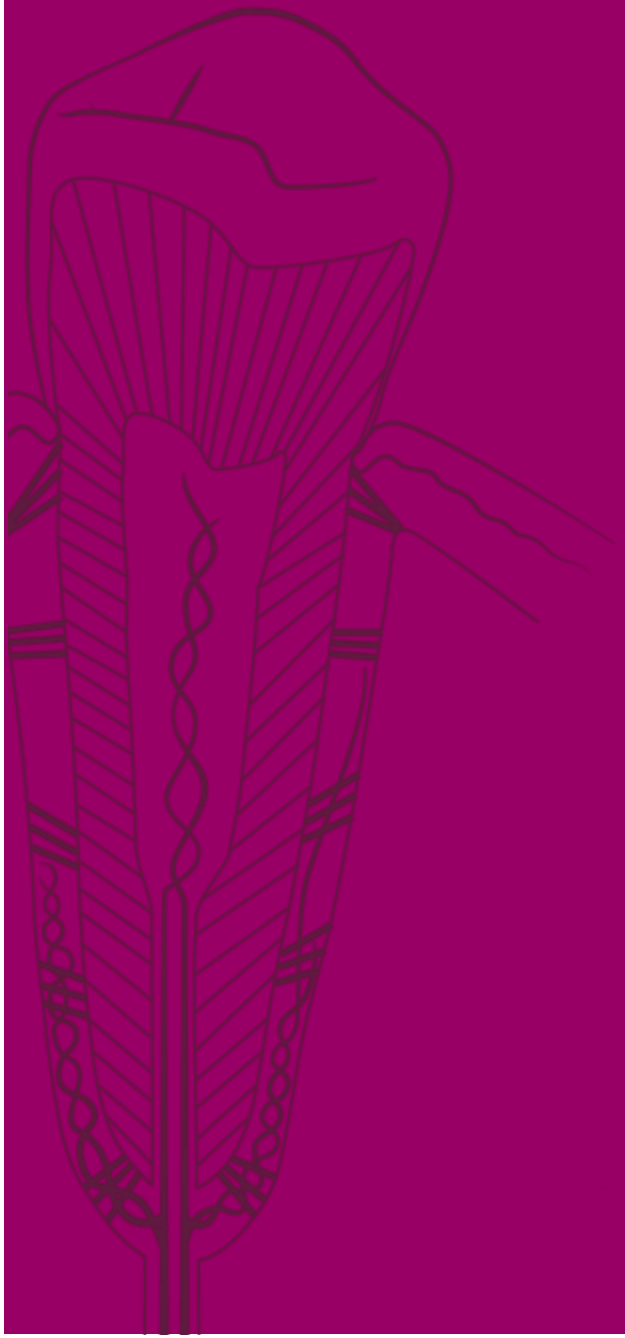
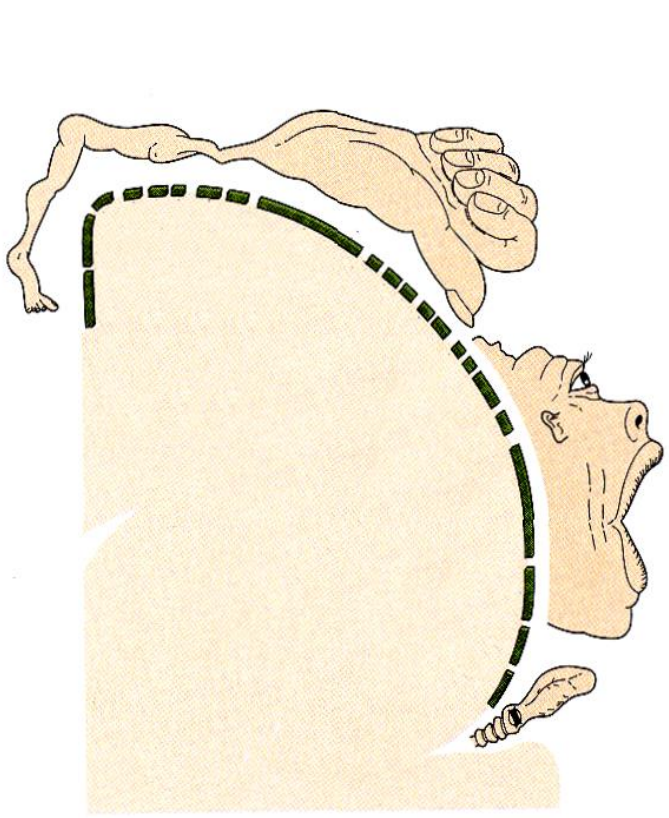


The enjoyment of oral mechanosensation

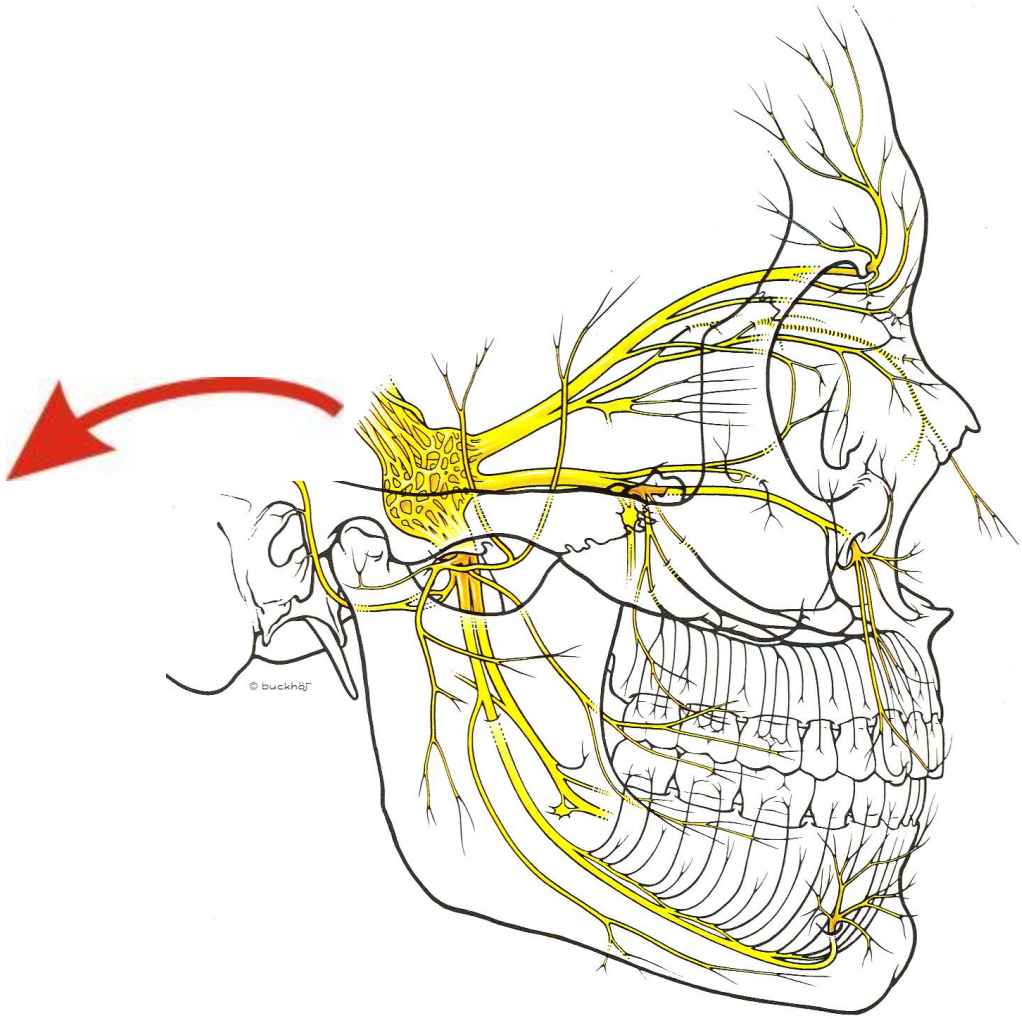
Professor Mats Trulsson
Department of Dental Medicine
Karolinska Institutet

Richly innervated area



Medial Lateral

Kandel et al, 2000

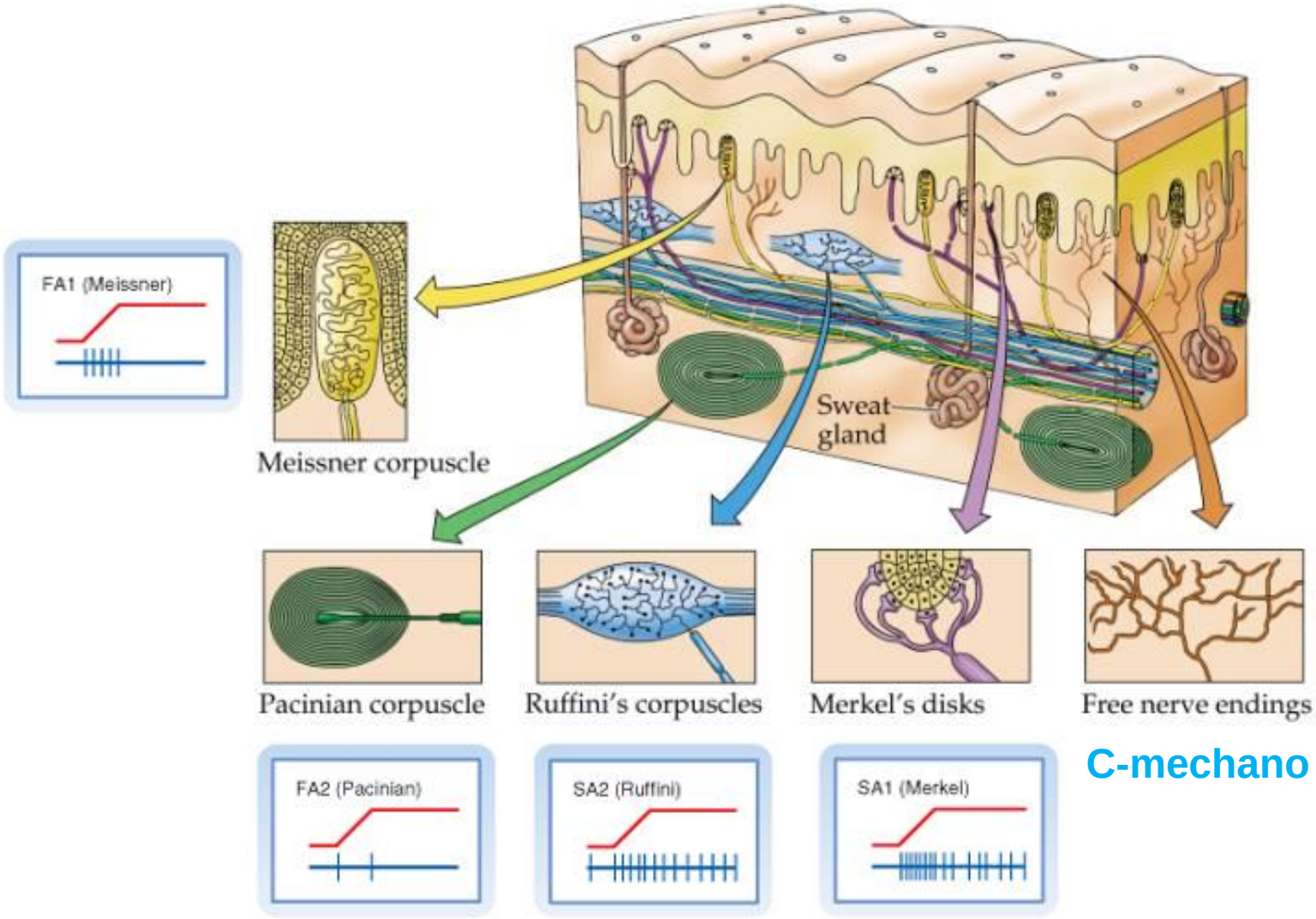


Buckhöj

Sensory receptors

- Mechanoreceptors
- Thermoreceptors
- Chemoreceptors
- Nociceptors

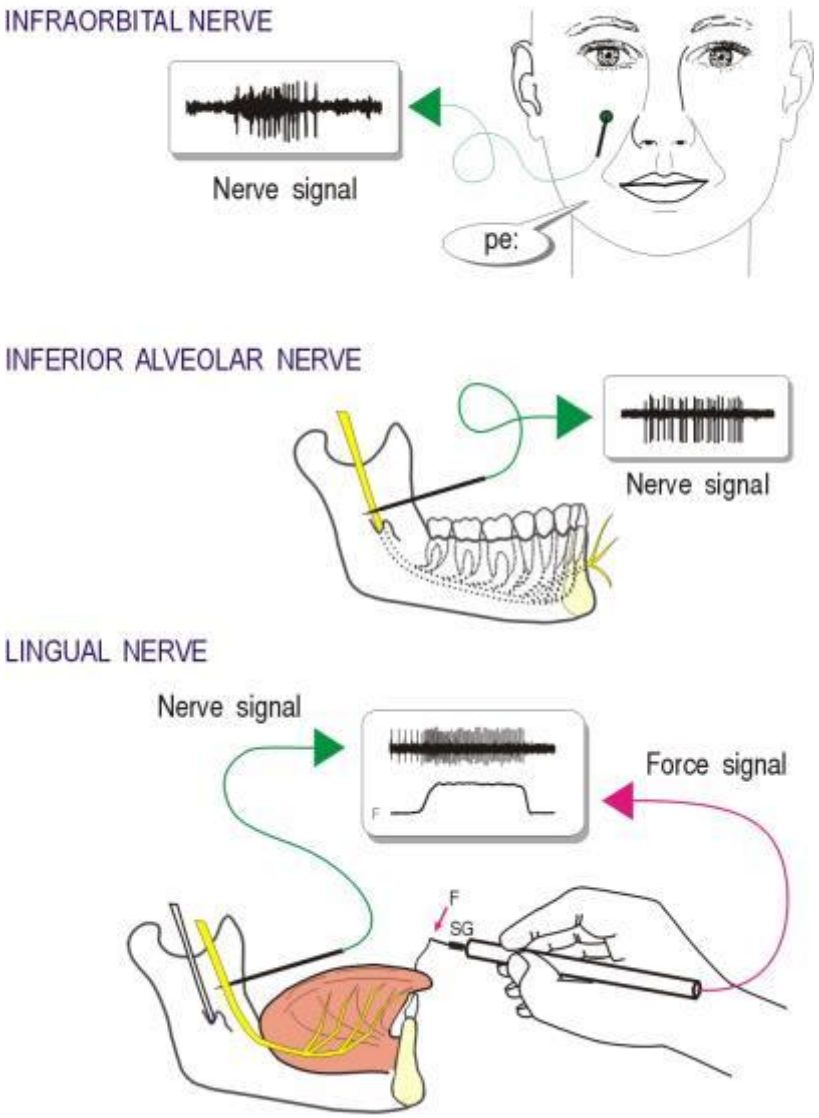
Mechanoreceptors



C-mechano

Neuroscience, Purves et al. 1997

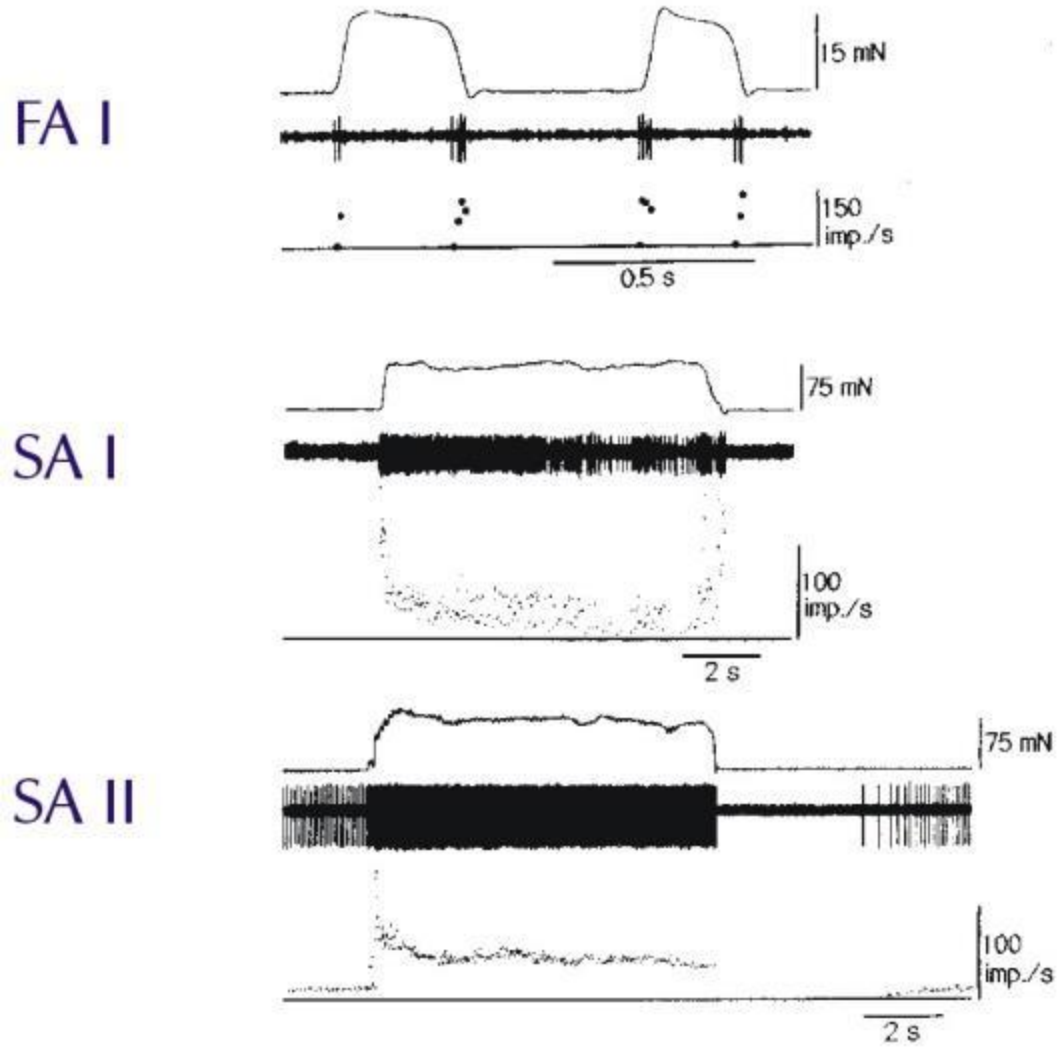
Oro-facial microneurography



Trulsson and Johansson 2002

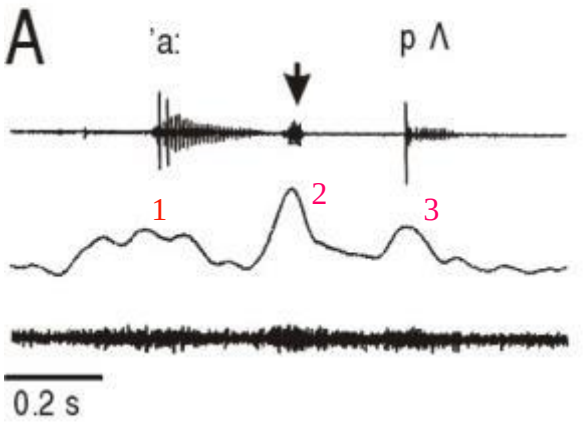
Trulsson 2006

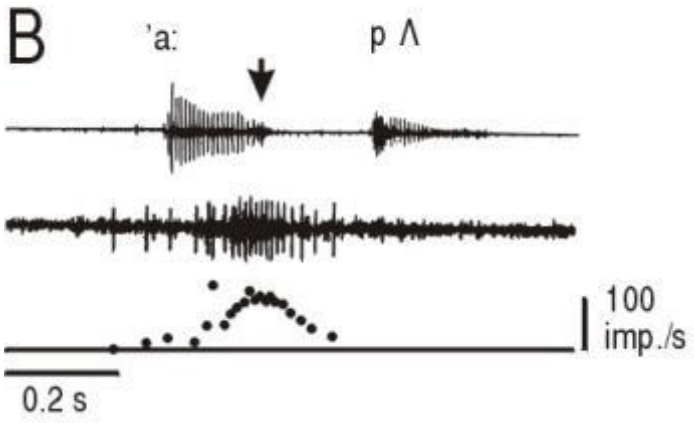
Oro-facial tactile receptors

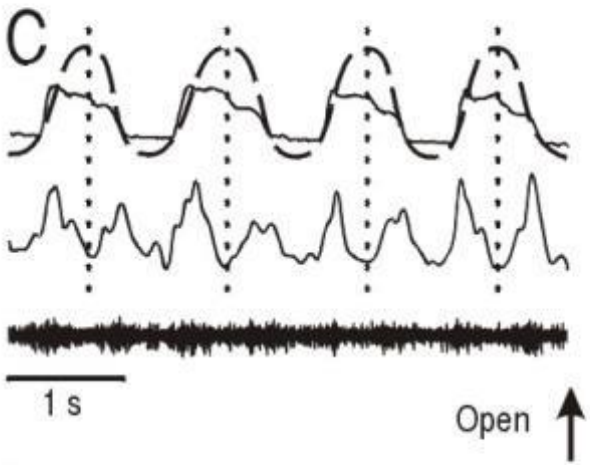


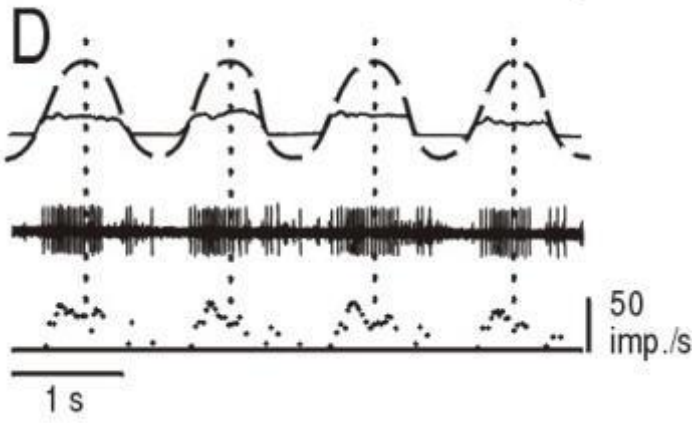
Trulsson and Johansson 2002

Responses during speech and chewing



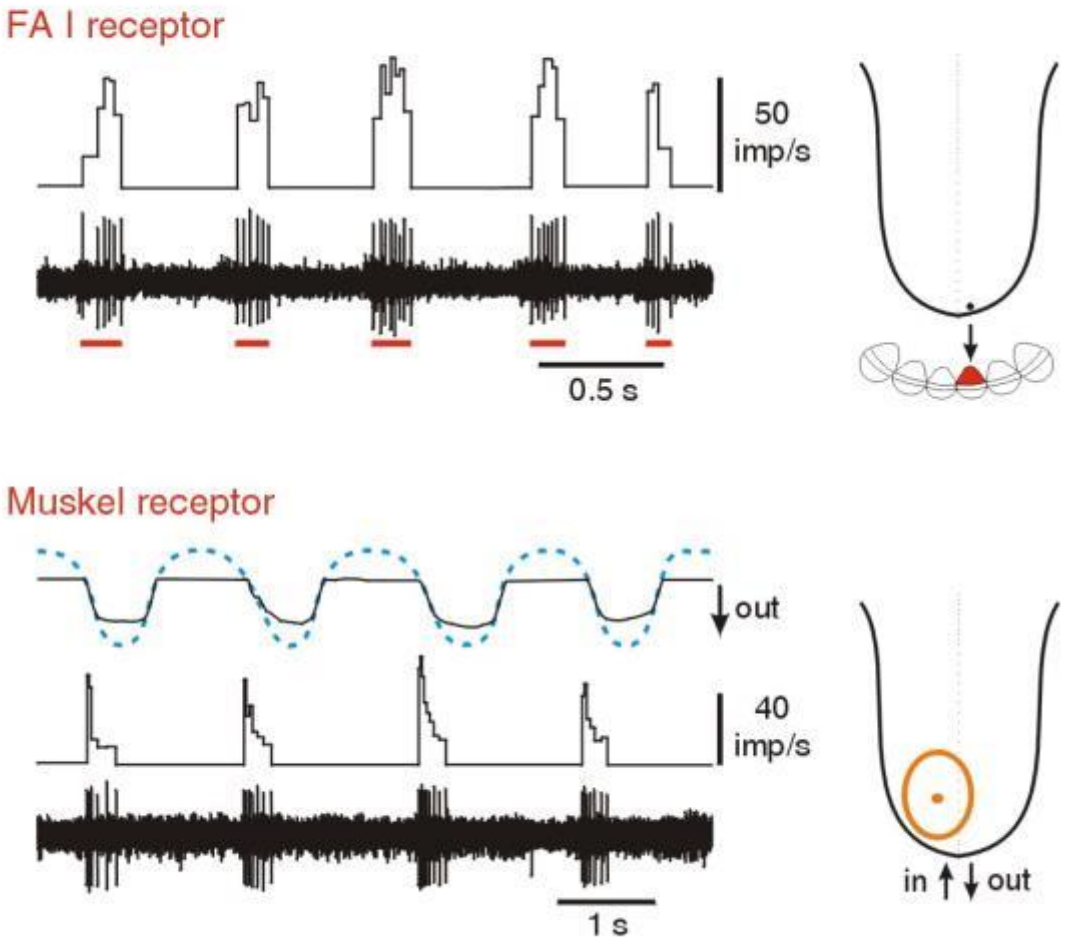






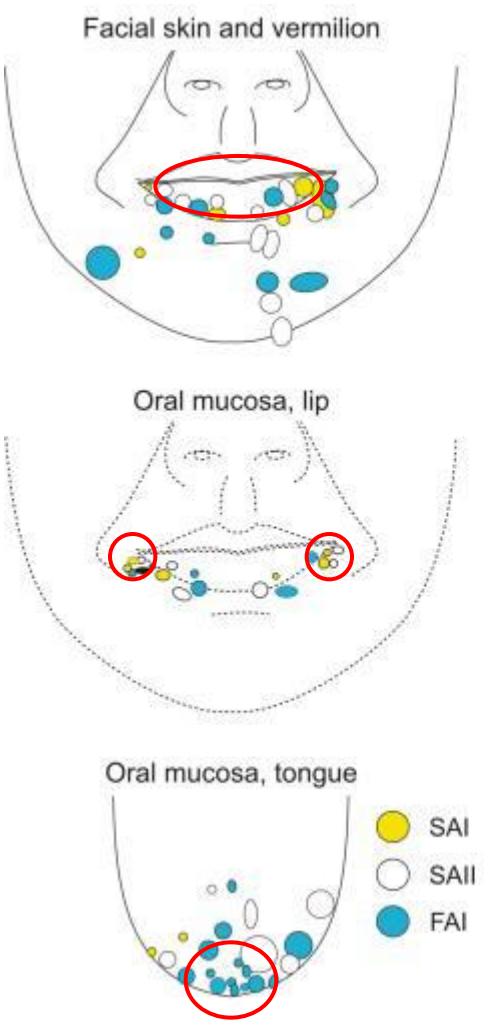
Trulsson and Johansson 2002

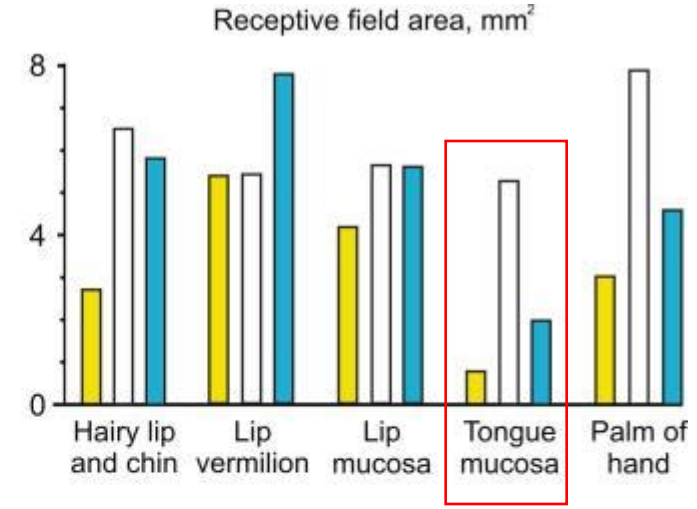
Responses during tongue movements

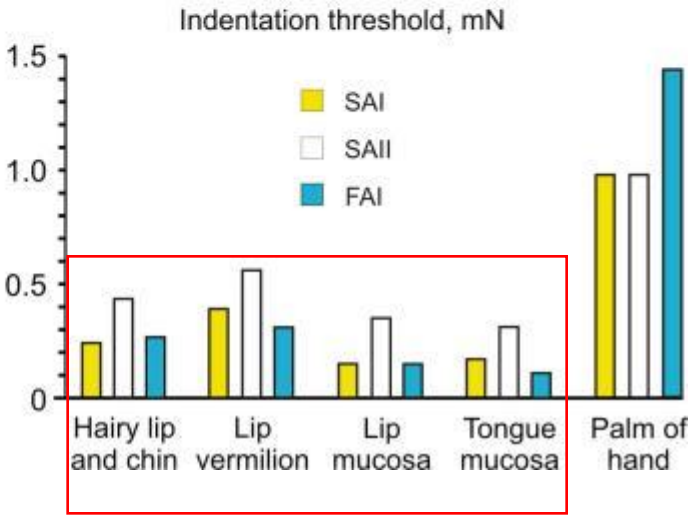


Trulsson and Essick 1997

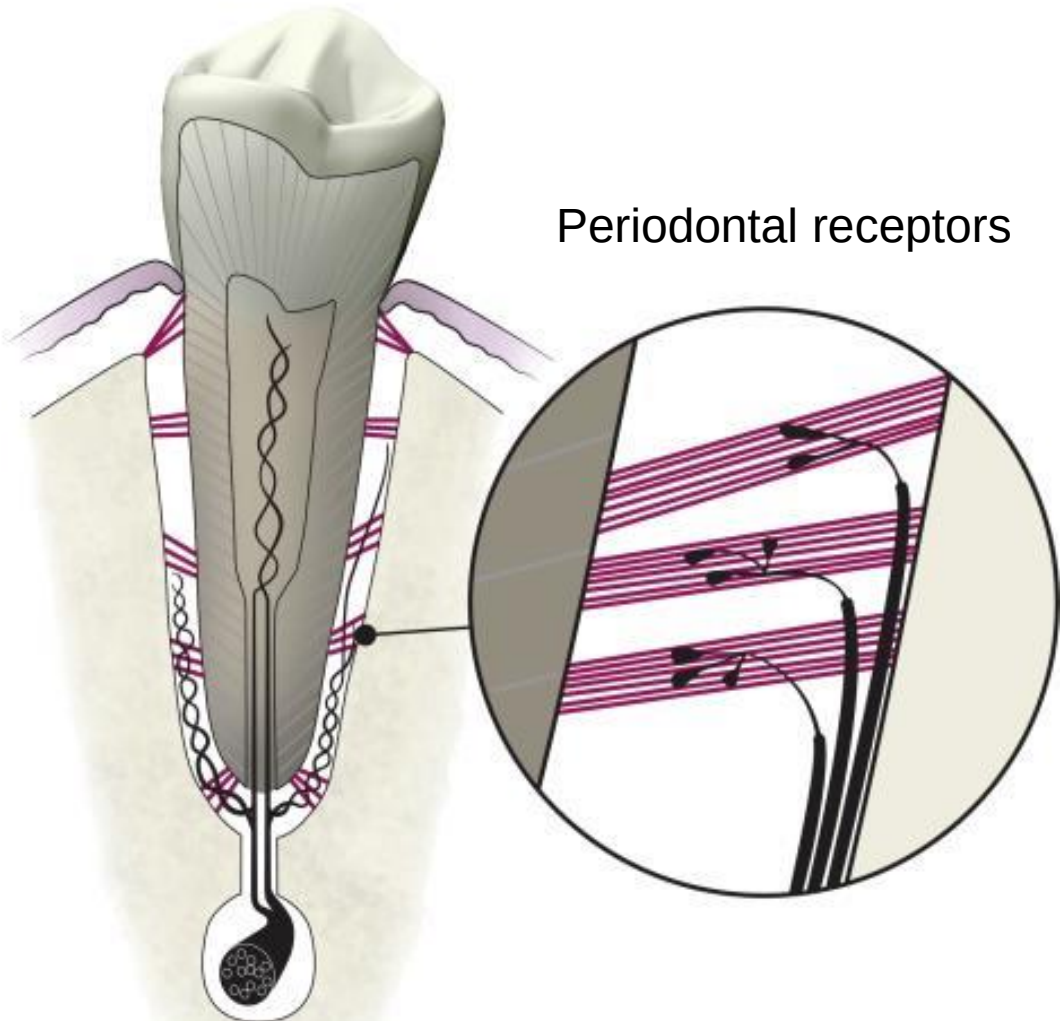
Receptive fields



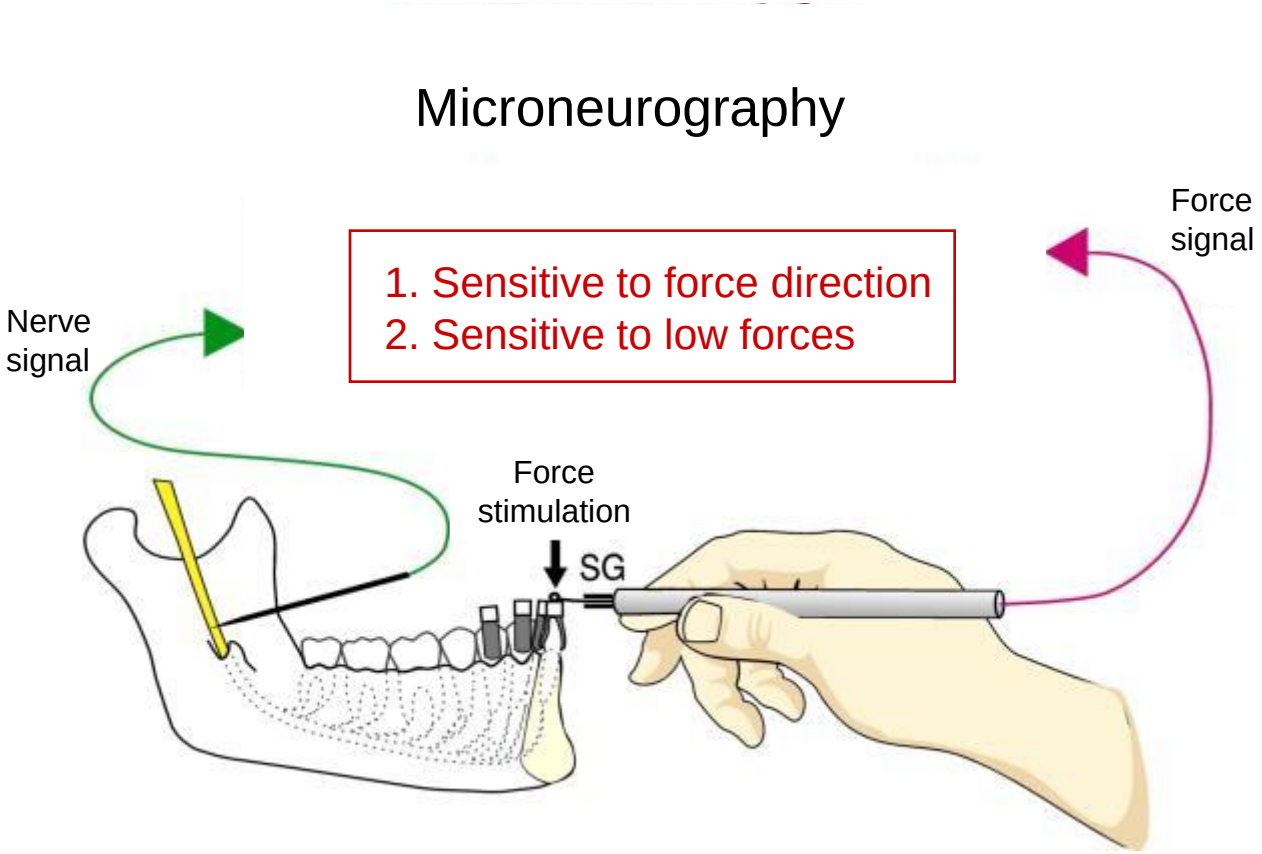




Natural Tooth

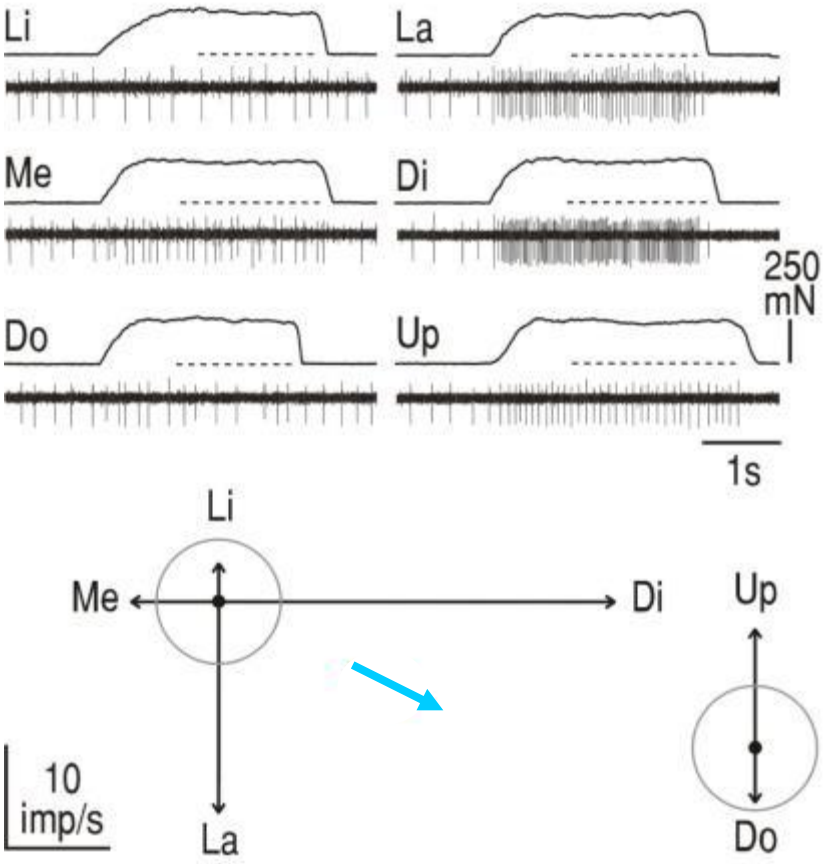


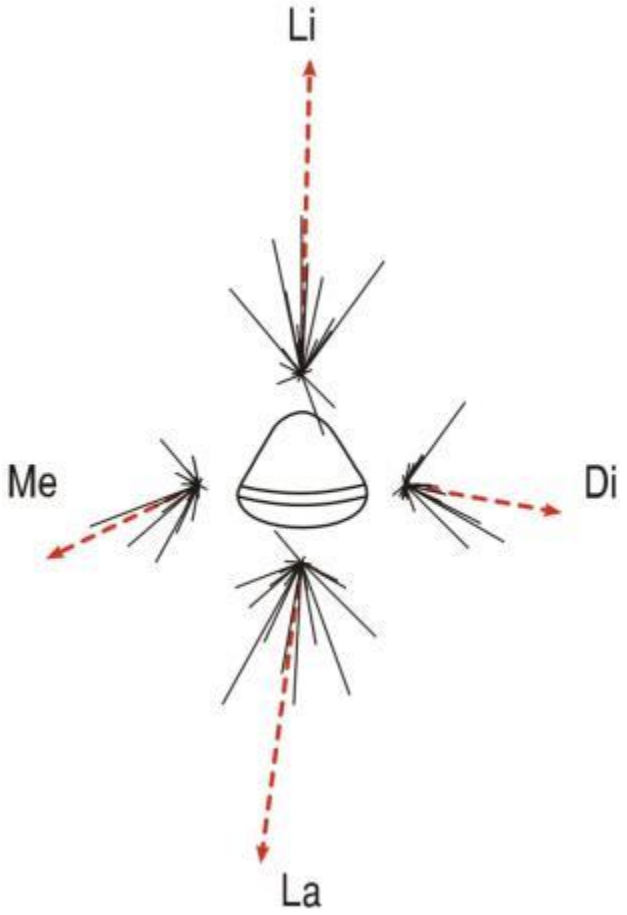
Recording from human periodontal receptors



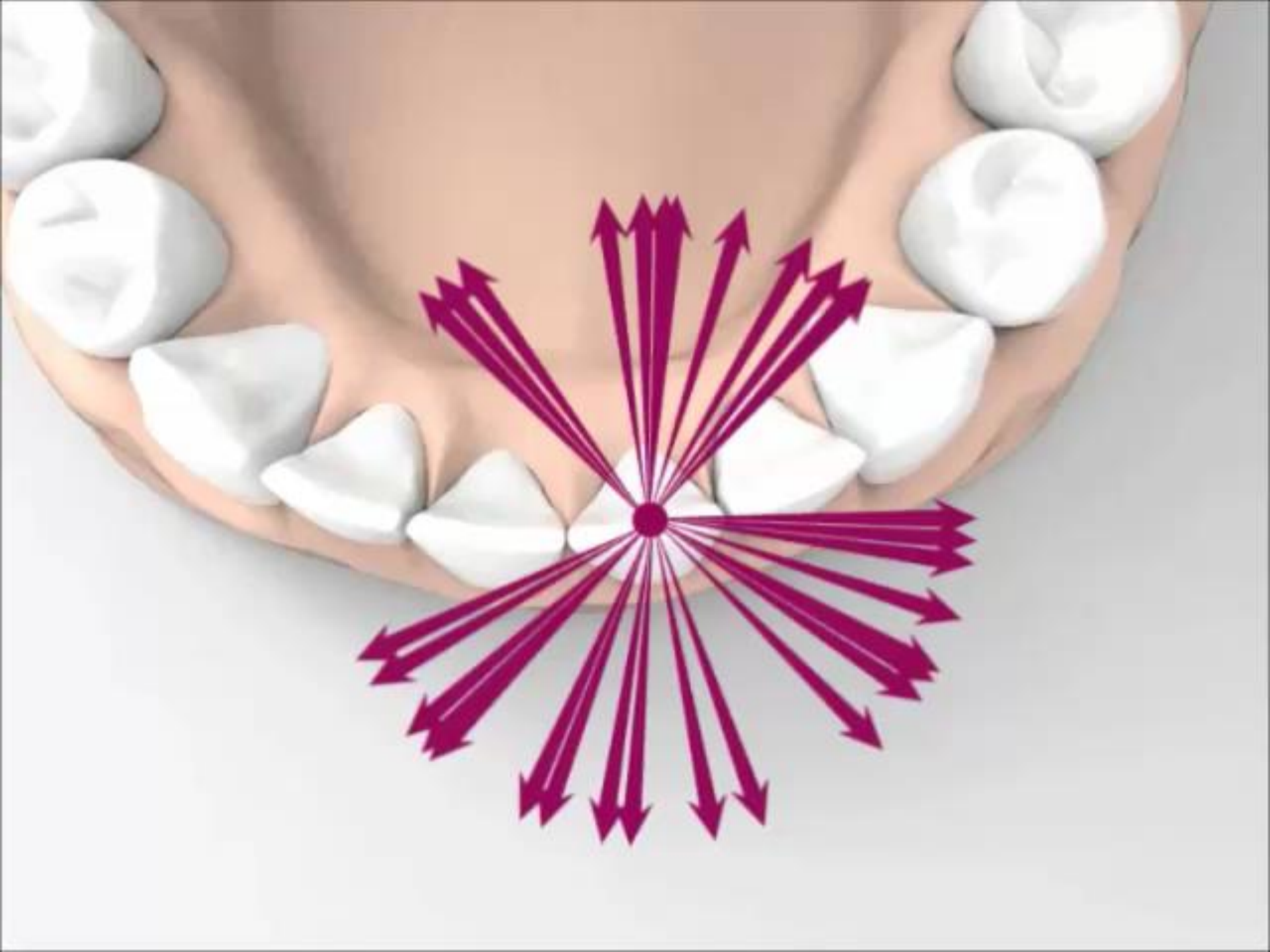
Trulsson och Johansson, *Prog Neurobiol.* 1996.
Johnsen och Trulsson, *J Neurophysiol*. 2005.

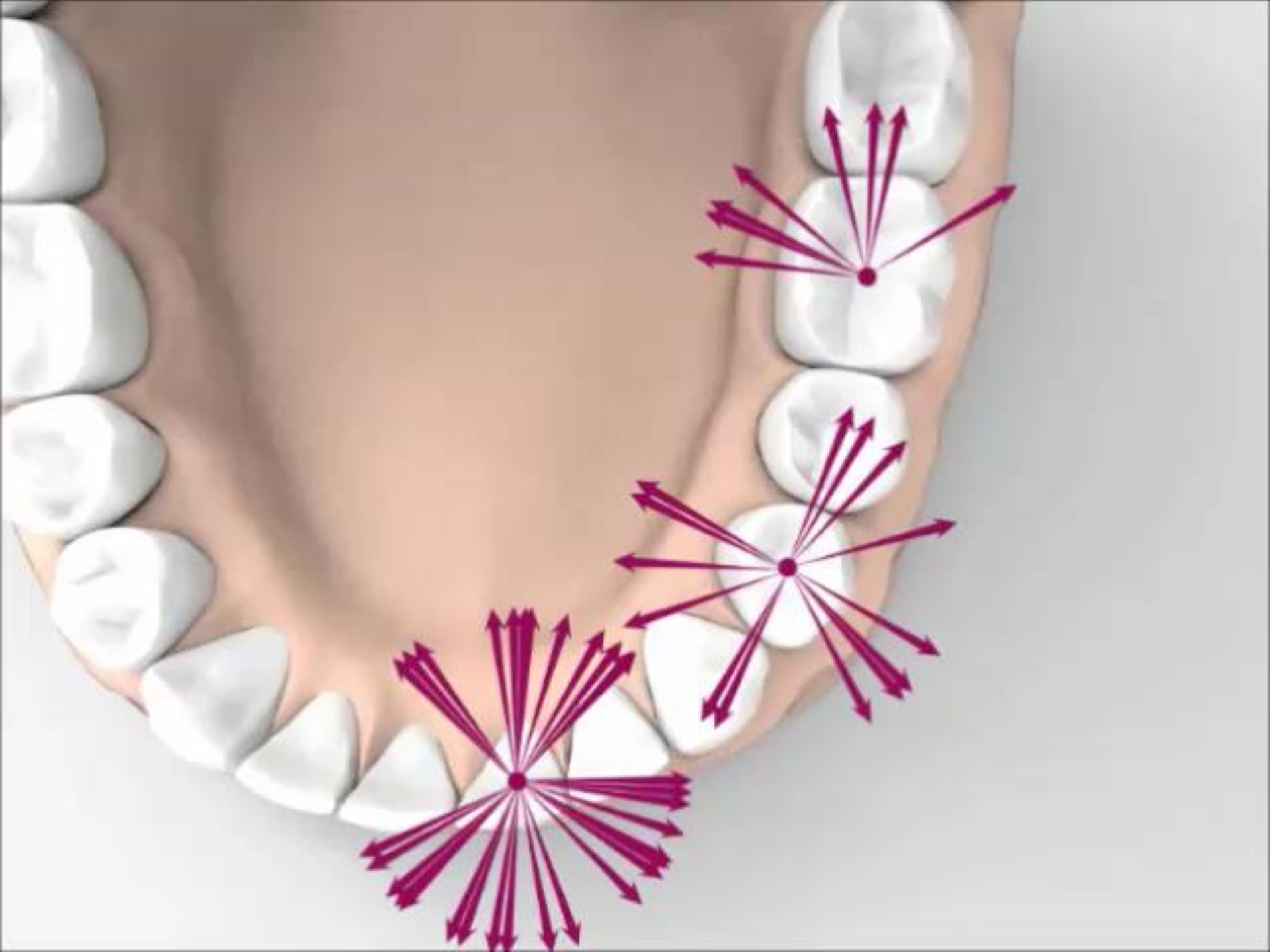
Sensitive to force direction

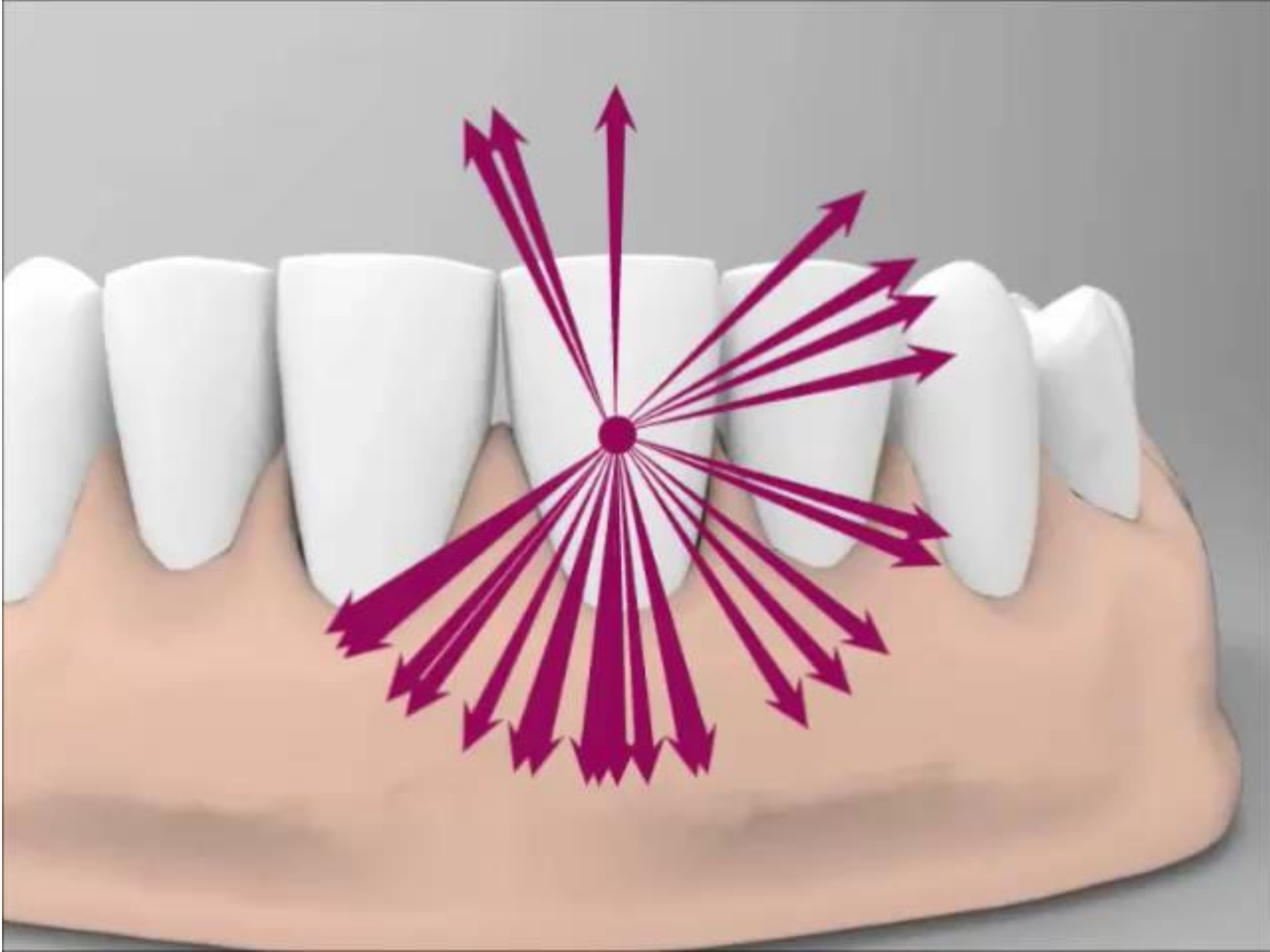


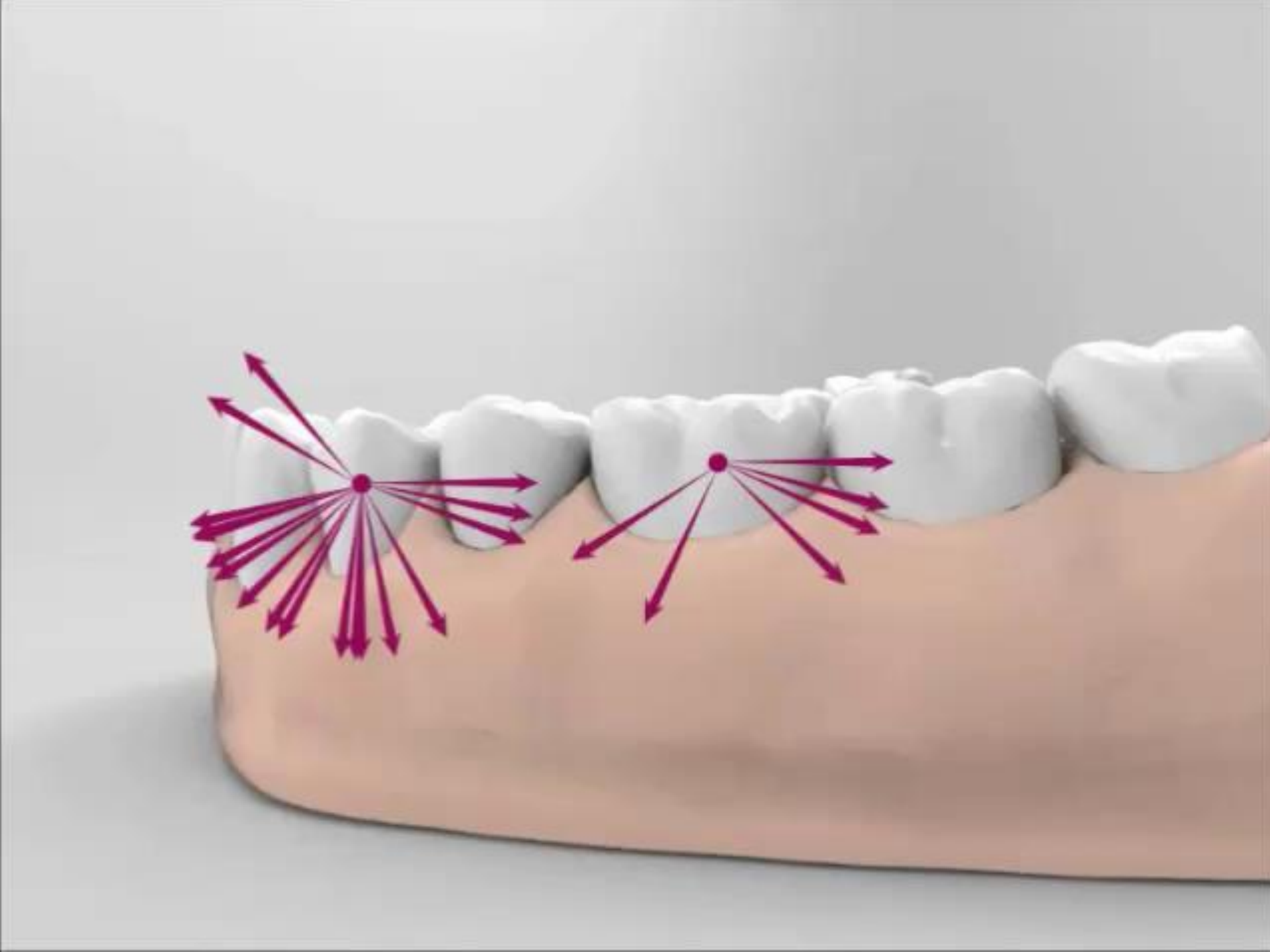


Trulsson et al.
J Physiol. 1992.

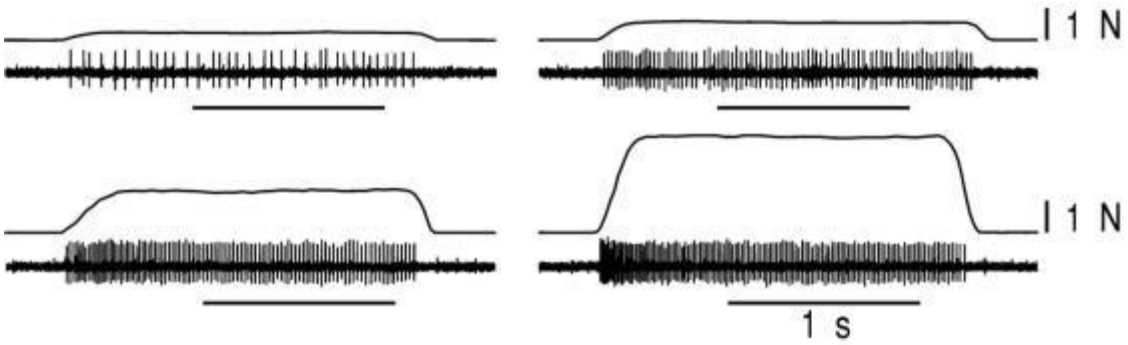


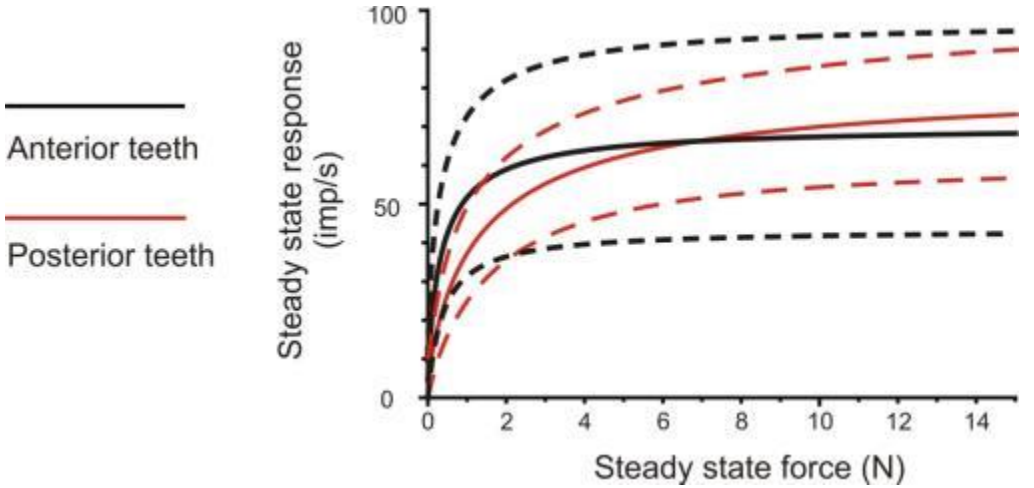






Sensitive to low forces





Mathematical model

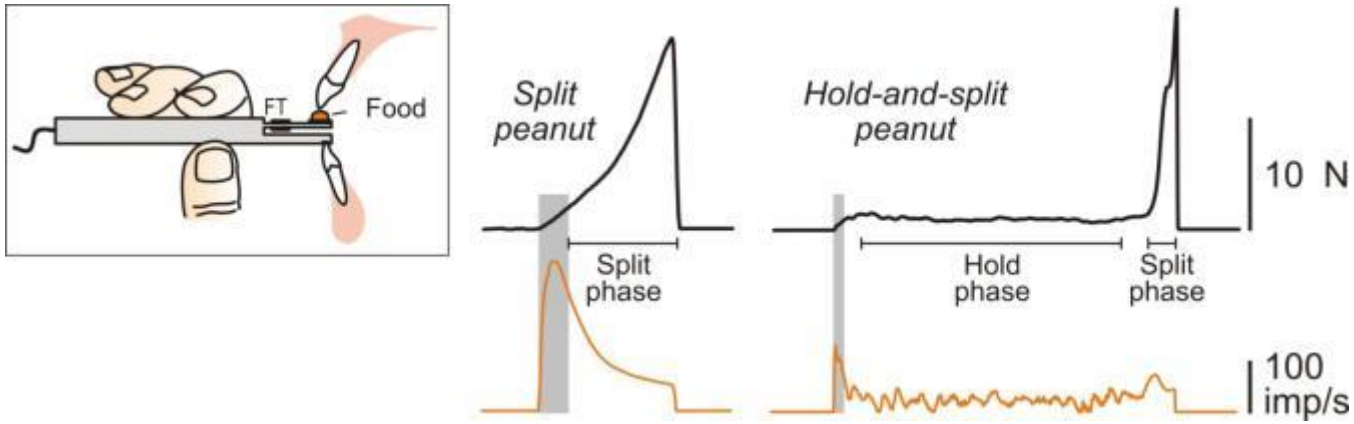
$$R = a + b f + d f_{HP}$$

$$f = \frac{F}{(F + c)}$$

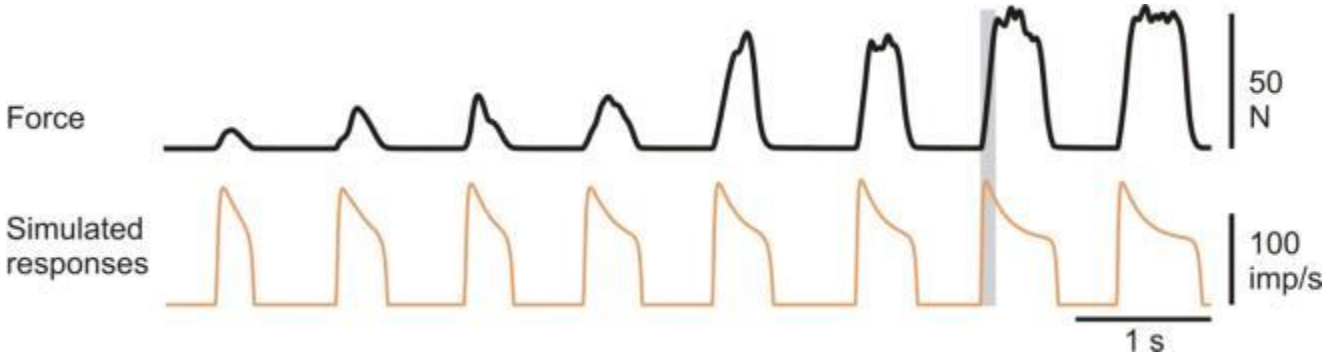
Trulsson and Johansson, 1994
Johnsen and Trulsson, 2005

The tooth as a sensor - hypothesis

Signaling during manipulation and biting



Signaling during chewing



Role of Periodontal mechanoreceptors

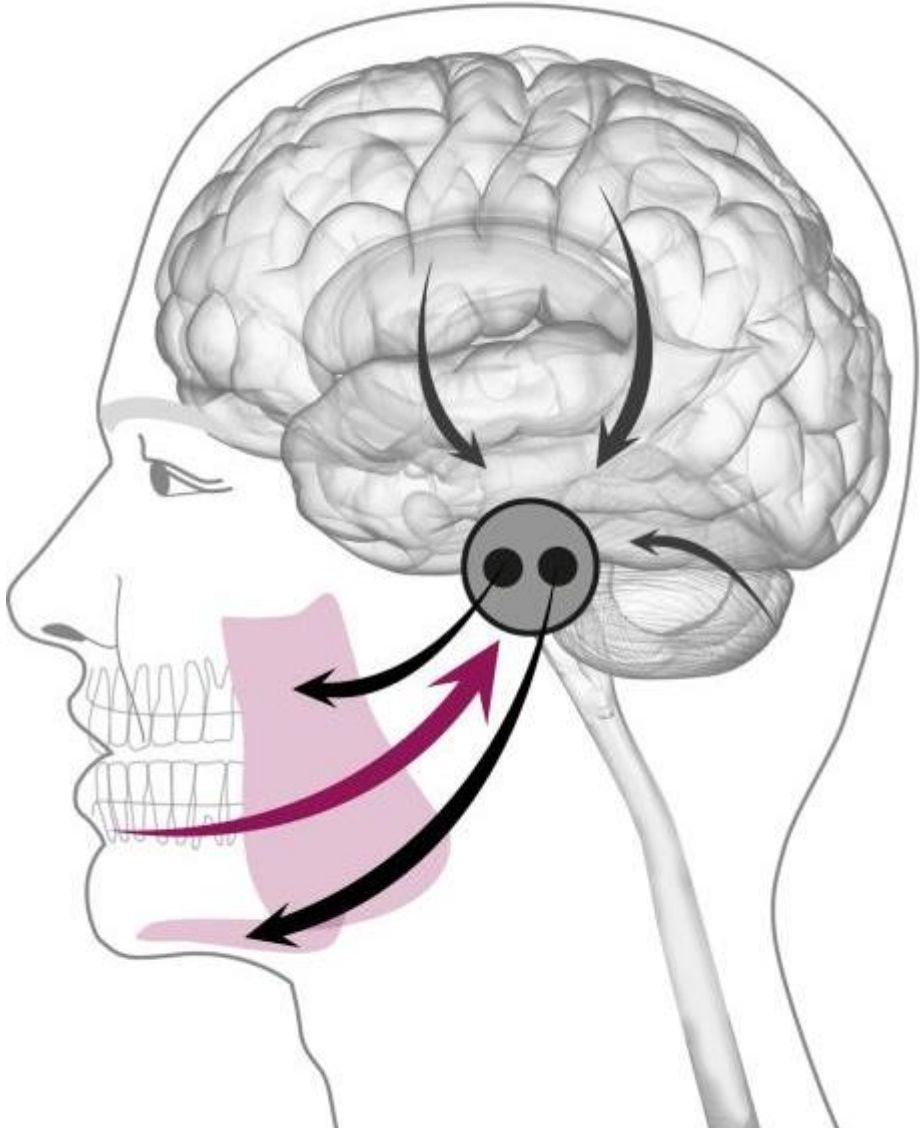
Periodontal receptors signal information about:

- The point of attack and the direction of tooth loads.
- The intensity of the force, with the highest sensitivity at very low force levels.

The information is used by the brain to control:

- Food positioning and bite force direction.
- The force intensity during manipulation, biting and chewing.

Orofacial Mechanoreceptors



Exteroceptors

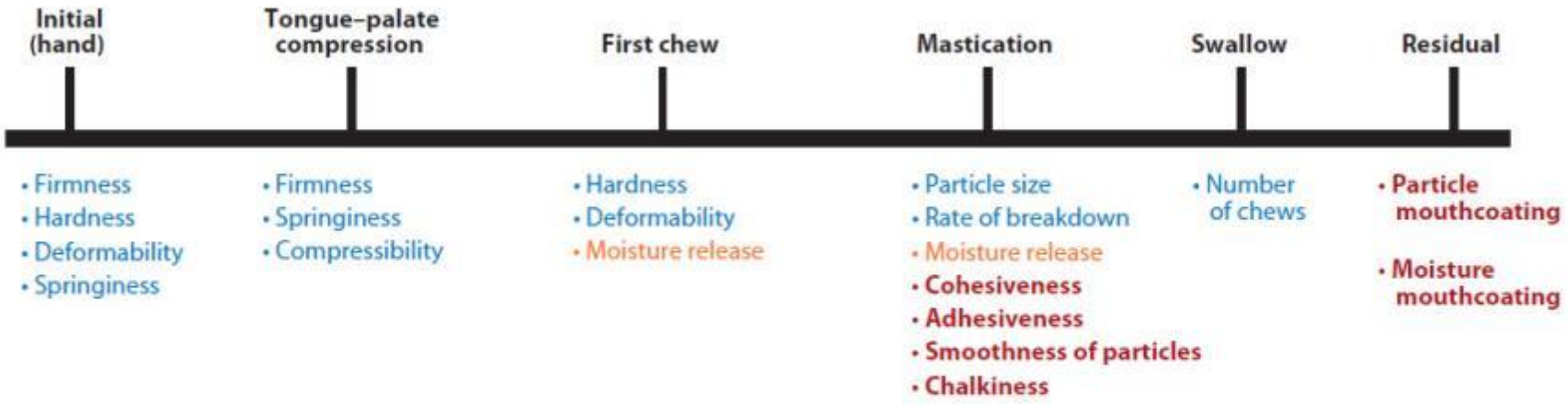
Proprioceptors

Perception

Sensorimotor regulation

Mechanoreceptors and the enjoyment of eating

Textural perception of food

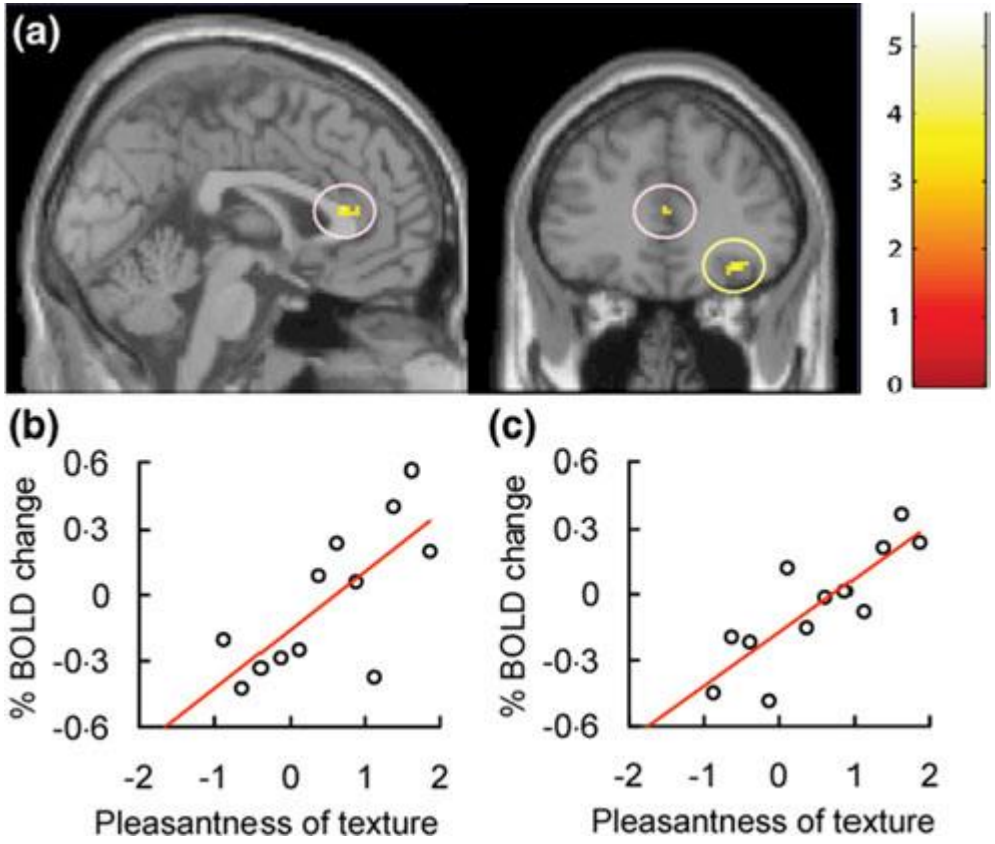


Sensory attributes evaluated at different stages of oral processing. Terms are associated with force deformation and fracture (*blue*); microstructure (*orange*); or saliva, bolus formation, and oral surface interactions (*red*).

Koc et al. 2013

Mechanoreceptors and the enjoyment of eating

Subjective pleasantness of fat texture



Anterior cingulate cortex

(Pink circles)

Orbitofrontal cortex

(Yellow circle)

Edmund Rolls 2012

Mechanoreceptors and the enjoyment of eating

Sensorimotor regulation of chewing

Gum chewing in young adults resulted in:

- Improved attention
- Increased alertness
- Elevated mood
- Decreased Stress

Chewing makes you feel good!

Andrew Smith et al. 2009, 2012