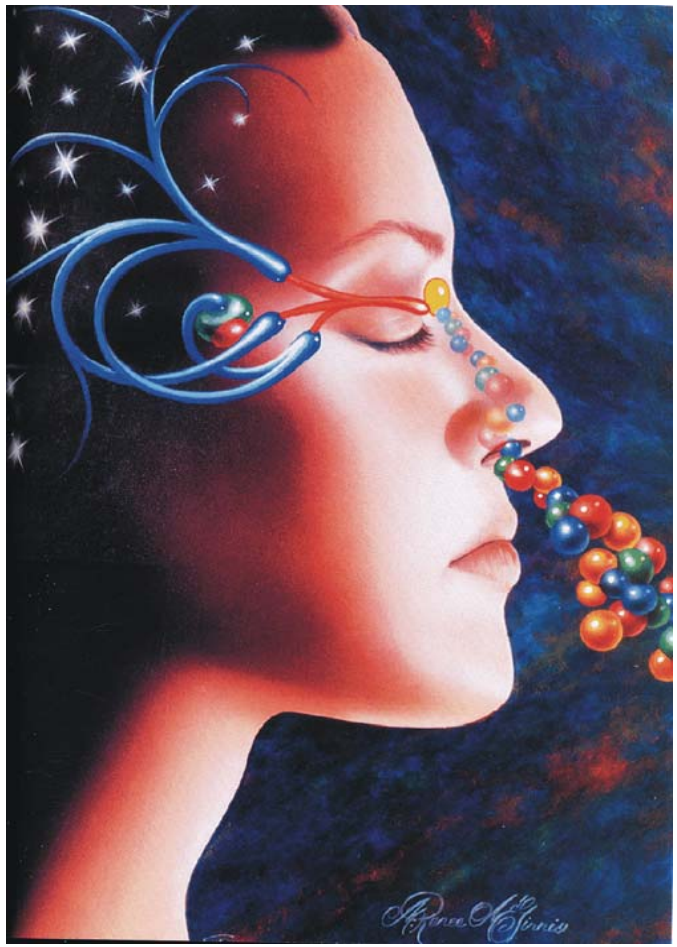
Olfaction

Emotions and behaviour

memory

quality of nutrients / food

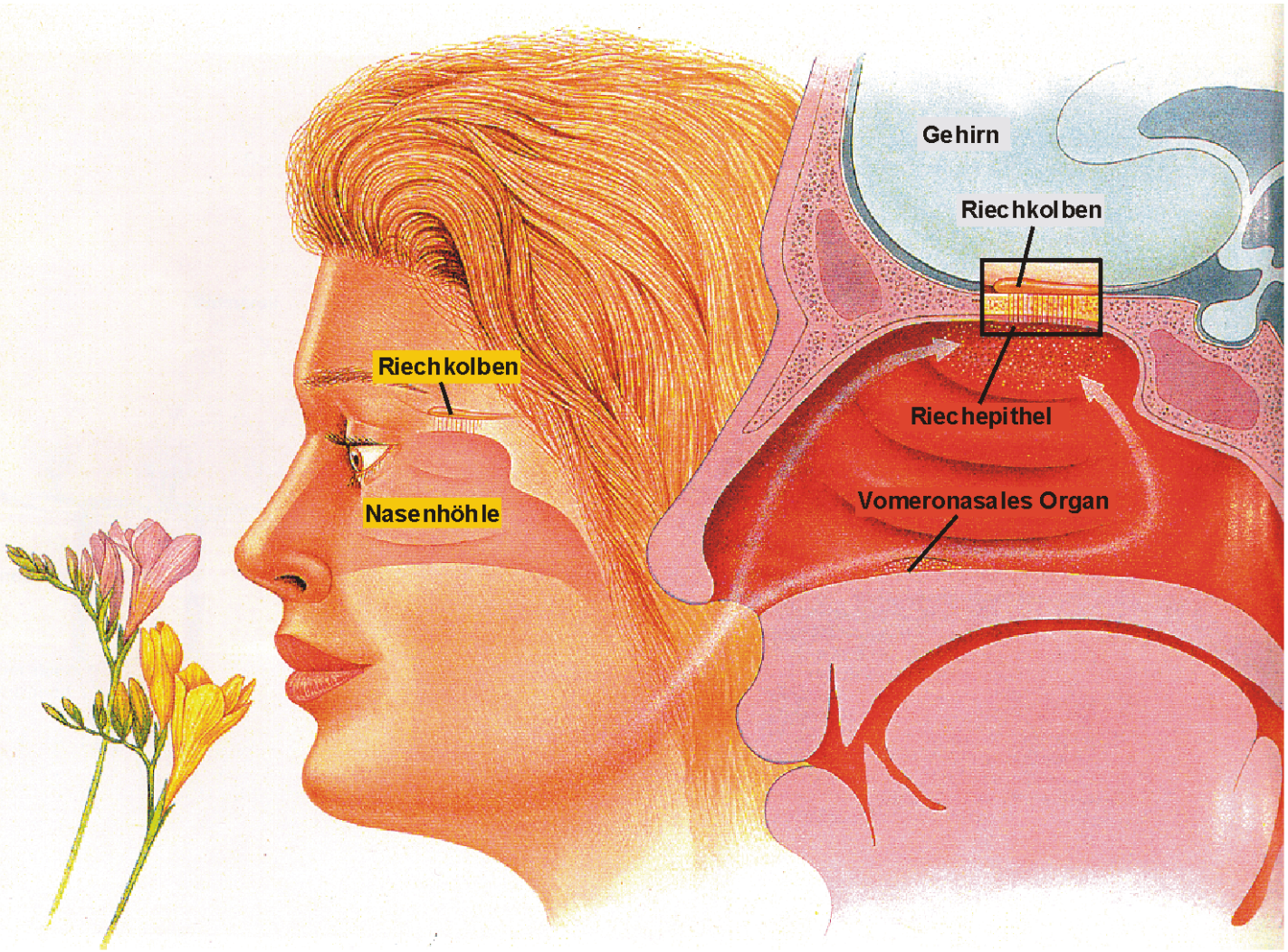


social behaviour

choosing a partner

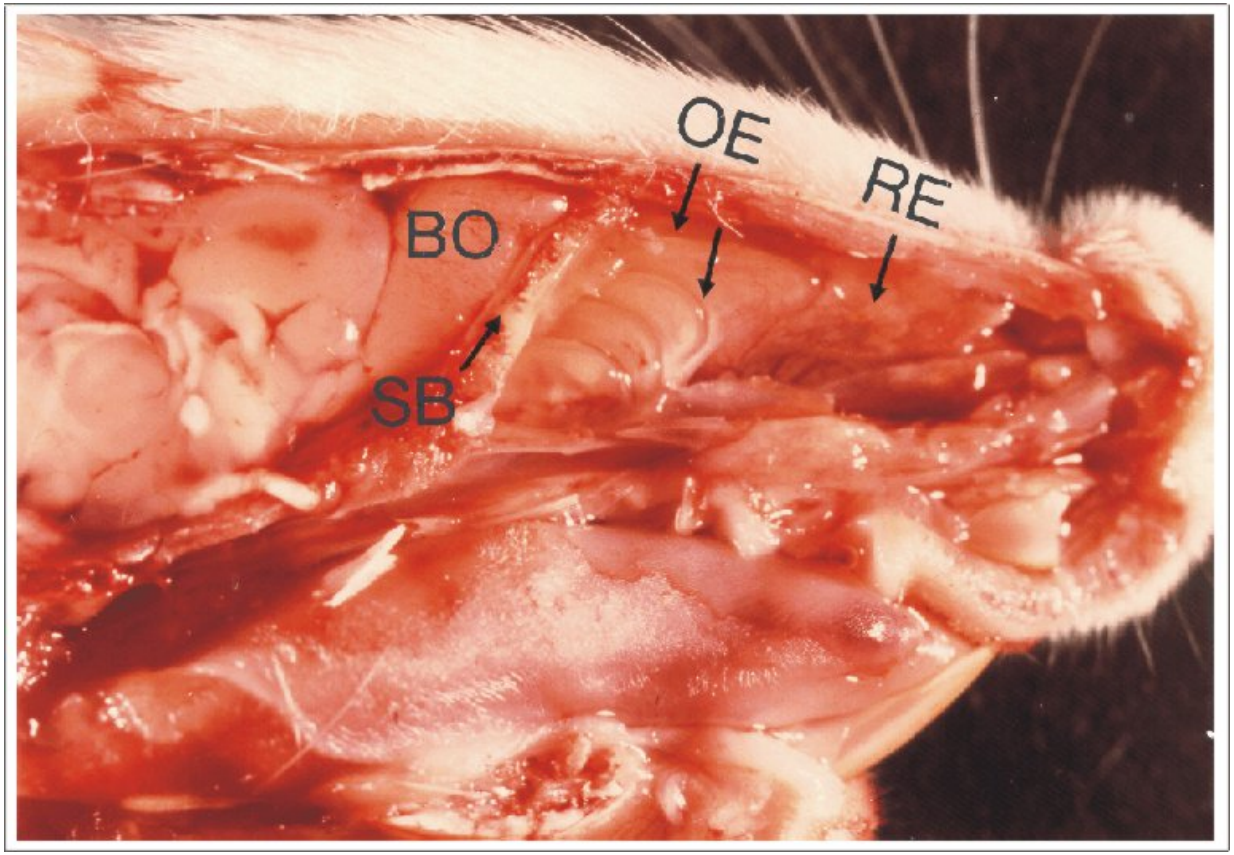
orientation in environment

Olfaction

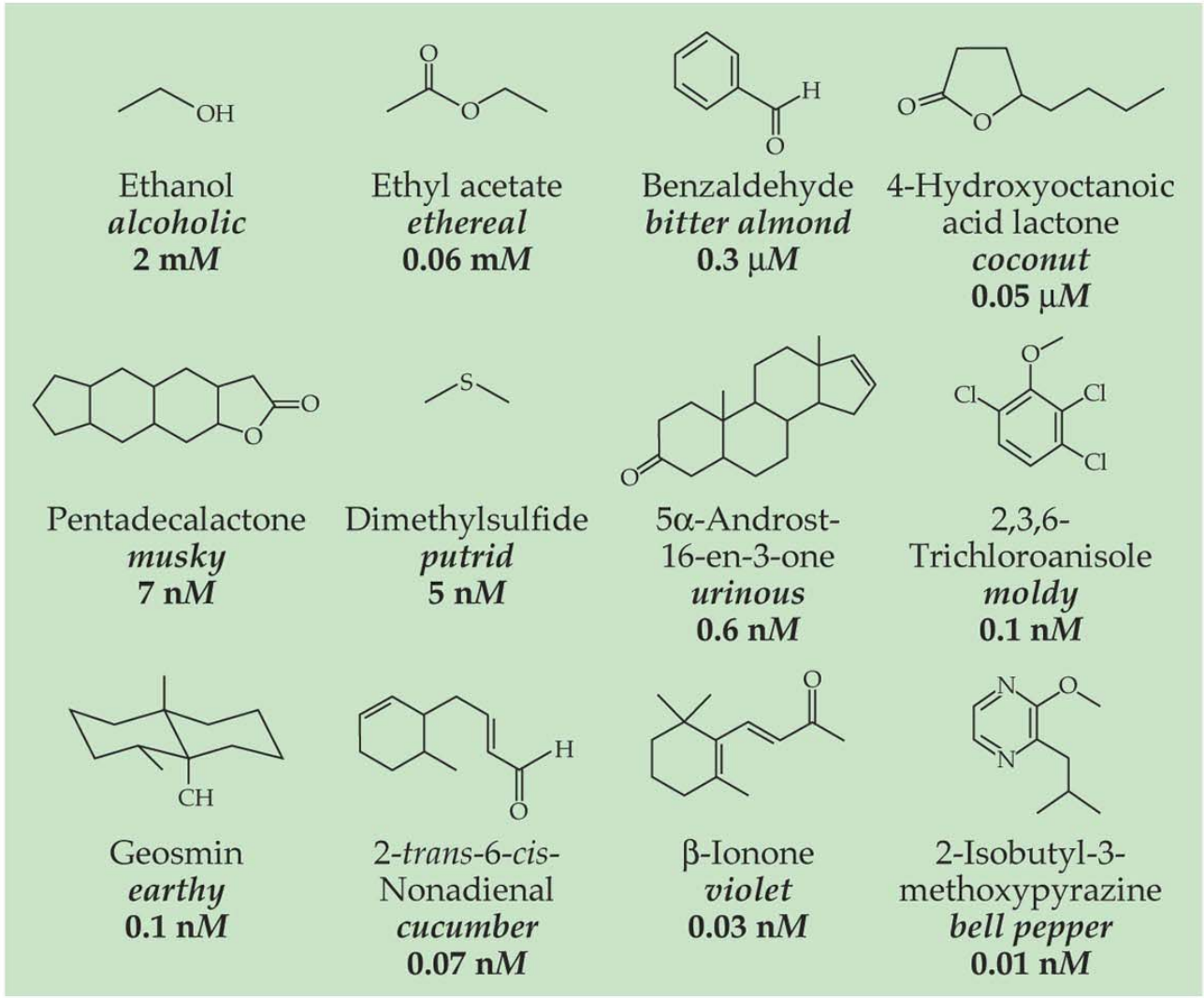


Axel, R. (1995) Spektrum der Wissenschaft, Dezember 1995

Olfaction

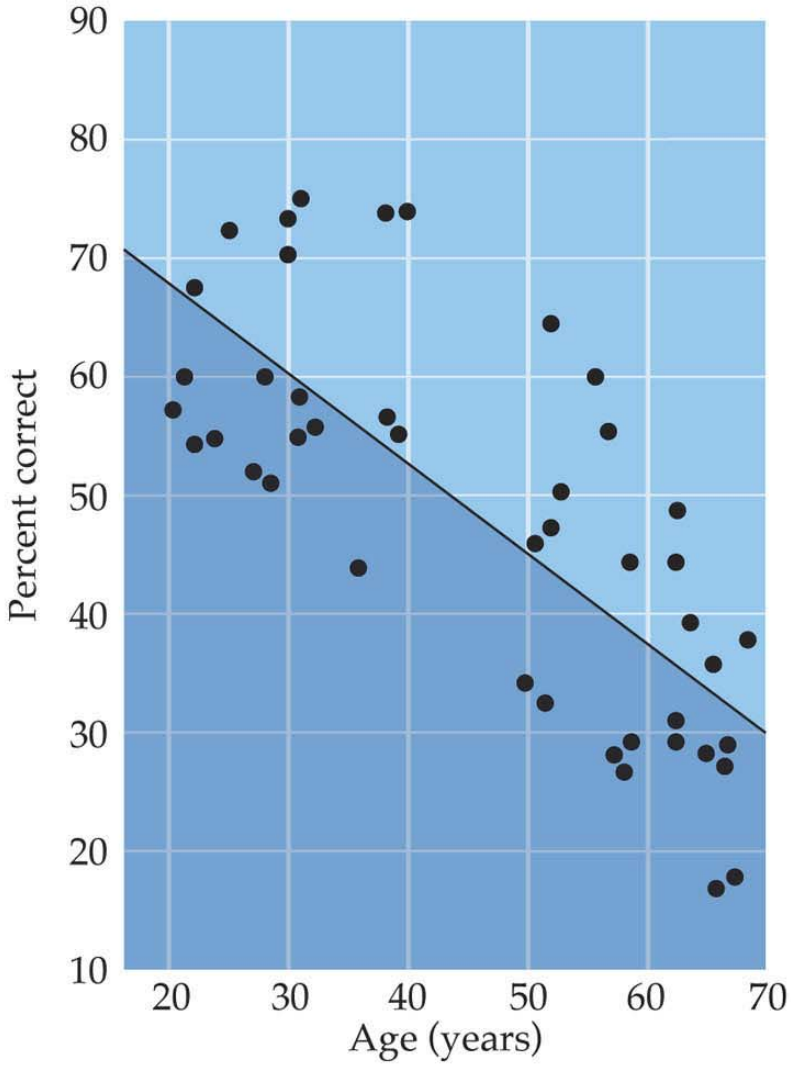


Olfactory thesholds



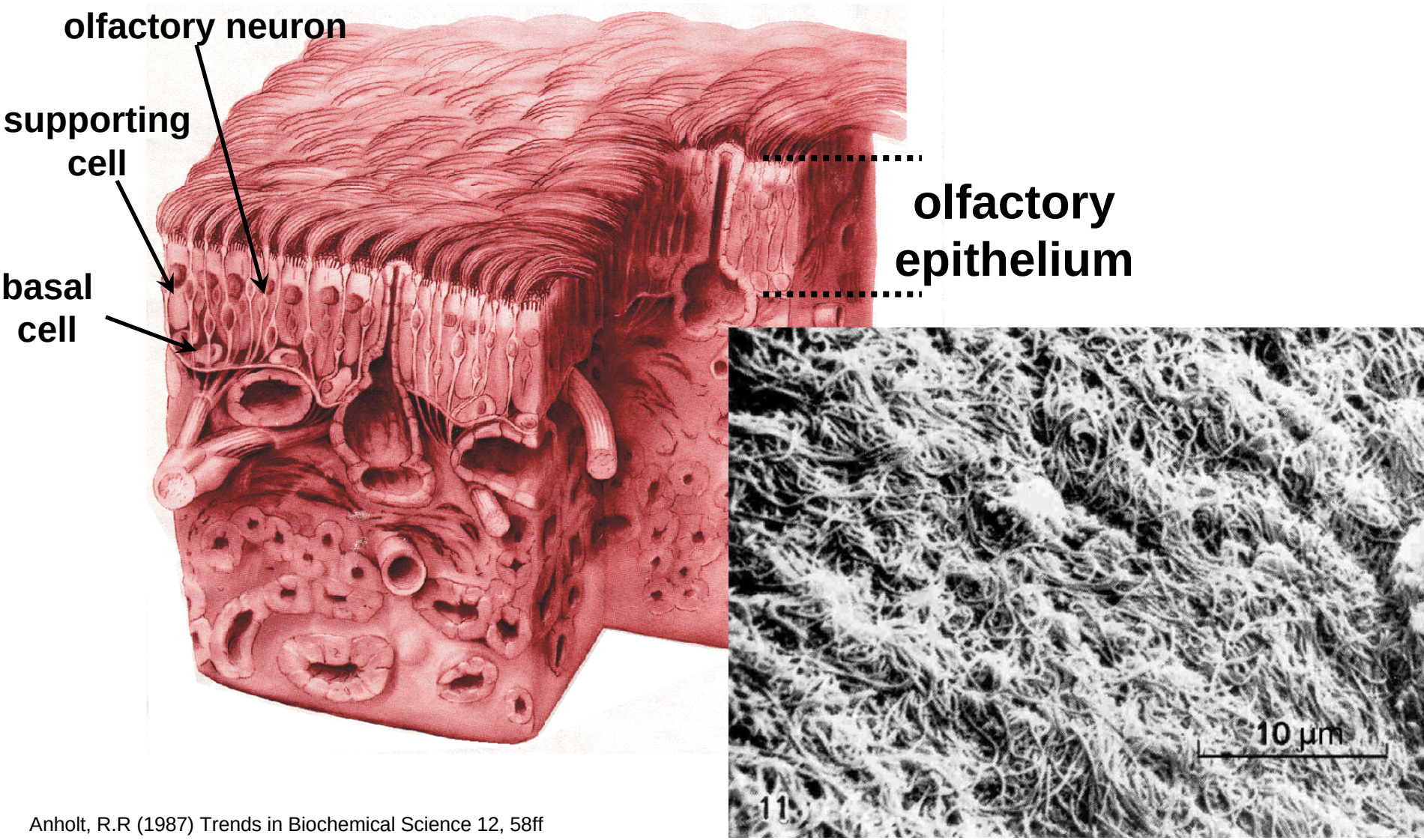
NEUROSCIENCE, Third Edition, **Figure 14.2** © 2004 Sinauer Associates, Inc.

Decline in olfactory sensitivity



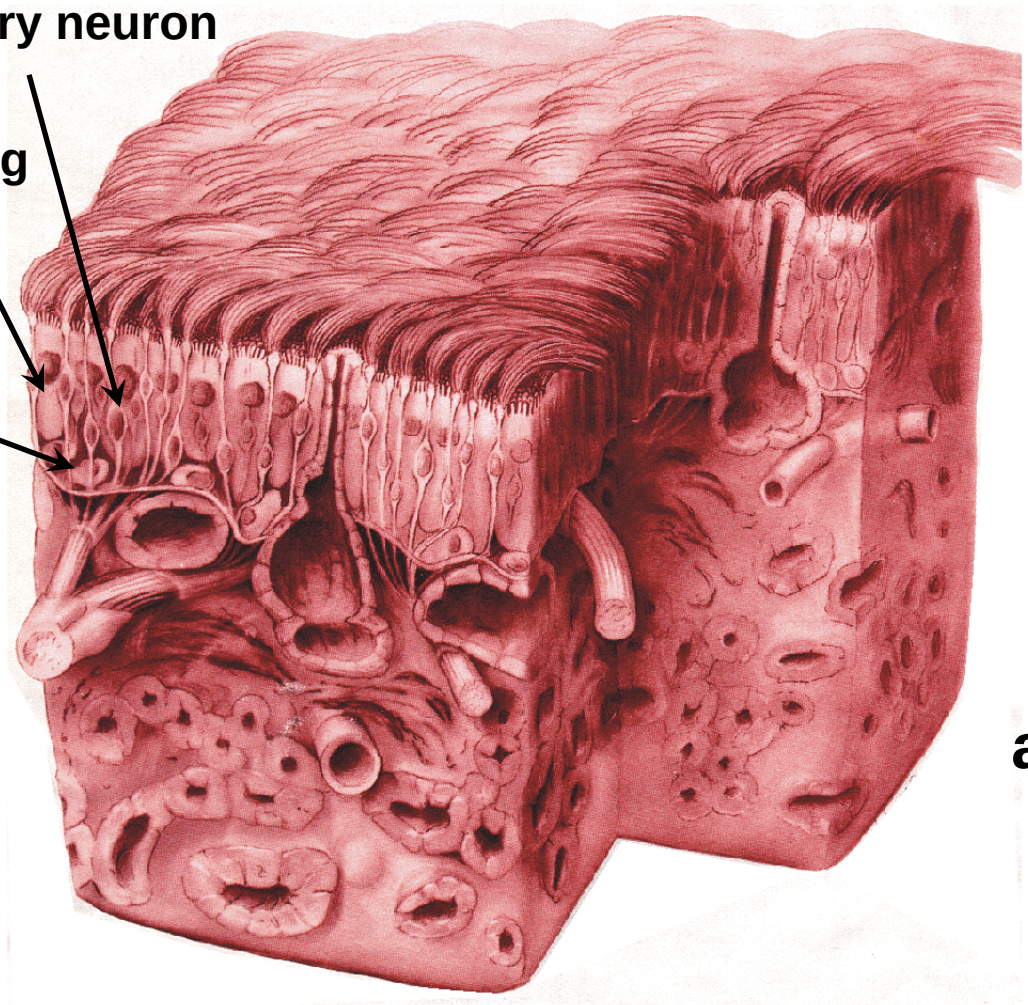
NEUROSCIENCE, Third Edition, **Figure 14.4** © 2004 Sinauer Associates, Inc.

The olfactory epithelium



Anholt, R.R (1987) Trends in Biochemical Science 12, 58ff

Signaltransduktion



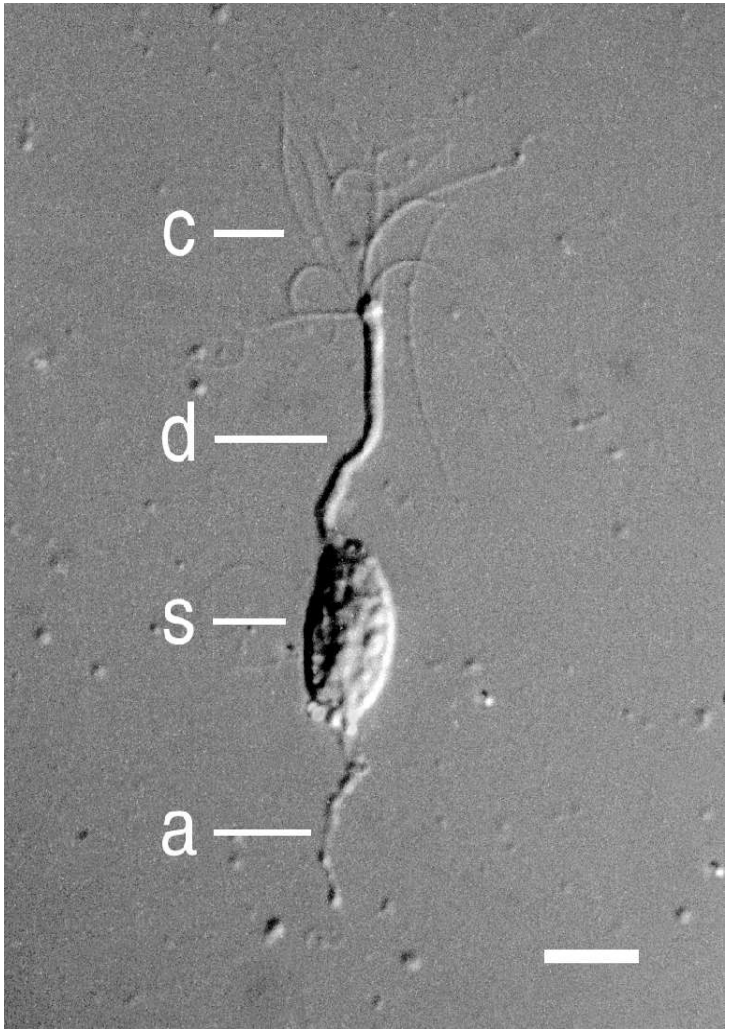
mammals
5 - 120 million
olfactory neurons

humans
approx. 10 million

life time
approx. 4 – 8 weeks

Anholt, R.R (1987) Trends in Biochemical Science 12, 58ff

Signal transduction



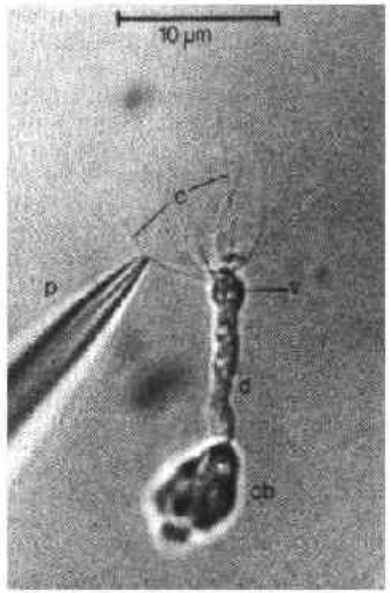
c = cilia
function: detect odorants;
chemo-electrical signal transduction

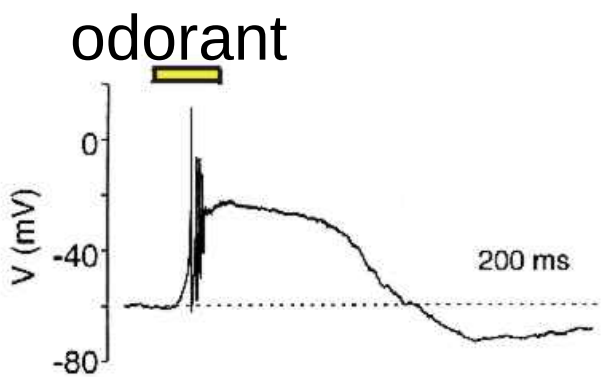
d = dendrite

s = soma
function: energy production,
protein biosynthesis

a = axon
function: generate and conduct
action potentials

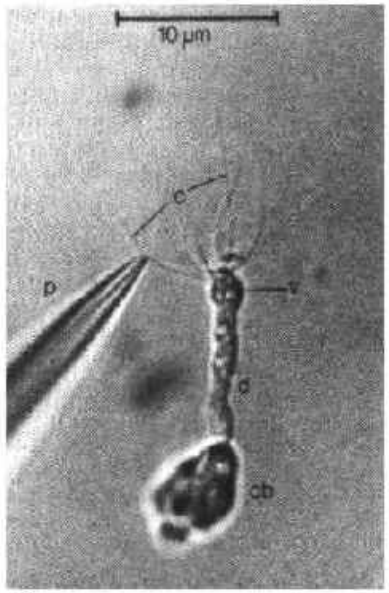
Odorants excite olfactory neurons

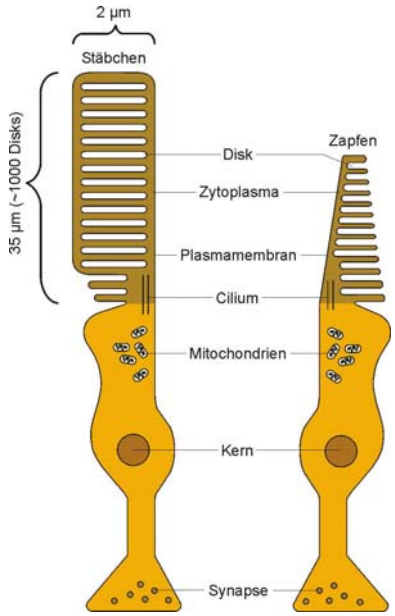


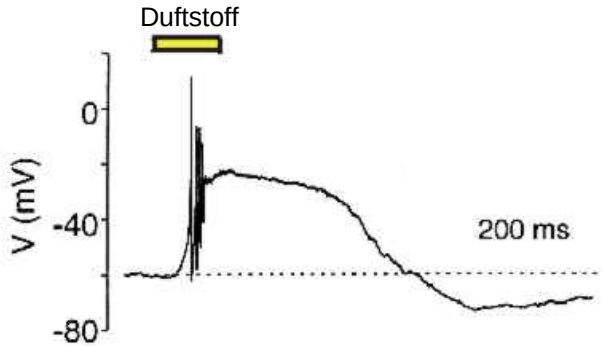


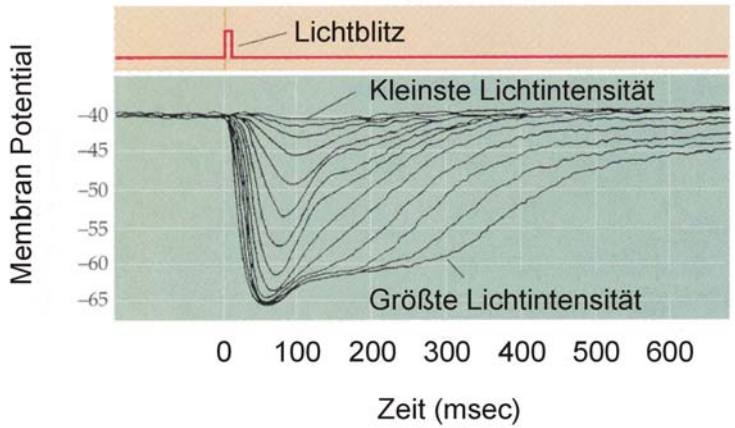
depolarisation

Signal transduction









depolarisation

hyperpolarisation

Signal transduction

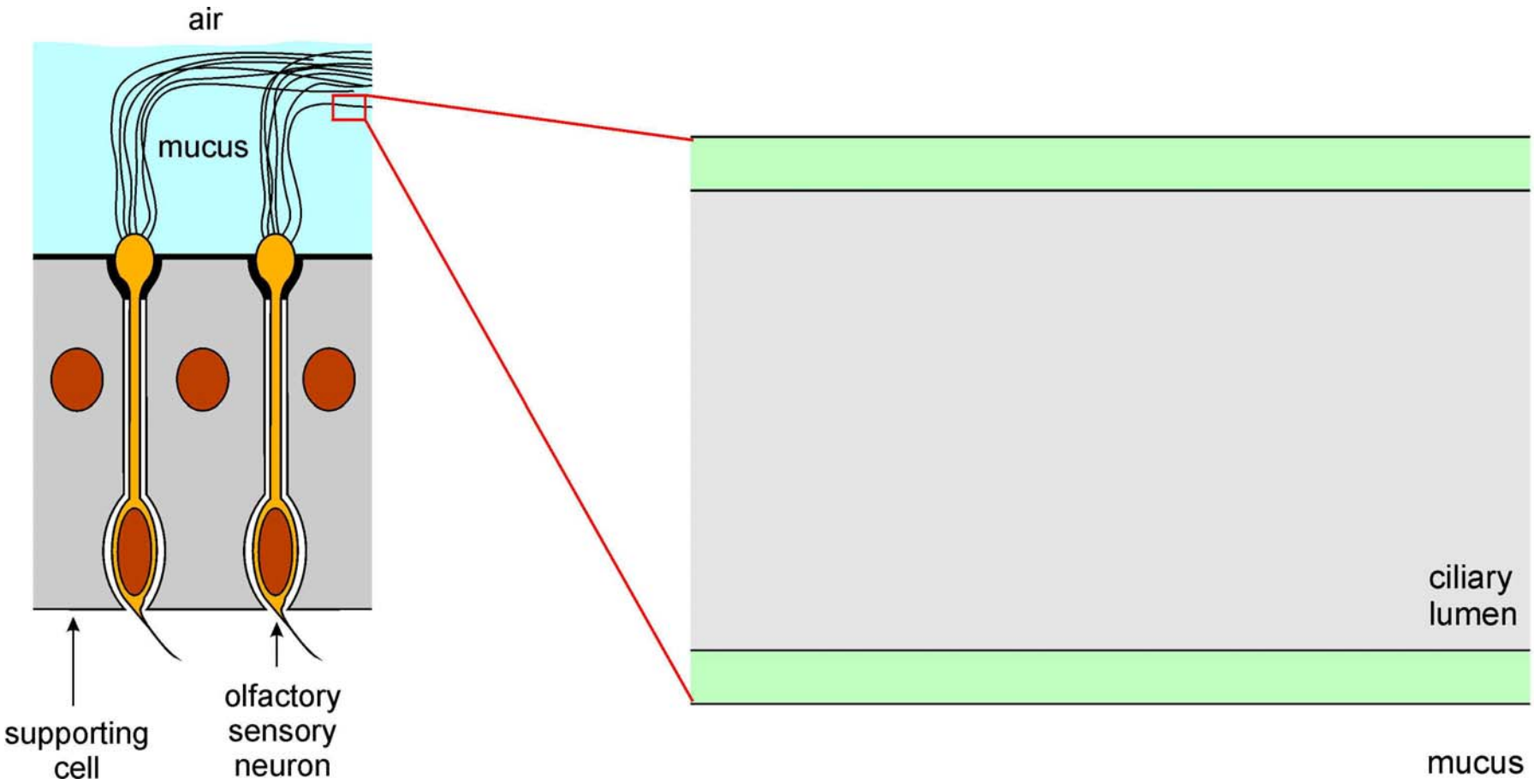
in olfaction

Olfaction

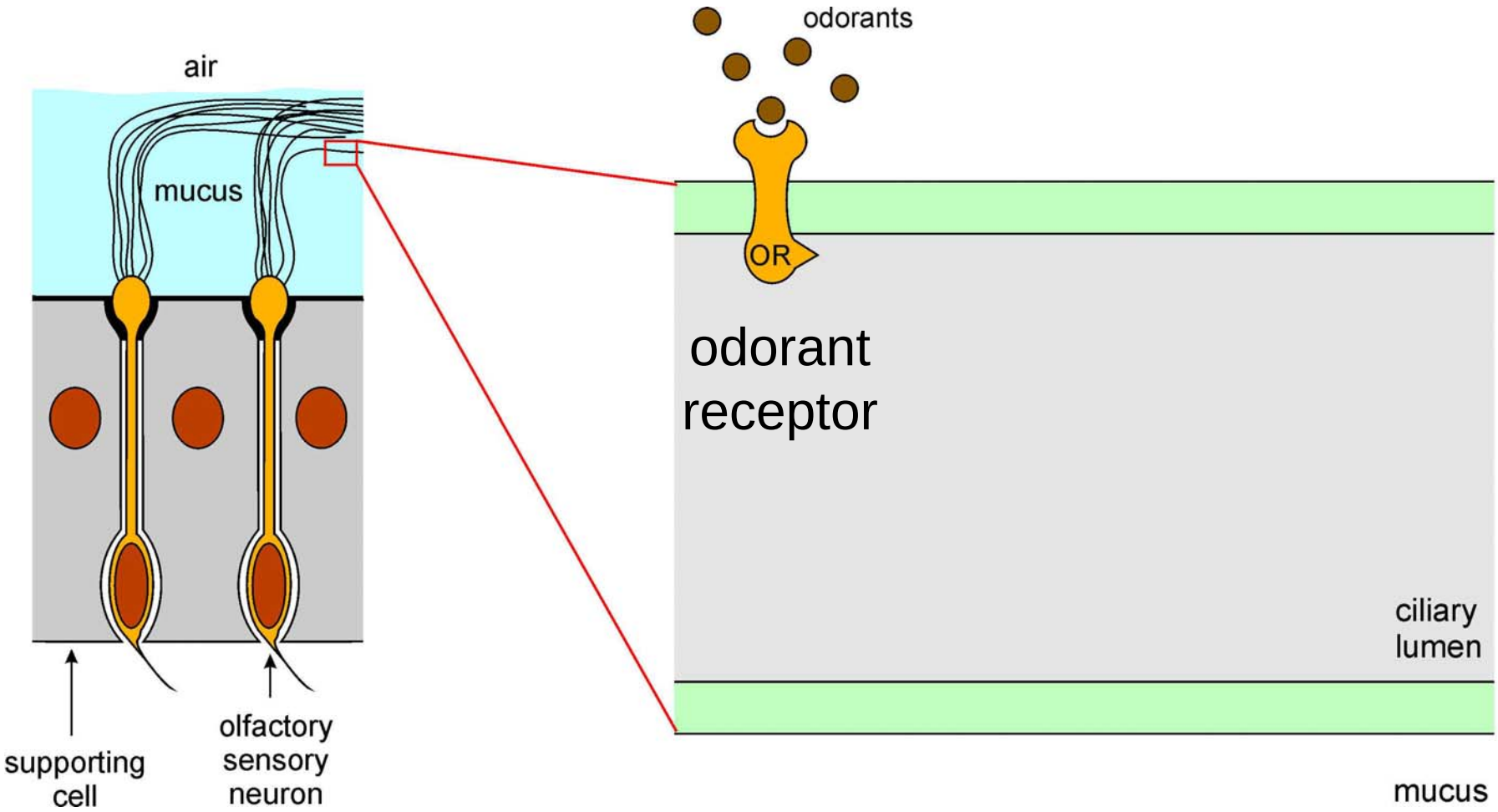
receptors
specificty

sensitivity
enzyme cascade

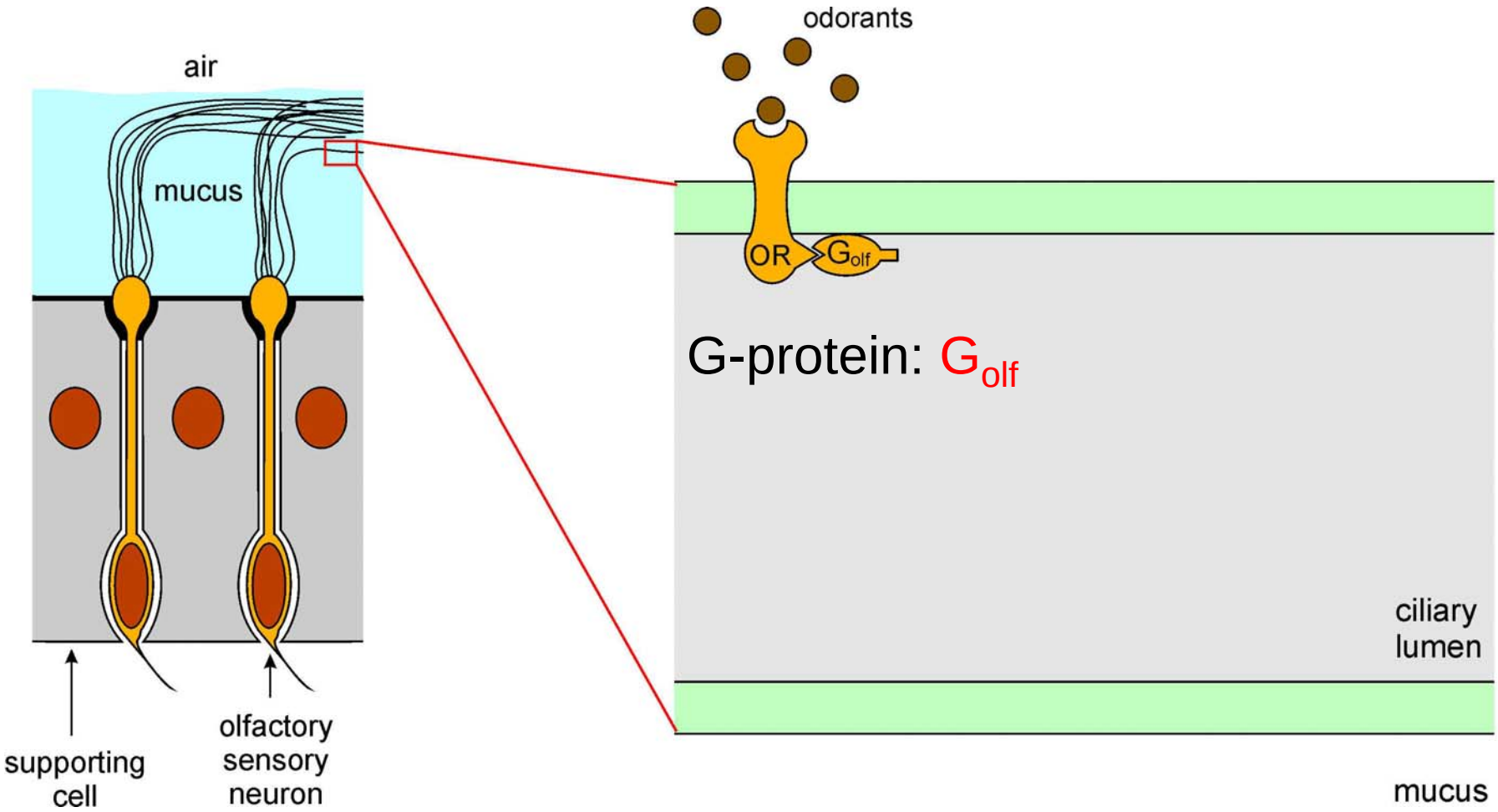
electrical response
ion channel(s)



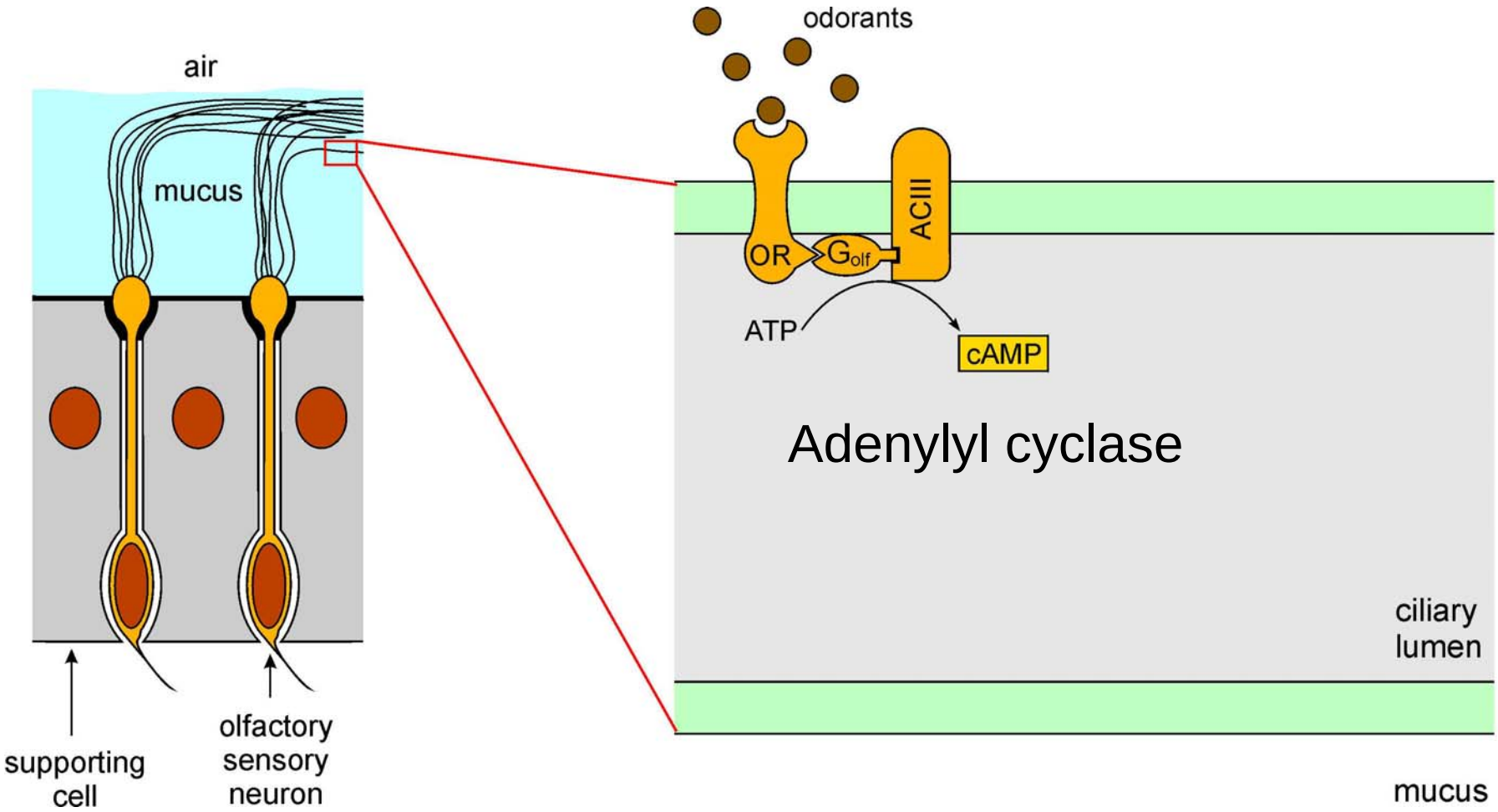
Olfaction


air
mucus
supporting cell
olfactory sensory neuron
odorants
OR
odorant receptor
ciliary lumen
mucus

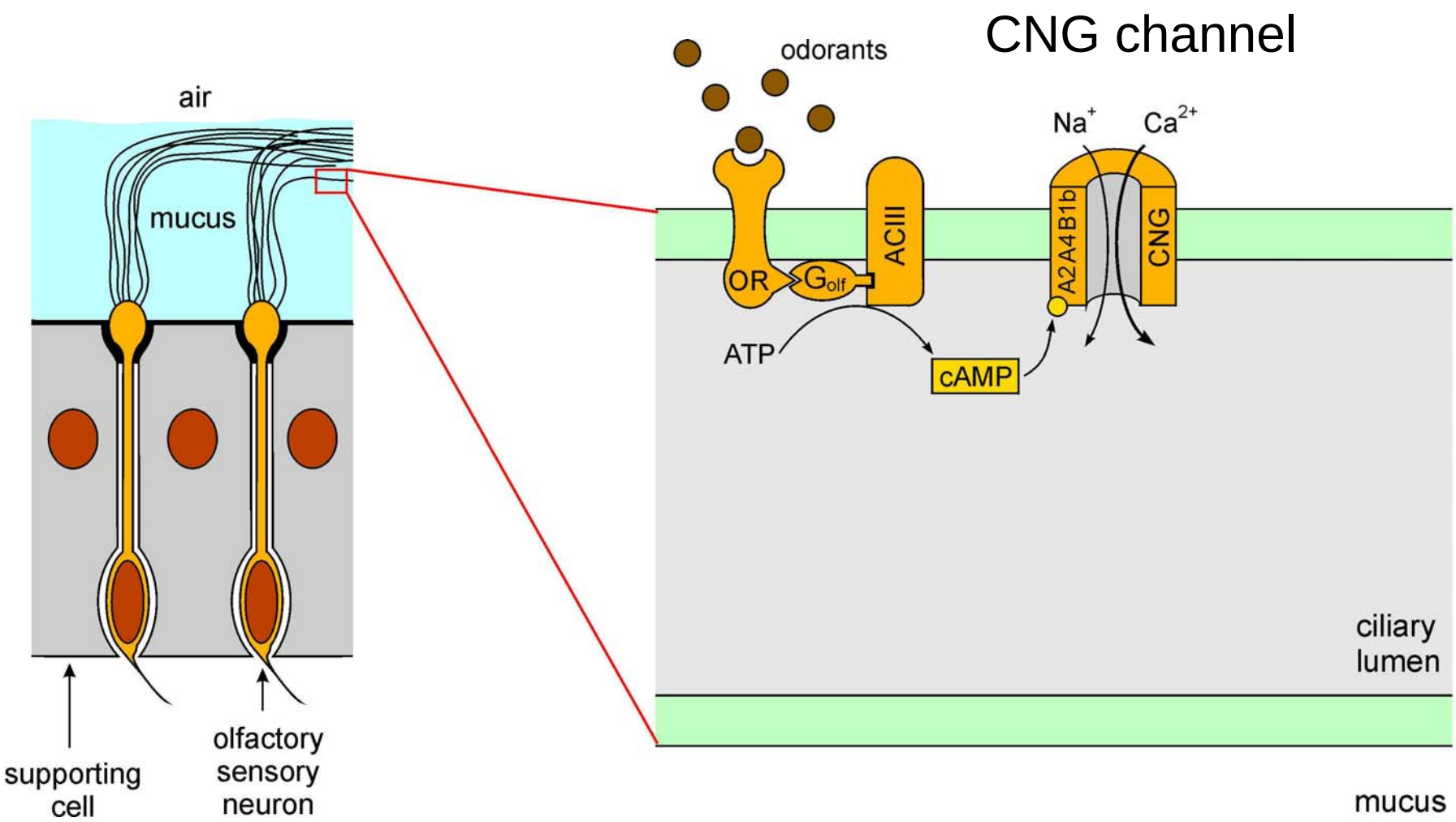
Olfaction


air
mucus
supporting cell
olfactory sensory neuron
odorants
OR
G_{olf}
G-protein: G_{olf}
ciliary lumen
mucus

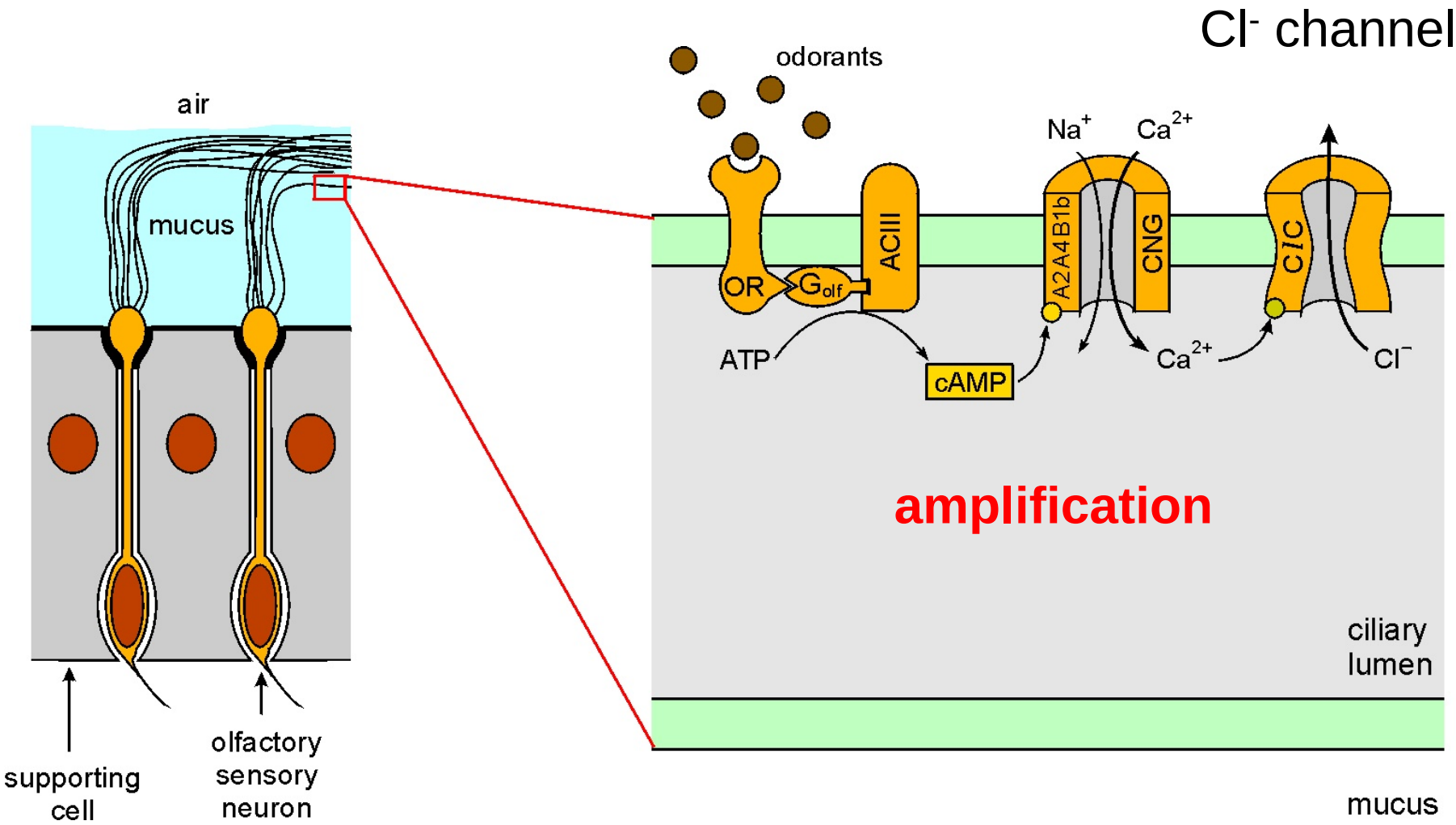
Olfaction


air
mucus
supporting cell
olfactory sensory neuron
odorants
OR
G_{olf}
ACIII
ATP
cAMP
Adenylyl cyclase
ciliary lumen
mucus

Olfaction


air
mucus
supporting cell
olfactory sensory neuron
odorants
CNG channel
OR
G_{olf}
ACIII
ATP
cAMP
Na^+
Ca^{2+}
A2A4B1b
CNG
ciliary lumen
mucus

Olfaction

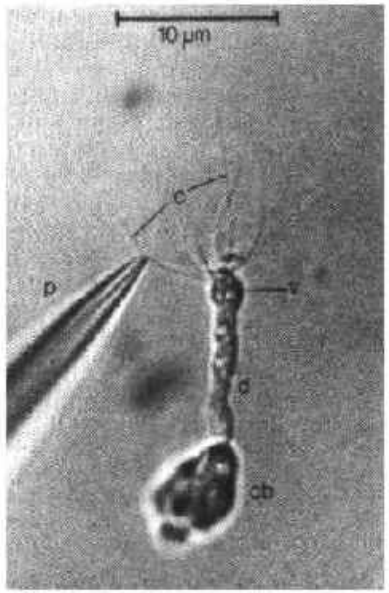

air
mucus
supporting cell
olfactory sensory neuron
odorants
OR
G_{olf}
ACIII
ATP
cAMP
Na^+
Ca^{2+}
A2A4B1b
CNG
Ca^{2+}
ClC
Cl^-
Cl^- channel
amplification
ciliary lumen
mucus

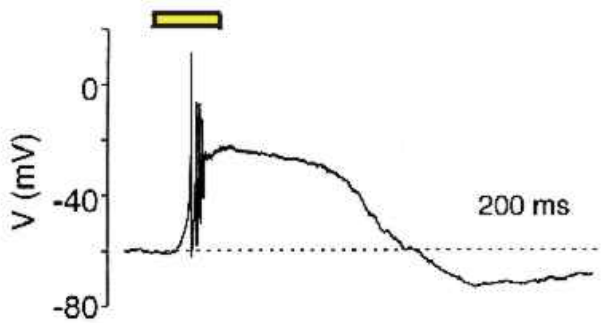
Is the signalling cascade

supported by

chloride efflux?

Olfaction

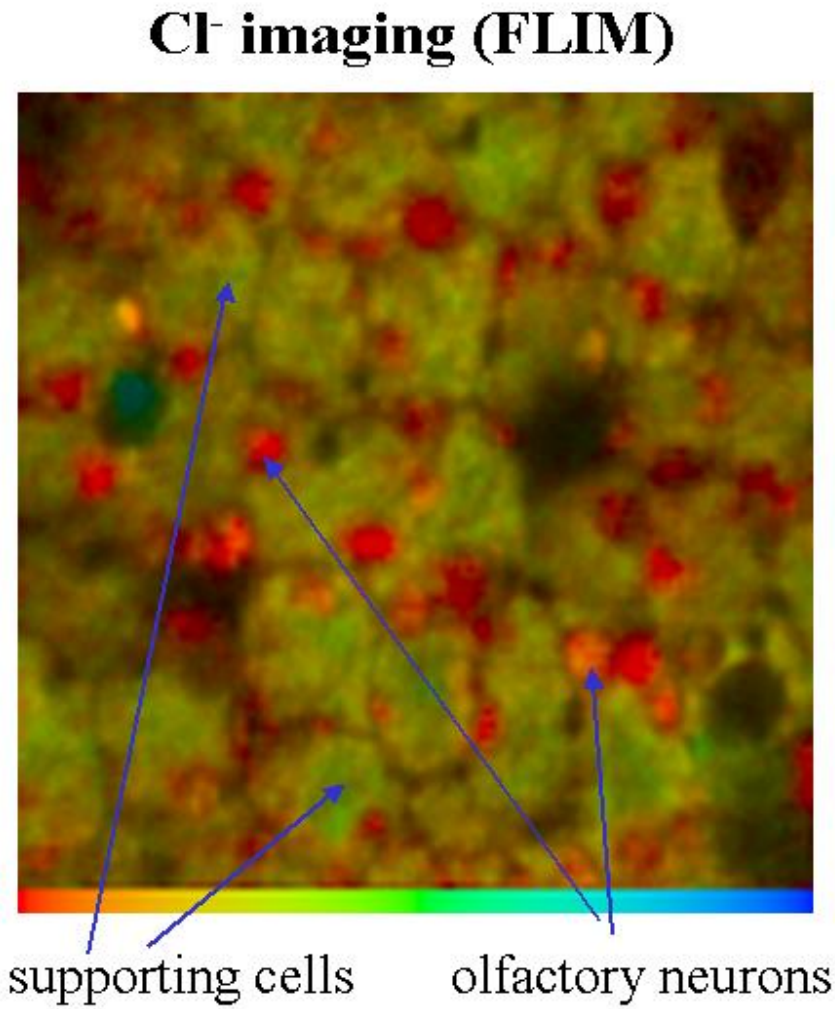




Ion distribution (vertebrate)

	outside	inside
Na^+	140 mM	3-30 mM
K^+	5 mM	140 mM
Ca^{2+}	2 mM	< 1 µM
Mg^{2+}	2 mM	einige mM
Cl^-	140 mM	10 mM

Olfaction



high [Cl^-] in the neuron

$\Rightarrow$ amplification

Properties of the molecular components of the signalling cascade