke itch in patients with chronic pruritus: central sensitization for itch. *AAN Enterprises*URL https://n.neurology.org/content/62/2/212.short [accessed on 22 November 2021].

8 Schmelz M. Itch and pain differences and commonalities. In: *Pain Control*. , Springer, 2015; 285–301.

9 LaMotte RH. Allodynia and Alloknesis. In: *Encyclopedia of Pain*. Berlin, Heidelberg, Springer Berlin Heidelberg; 52–5.

10 Jensen TS, Finnerup NB. Allodynia and hyperalgesia in neuropathic pain: clinical manifestations and mechanisms. *Lancet Neurol* 2014; **13**:924–35.

11 Tsagareli Merab. Hyperalgesia and Allodynia: A Closer Look. Symptoms, Mechanisms and Treatment. , Nova Science Publishers, 2019.

12 LaMotte RH, Dong X, Ringkamp M. Sensory neurons and circuits mediating itch. *Nat Rev Neurosci* 2014; **15**:19–31.

13 Sandkuhler J. Models and mechanisms of hyperalgesia and allodynia. *Physiol Rev* 2009; **89**:707–58.

14 Weisshaar E, Dunker N, Gollnick H. Topical capsaicin therapy in humans with hemodialysis-related pruritus. *Neurosci Lett* 2003; **345**:192–4.