

M U N I

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7

Čich a chuť

Čich a chuť jsou „chemické smysly“, které spolu úzce souvisí

Čich a chuť jsou „chemické“ signály, které spolu úzce souvisí

Pachové signály trvají v čase

Čich

- Schopnost vnímat chemické látky ve vzduchu

Čich

- Schopnost vnímat chemické látky ve vzduchu
- Podmínil rozvoj kůry

Čich

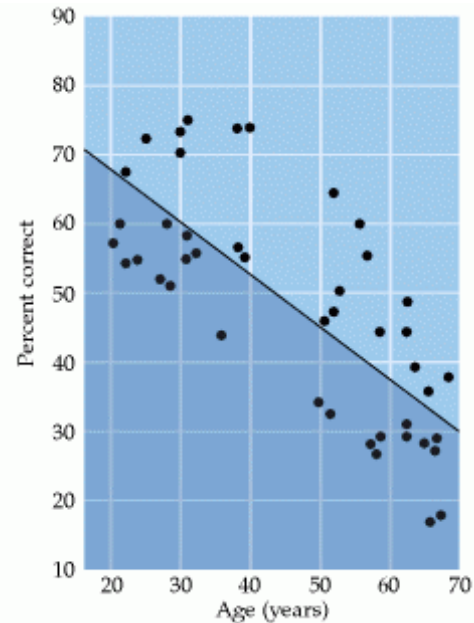
- Schopnost vnímat chemické látky ve vzduchu
- Podmínil rozvoj kůry
- Identifikace místa
- Identifikace potravy

Čich

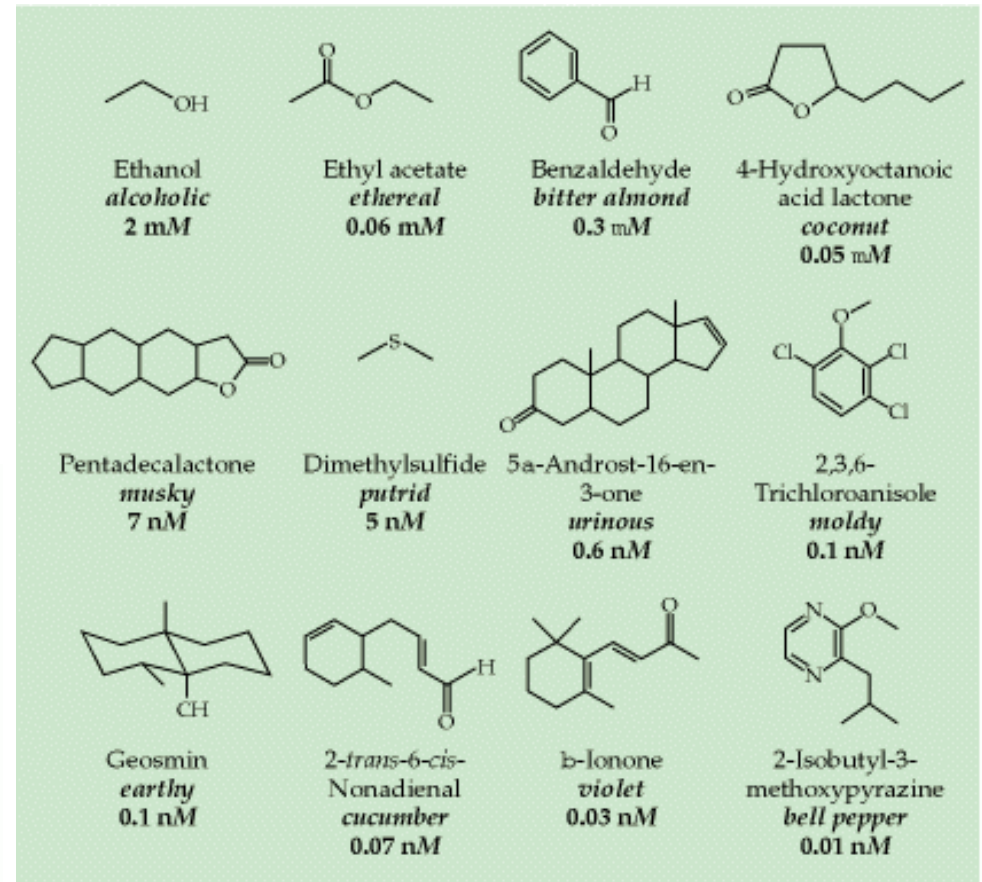
- Schopnost vnímat chemické látky ve vzduchu
- Podmínil rozvoj kůry
- Identifikace místa
- Identifikace potravy
- Člověk je mikroolfaktorický tvor
 - Úbytek analytických schopností vedl k relativnímu zvýraznění psychologické komponenty

Čich

- Člověk je schopen rozlišit asi 80 chemických látek a 144-10000 vůní
- Vyšší citlivost vůči liposolubním molekulám
- Čich s věkem výrazně degeneruje



<http://www.slideshare.net/drpsdeb/presentations>



<http://www.slideshare.net/drpsdeb/presentations>

10 základních kategorií vůní

- ✓ vůně (příjemná)
- ✓ dřevo/pryskyřice
- ✓ ovoce (kromě citrusů)
 - ✓ Hniloba
 - ✓ Chemikálie
 - ✓ Pepermint
 - ✓ sladké vůně
 - ✓ Popcorn
- ✓ palčivé/štiplavé vůně
 - ✓ citrón

[Categorical dimensions of human odor descriptor space revealed by non-negative matrix factorization.](#)

Castro JB, Ramanathan A, **Chennubhotla** CS.

PLoS One. 2013 Sep 18;8(9):e73289. doi: 10.1371/journal.pone.0073289. eCollection 2013.

PMID:24058466

10 largest-valued descriptors for each of the 10 basis vectors obtained from non-negative matrix factorization.

W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
FRAGRANT	WOODY, RESINOUS	FRUITY, OTHER THAN CITRUS	SICKENING	CHEMICAL	MINTY, PEPPERMINT	SWEET	POPCORN	SICKENING	LEMON
FLORAL	MUSTY, EARTHY, MOLDY	SWEET	PUTRID, FOUL, DECAYED	ETHERISH, ANAESTHETIC	COOL, COOLING	VANILLA	BURNT, SMOKY	GARLIC, ONION	FRUITY, CITRUS
PERFUMERY	CEDARWOOD	FRAGRANT	RANCID	MEDICINAL	AROMATIC	FRAGRANT	PEANUT BUTTER	HEAVY	FRAGRANT
SWEET	HERBAL, GREEN, CUT GRASS	AROMATIC	SWEATY	DISINFECTANT, CARBOLIC	ANISE (LICORICE)	AROMATIC	NUTTY (WALNUT ETC)	BURNT, SMOKY	ORANGE
ROSE	FRAGRANT	LIGHT	SOUR, VINEGAR	SHARP, PUNGENT, ACID	FRAGRANT	CHOCOLATE	OILY, FATTY	SULFIDIC	LIGHT
AROMATIC	AROMATIC	PINEAPPLE	SHARP, PUNGENT, ACID	GASOLINE, SOLVENT	MEDICINAL	MALTY	ALMOND	SHARP, PUNGENT, ACID	SWEET
LIGHT	LIGHT	CHERRY (BERRY)	FECAL (LIKE MANURE)	PAINT	SPICY	ALMOND	HEAVY	HOUSEHOLD GAS	COOL, COOLING
COLOGNE	HEAVY	STRAWBERRY	SOUR MILK	CLEANING FLUID	SWEET	CARAMEL	WARM	PUTRID, FOUL, DECAYED	AROMATIC
HERBAL, GREEN, CUT GRASS	SPICY	PERFUMERY	MUSTY, EARTHY, MOLDY	ALCOHOLIC	EUCALIPTUS	LIGHT	MUSTY, EARTHY, MOLDY	SEWER	HERBAL, GREEN, CUT GRASS
VIOLETS	BURNT, SMOKY	BANANA	HEAVY	TURPENTINE (PINE OIL)	CAMPHOR	WARM	WOODY, RESINOUS	BURNT RUBBER	SHARP, PUNGENT, ACID

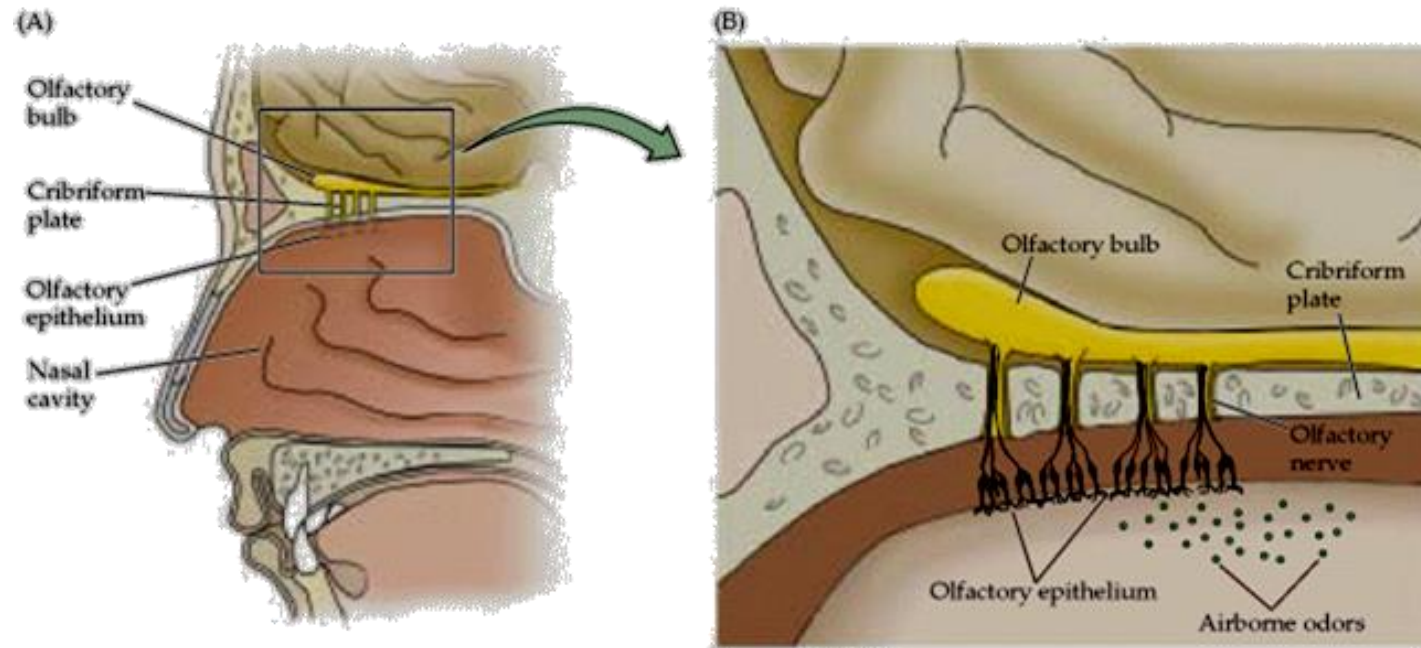
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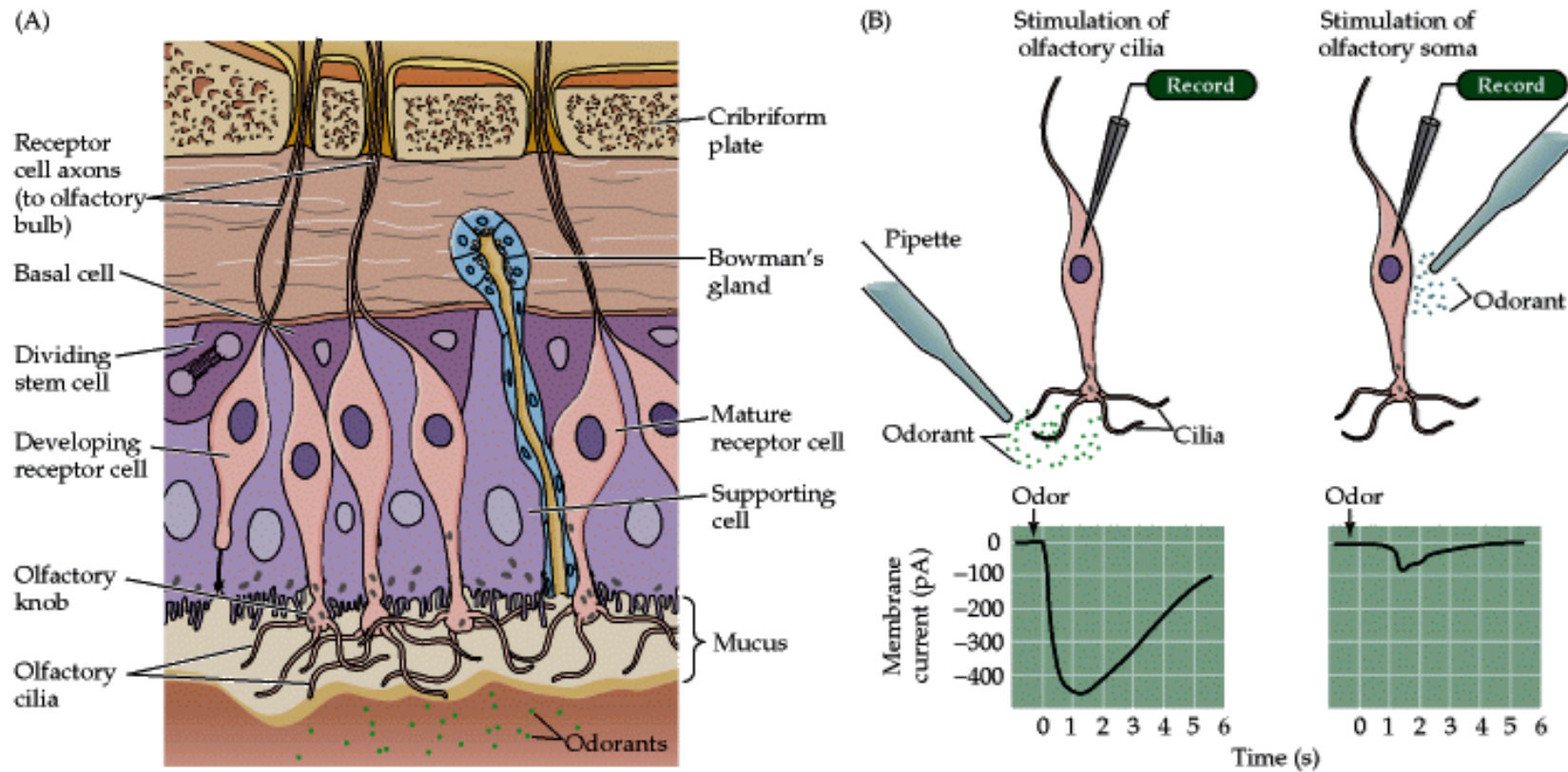
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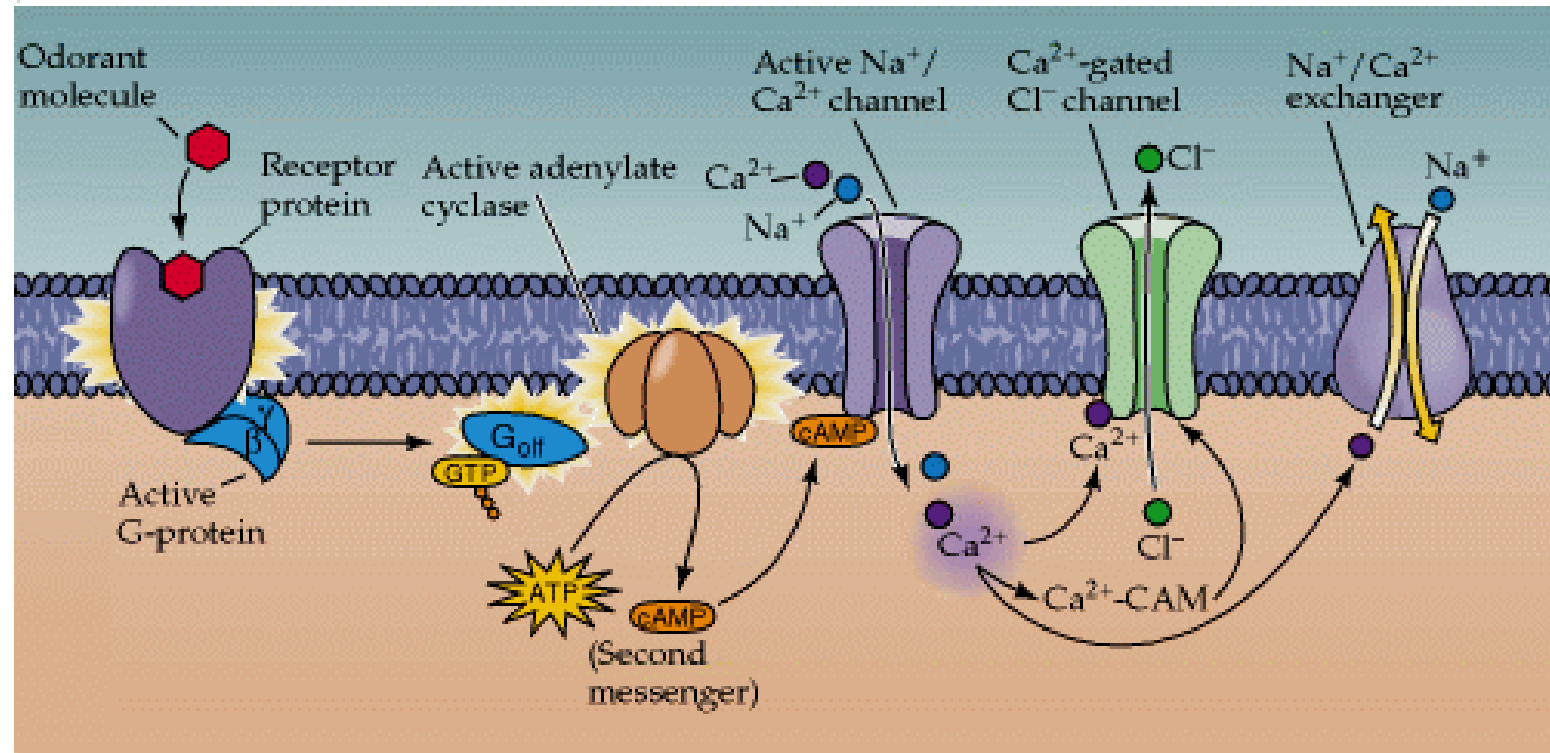
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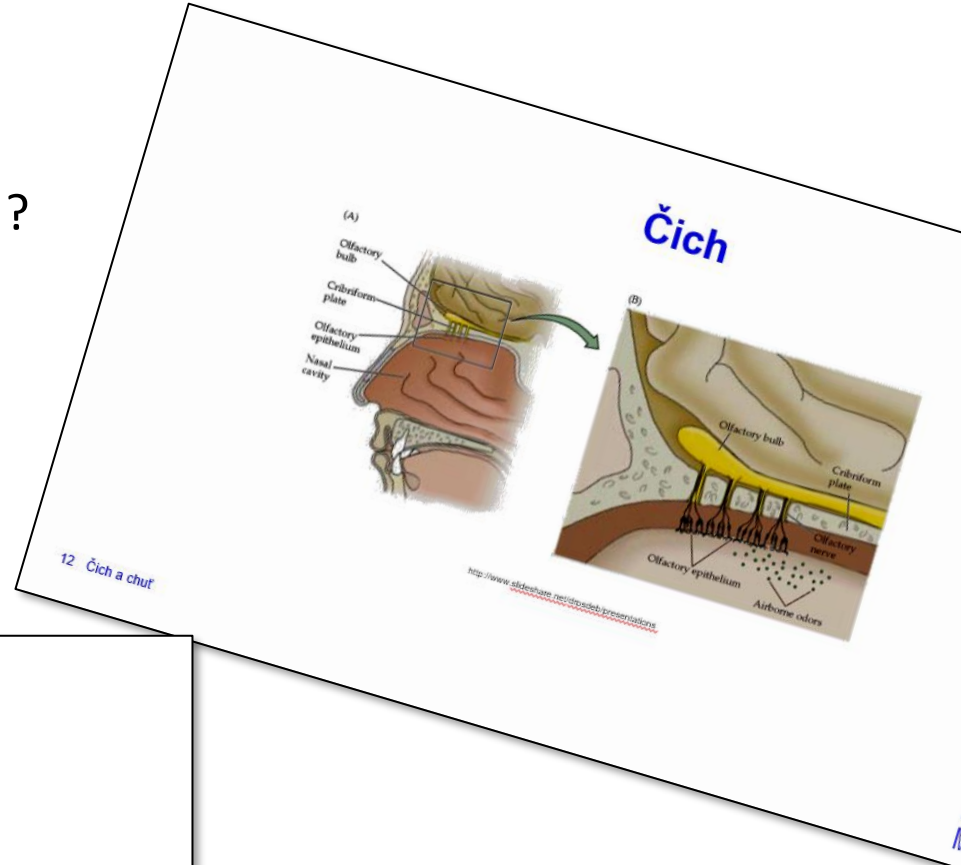
- Detekce struktury molekul ?
 - Funkční skupina ?
 - Tvar molekuly ?

for each of the 10 basis vectors obtained from non-negative matrix factorization.

W3	W4	W5	W6	W7	W8	W9	W10
BODY, RESINOUS	FRUITY, OTHER THAN CITRUS	PUTRID, FOUL, DECAYED	CHEMICAL	MENTH, PEPPERMENT	SWEET	POPORN	SICKENING
FRUITY, EARTHY, MOLDY	SWEET	RANCID	ETHEREAL, ANAESTHETIC, MEDICINAL	COOL, COOLING	FRAGRANT	PEANUT BUTTER	FRUITY, CITRUS
CEDARWOOD	FRAGRANT	SWEATY	DISINFECTANT, CARBOLIC	AROMATIC	FRAGRANT	NUTTY (WALNUT ETC)	FRAGRANT
HERBAL, GREEN, CUT GRASS	LIGHT	SOUR, VINEGAR	SHARP, PUNGENT, ACID	ANISE (LICORICE)	CHOCOLATE	OILY, FATTY	SULFIDIC
FRAGRANT	PINEAPPLE	SHARP, PUNGENT, ACID	FECAL (LIKE MANURE)	GASOLINE, SOLVENT	SPICY	ALMOND	SHARP, PUNGENT, ACID
AROMATIC	CHERRY (BERRY)	STRAWBERRY	SOUR MILK	CLEANING FLUID	SWEET	CARAMEL	HOUSEHOLD GAS
LIGHT	STRAWBERRY	PERFLUMERY	MUSTY, EARTHY, MOLDY	ALCOHOLIC	EUCALYPTUS	LIGHT	PUTRID, FOUL, DECAYED
HEAVY	PERFLUMERY	BANANA	HEAVY	TURPENTINE (PINE OIL)	CAMPBOR	WARM	HERBAL, GREEN, CUT GRASS
AL, GREEN, GRASS	SPICY	BURN, SMOKY	HEAVY	TURPENTINE (PINE OIL)	CAMPBOR	WARM	HERBAL, GREEN, CUT GRASS
SOLETS	BURN, SMOKY	BANANA	HEAVY	TURPENTINE (PINE OIL)	CAMPBOR	WARM	HERBAL, GREEN, CUT GRASS

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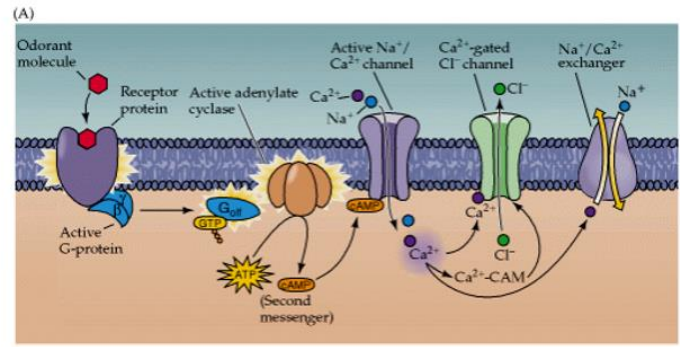
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15 Čich a chut

Čich

- Detekce struktury molekul ?
 - Funkční skupina ?
 - Tvar molekuly ?
- Detekce vibrace molekul ?

for each of the 10 basis vectors obtained from non-negative matrix factorization.

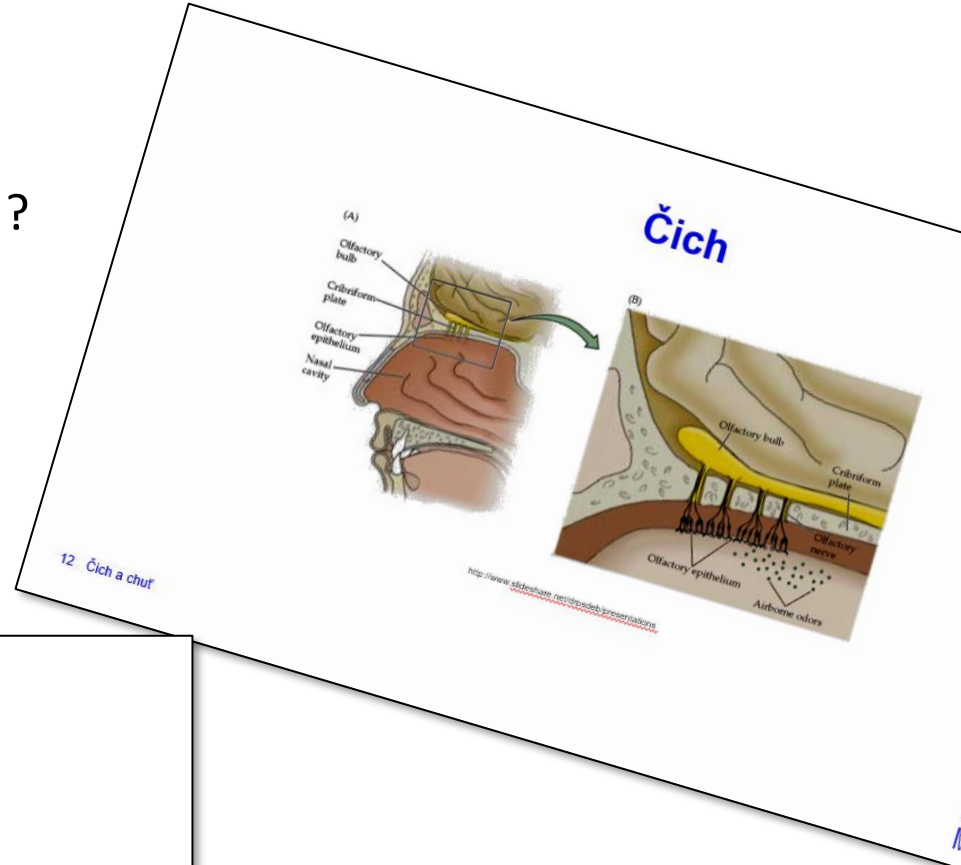
W3	W4	W5	W6	W7	W8	W9	W10
BODY, RESINOUS	FRUITY, OTHER THAN CITRUS	PUTRID, FOUL, DECAYED	CHEMICAL	MENTHOL, PEPPERMENT	SWEET	VANILLA	POPCORN
BUSTY, EARTHY, MOLDY	SWEET	FRAGRANT	ETHEREAL, ANAESTHETIC, MEDICINAL	COOL, COOLING, AROMATIC	FRAGRANT	PEANUT BUTTER	SICKENING
CEDARWOOD	FRAGRANT	FRAGRANT	DISINFECTANT, CARBOIC	SHARP, PUNGENT, ACID	FRAGRANT	CHOCOLATE, OILY, FATTY	FRUITY, CITRUS
HERBAL, GREEN, CUT GRASS	FRAGRANT	FRAGRANT	SHARP, PUNGENT, ACID	GASOLINE, SOLVENT	SPICY	ALMOND	HEAVY
FRAGRANT	FRAGRANT	FRAGRANT	SHARP, PUNGENT, ACID	FECAL (LIKE MANURE)	SOUR, MILK	CLEANSING FLUID	SWEET
AROMATIC	FRAGRANT	FRAGRANT	SHARP, PUNGENT, ACID	CHERRY (BERRY)	STRAWBERRY	PERFLUMERY	FRAGRANT
LIGHT	FRAGRANT	FRAGRANT	SHARP, PUNGENT, ACID	CHERRY (BERRY)	STRAWBERRY	PERFLUMERY	FRAGRANT
HEAVY	FRAGRANT	FRAGRANT	SHARP, PUNGENT, ACID	CHERRY (BERRY)	STRAWBERRY	PERFLUMERY	FRAGRANT
AL, GREEN, GRASS	FRAGRANT	FRAGRANT	SHARP, PUNGENT, ACID	CHERRY (BERRY)	STRAWBERRY	PERFLUMERY	FRAGRANT
W10	W9	W8	W7	W6	W5	W4	W3
LEMON	SICKENING	GARLIC, ONION	POPCORN	BURNED, SMOKY	BURNED, SMOKY	BURNED, SMOKY	FRUITY, CITRUS
FRAGRANT	FRAGRANT	FRAGRANT	FRAGRANT	FRAGRANT	FRAGRANT	FRAGRANT	FRAGRANT
SWEET	SWEET	SWEET	SWEET	SWEET	SWEET	SWEET	SWEET
COOL, COOLING	COOL, COOLING	COOL, COOLING	COOL, COOLING	COOL, COOLING	COOL, COOLING	COOL, COOLING	COOL, COOLING
AROMATIC	AROMATIC	AROMATIC	AROMATIC	AROMATIC	AROMATIC	AROMATIC	AROMATIC
HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS	HERBAL, GREEN, CUT GRASS
PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED	PUTRID, FOUL, DECAYED
HOUSEHOLD GAS	HOUSEHOLD GAS	HOUSEHOLD GAS	HOUSEHOLD GAS	HOUSEHOLD GAS	HOUSEHOLD GAS	HOUSEHOLD GAS	HOUSEHOLD GAS
MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY	MUSTY, EARTHY, MOLDY
BURNED, RUBBER	BURNED, RUBBER	BURNED, RUBBER	BURNED, RUBBER	BURNED, RUBBER	BURNED, RUBBER	BURNED, RUBBER	BURNED, RUBBER
SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID	SHARP, PUNGENT, ACID

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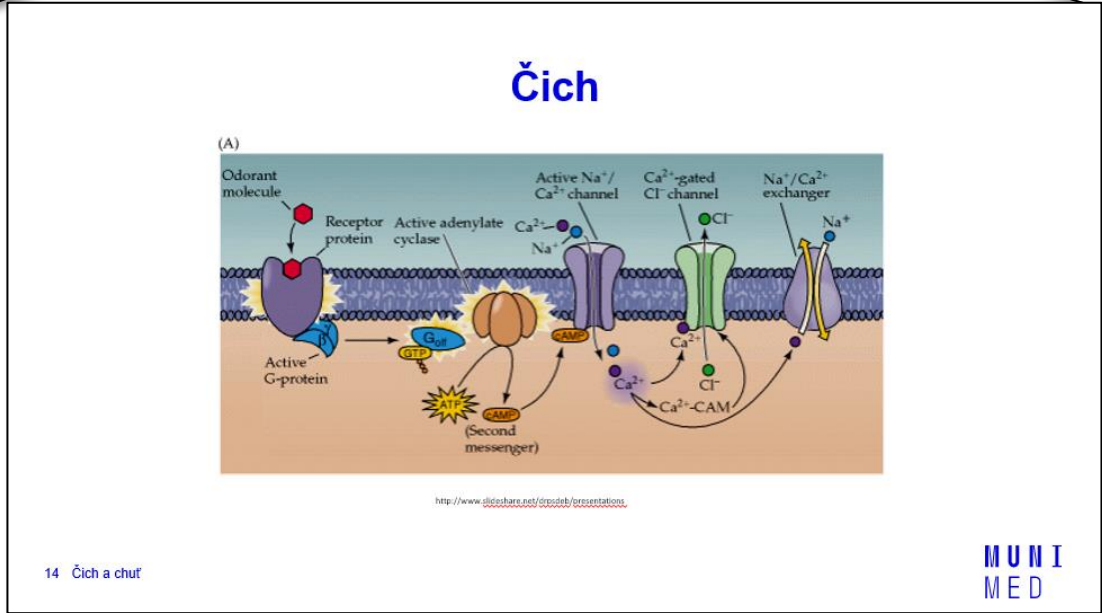
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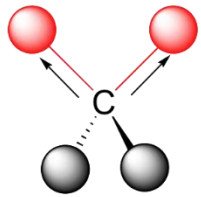
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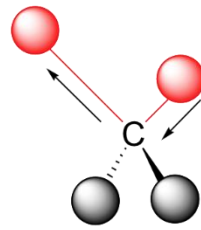
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Vibrace molekul

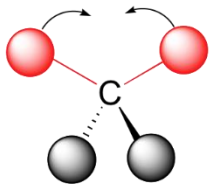
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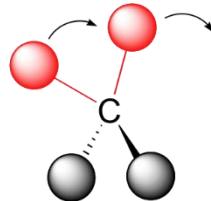
symmetric stretching



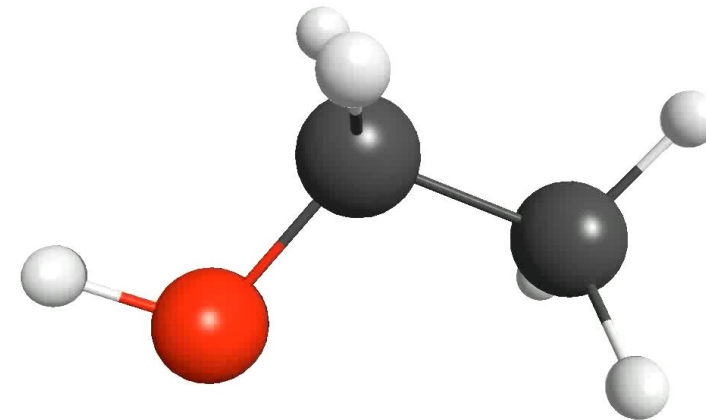
asymmetric stretching



scissoring

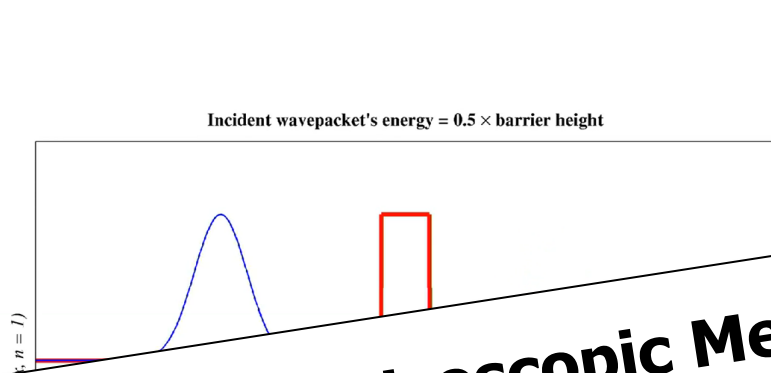


rocking



<https://orgspectroscopyint.blogspot.com/2014/12/infrared-spectroscopy.html>

Kvantová teorie čichu



Turin L. A Spectroscopic Mechanism for Primary Olfactory Reception.
Chem Senses. 1996;21:773–791.

<https://academic.oup.com/chemse/article/21/6/773/488342/>

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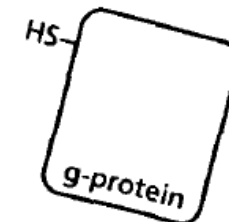
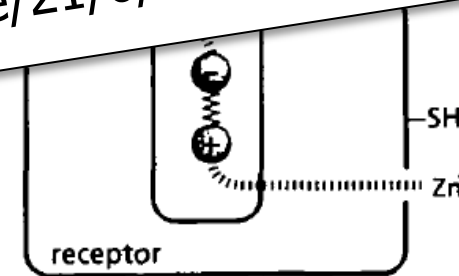


Figure 1 Schematic of the proposed transduction mechanism: the receptor protein accepts electrons from a soluble electron donor (NADPH). When the receptor binding site is empty (top), electrons are unable to tunnel across the binding site because no empty levels are available at the appropriate energy. The disulphide bridge between the receptor and its associated G-protein remains in the oxidized state. When an odorant (here represented as an elastic dipole) occupies the binding site (bottom), electrons can lose energy during tunnelling by exciting its vibrational mode. This only happens if the energy of the vibrational mode equals the energy gap between the filled and empty levels. Electrons then flow through the protein and reduce the disulphide bridge via a zinc ion, thus releasing the G-protein for further transduction steps.

<https://academic.oup.com/chemse/article>

Kvantová teorie čichu

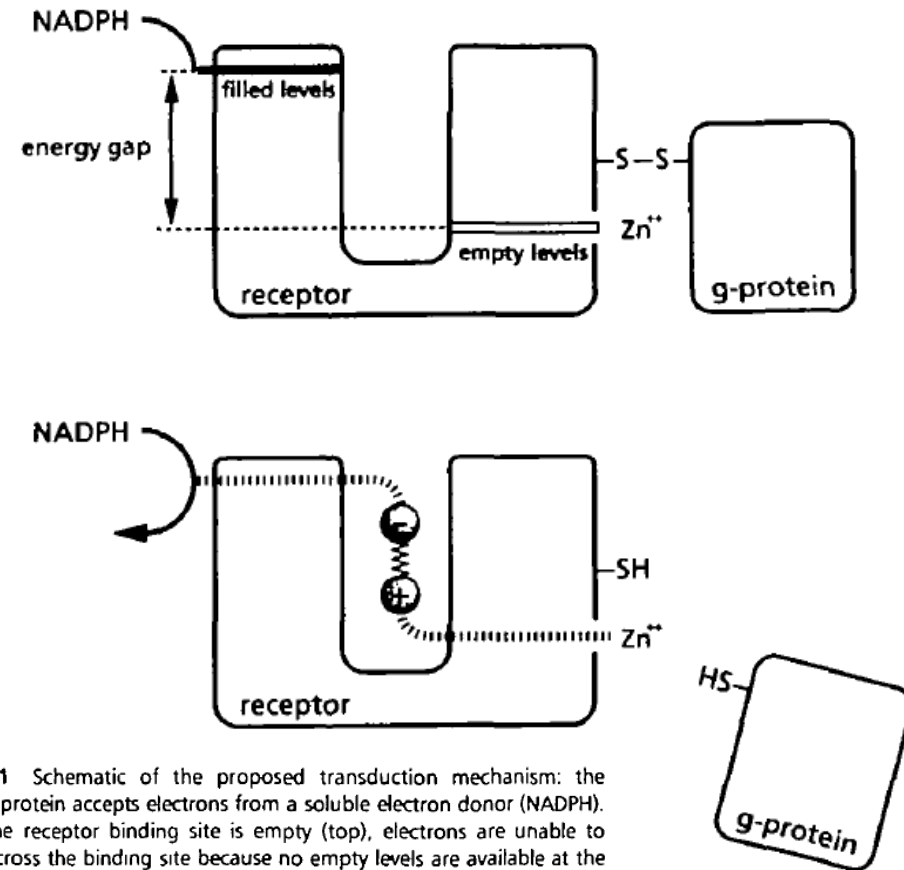
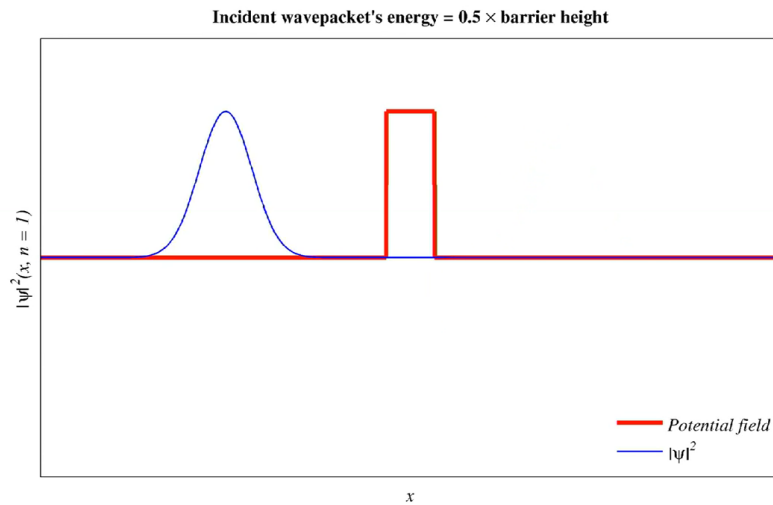
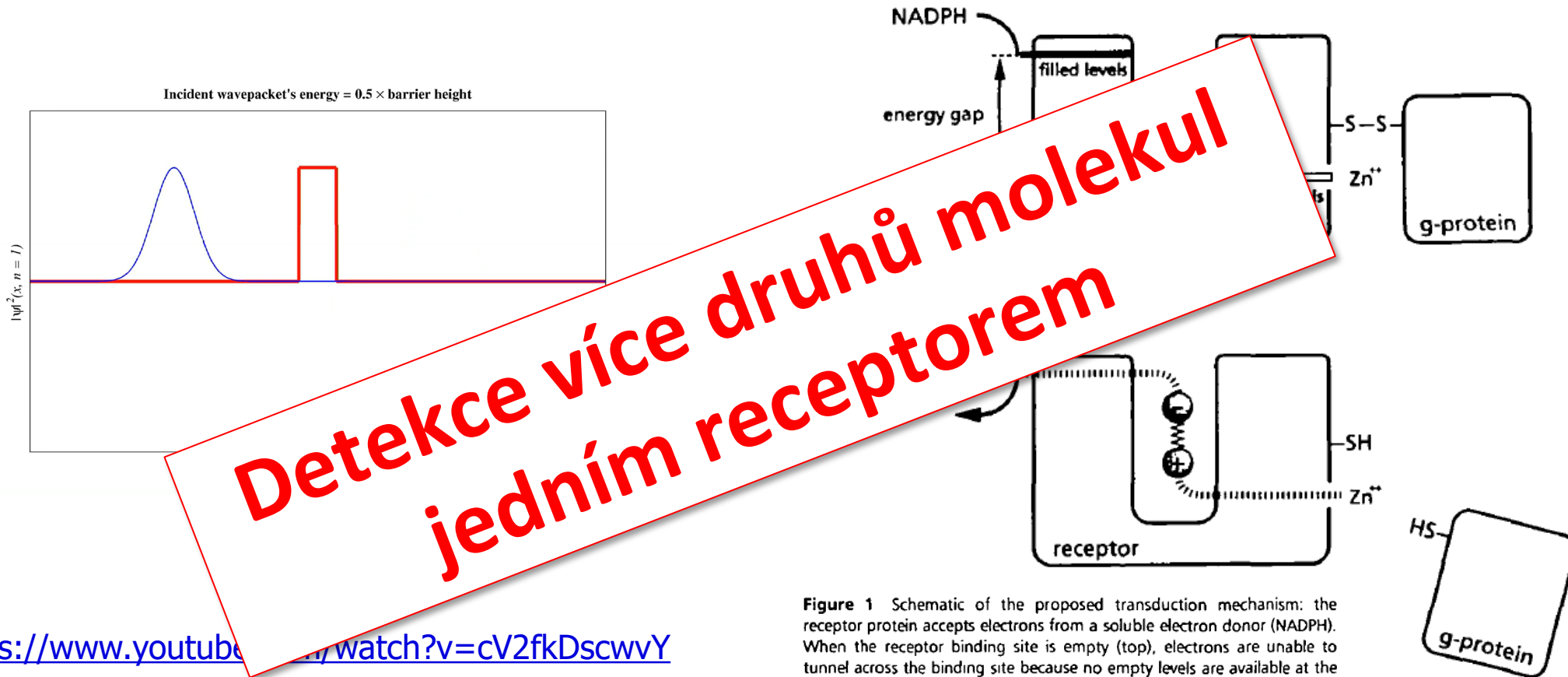


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<https://www.youtube.com/watch?v=cV2fkDscwvY>

Kvantová teorie čichu



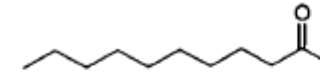
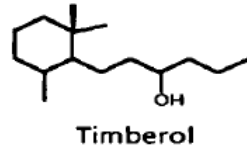
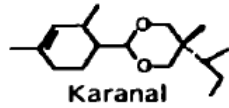
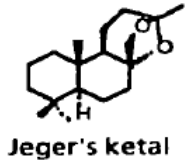
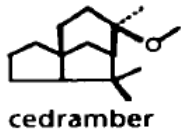
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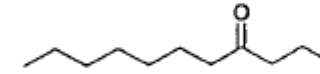
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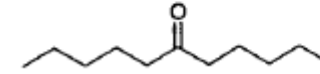
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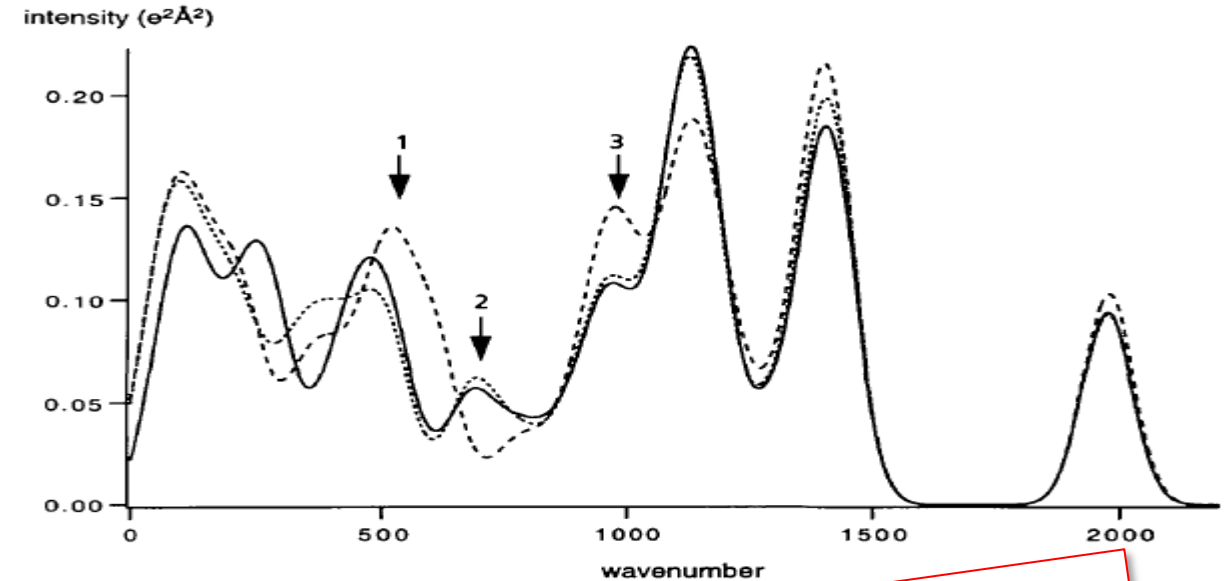
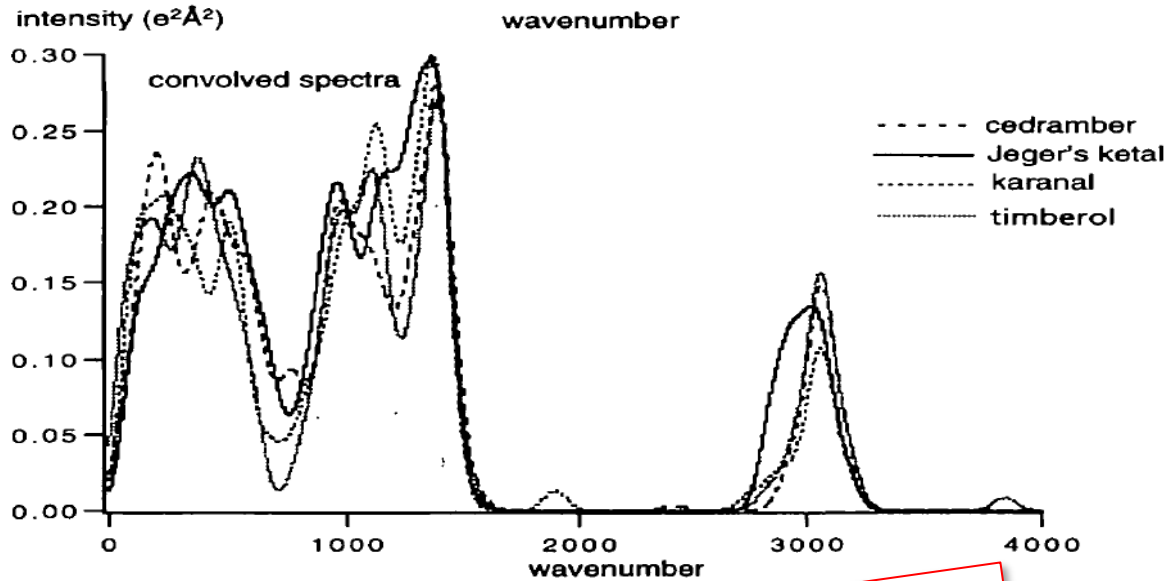
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4-undecanone ———



6-undecanone ———

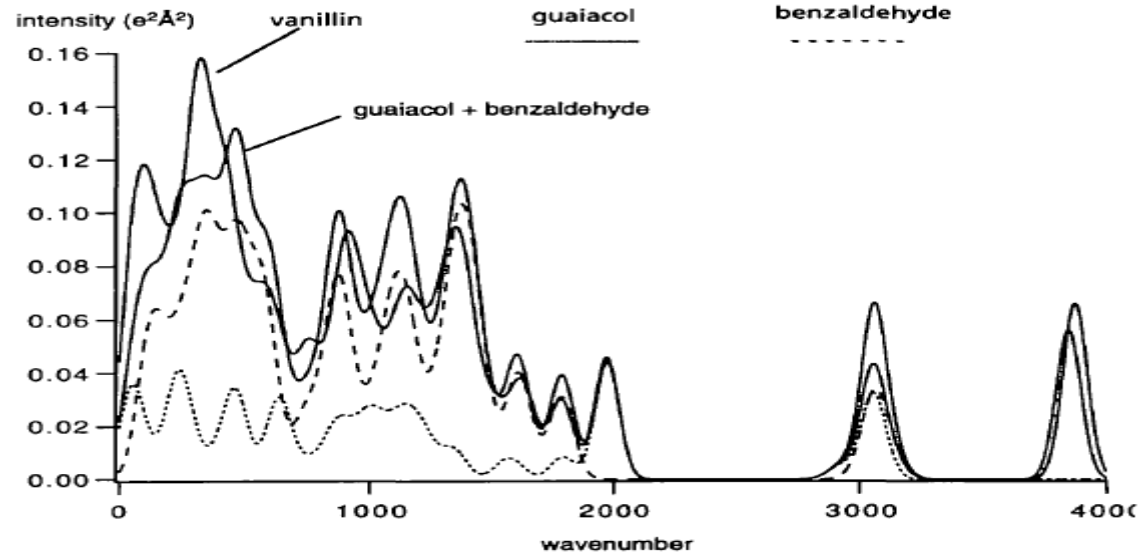
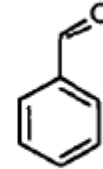
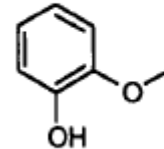
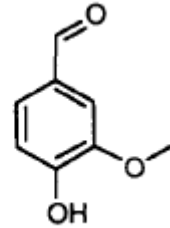


Různé molekuly, podobné vůně

Podobné molekuly, různé vůně

Kvantová teorie čichu

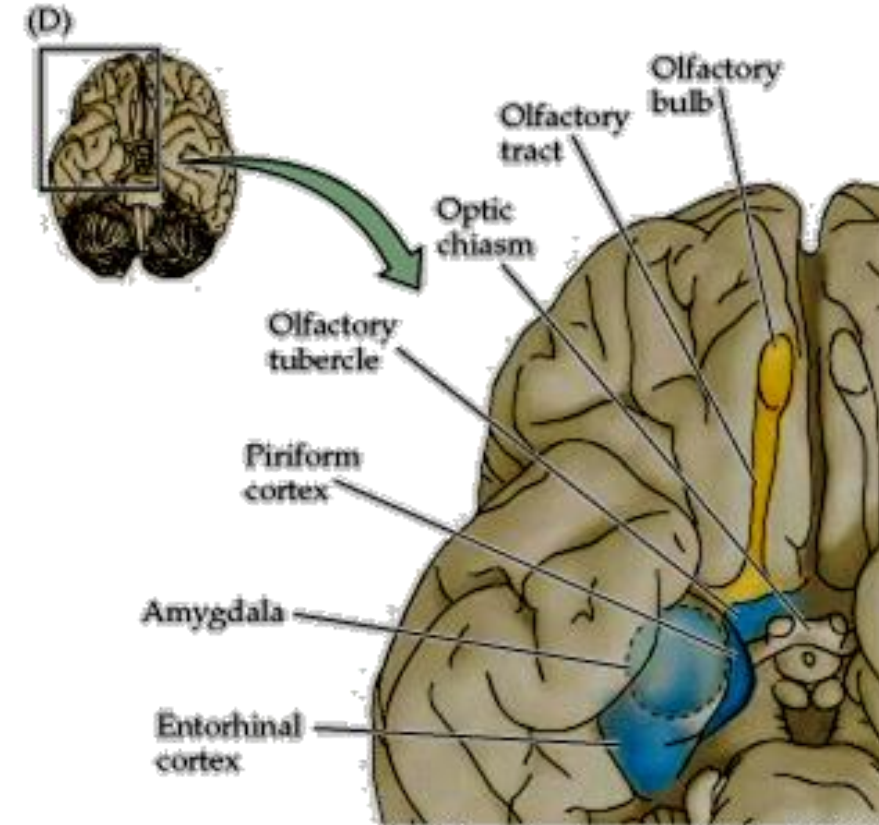
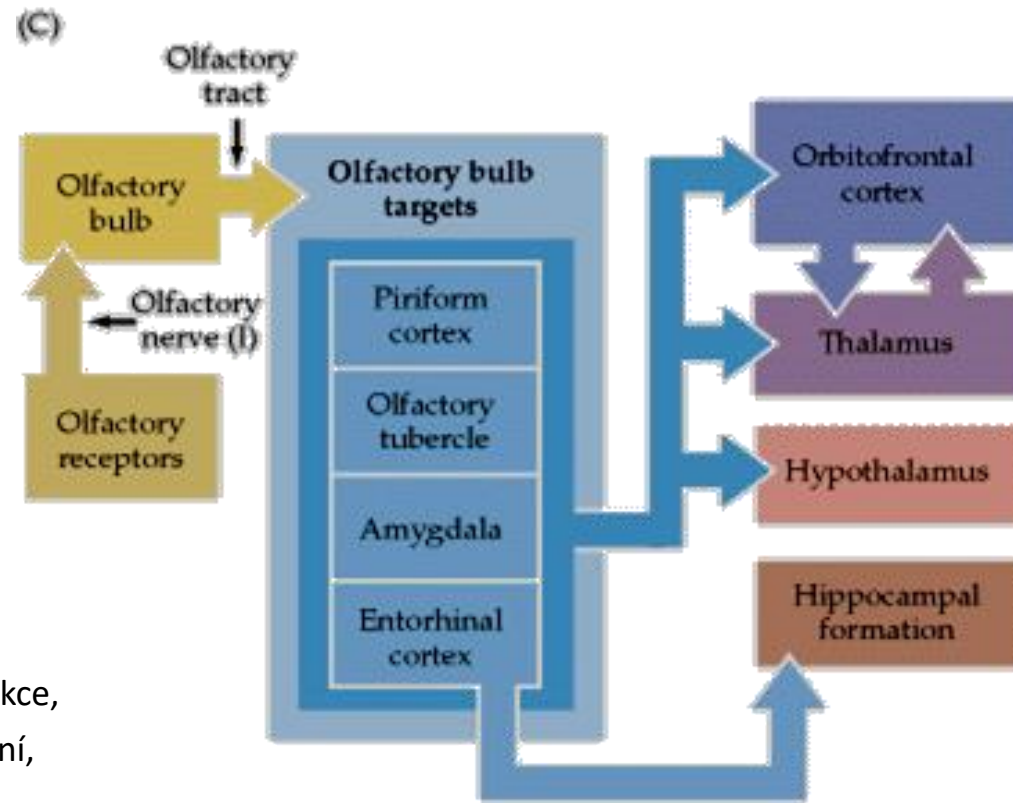
<https://academic.oup.com/chemse/article/21/6/773/488342/>



Aditivní syntéza vůní

Čich

- ✓ Piriformní kortex
 - „Podvědomá“ percepce
- ✓ Tuberculum olfactorium
 - Systém odměny
 - Napojení na striatum
- ✓ Entorinální kortex
 - Paměť
 - Napojení na hippocampus
- ✓ Amygdala
 - Periamygdalární komplex
- ✓ Orbitofrontální kortex
 - ✓ Součást prefrontálního kortexu
 - Vědomá percepce
 - Spoje - amygdala
 - Rozhodování, kognitivní funkce,
 - Spoje - piriformní, entorinální, hypotalamus



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Chuť

- Schopnost vnímat chemické látky rozpuštěné ve slinách

Chuť

- Schopnost vnímat chemické látky rozpuštěné ve slinách
- Úzká souvislost s čichem
- Identifikace potravy

Chuť

- Schopnost vnímat chemické látky rozpuštěné ve slinách
- Úzká souvislost s čichem
- Identifikace potravy
- Napojení na systém odměny

Chuť

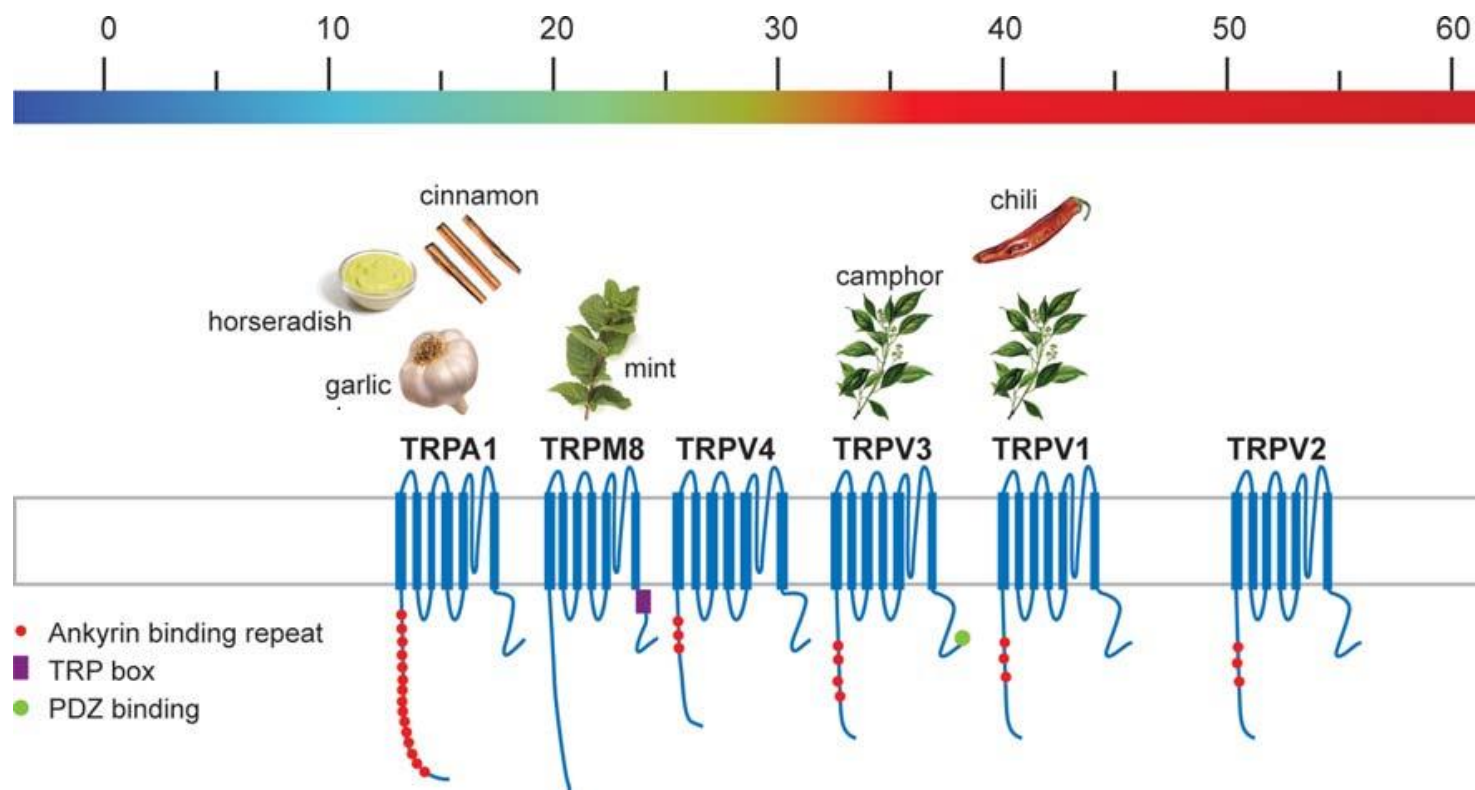
- Schopnost vnímat chemické látky rozpuštěné ve slinách
- Úzká souvislost s čichem
- Identifikace potravy
- Napojení na systém odměny



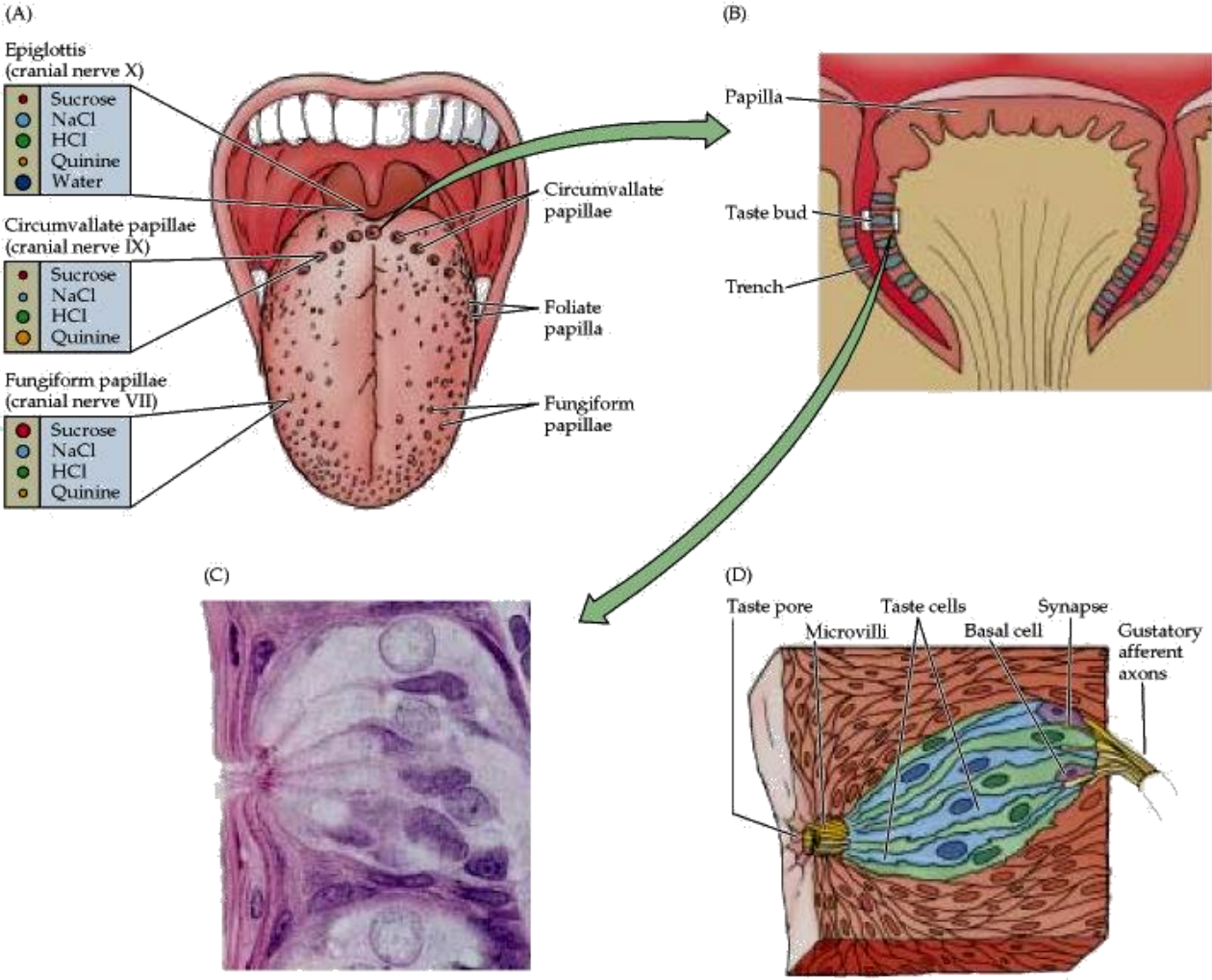
- ✓ Umami
➤ Taste-mGluR4 receptor – L - glutamáty
- ✓ Pálivá
➤ Zprostředkovaná nociceptory a termoreceptory

Thermoreceptor

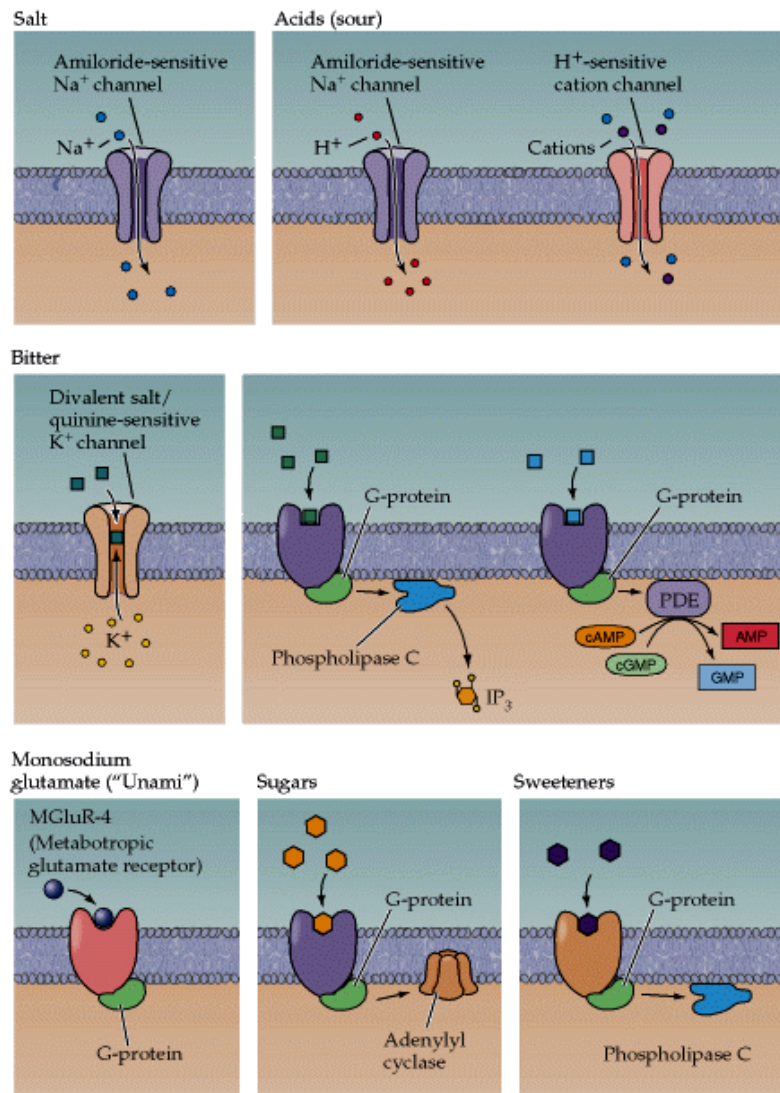
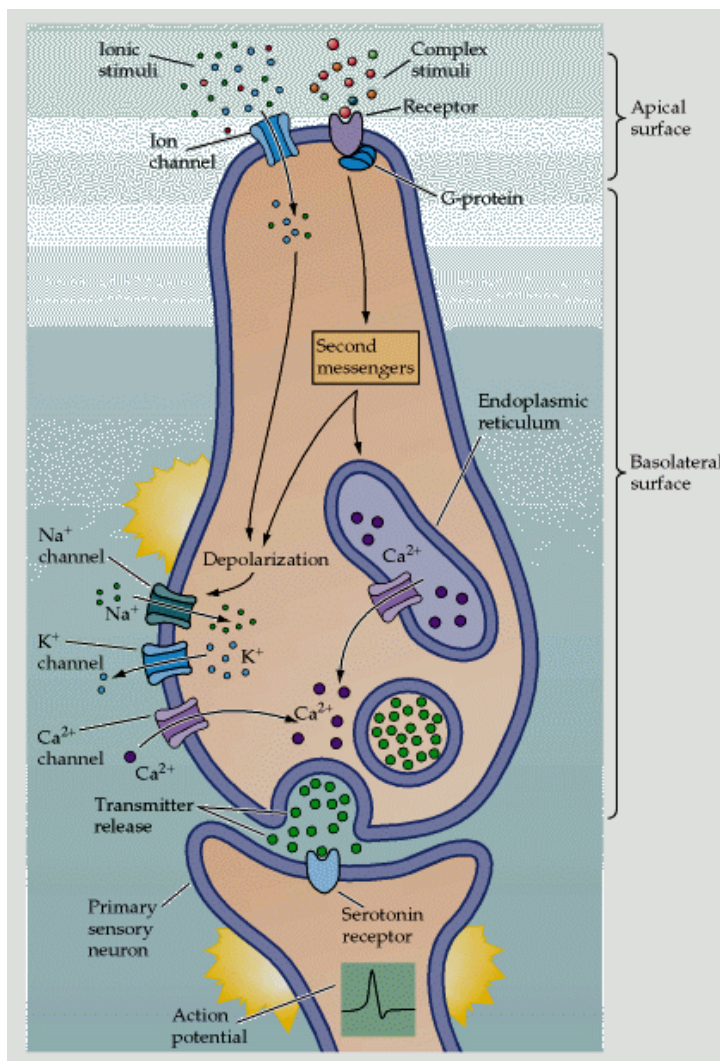
- Volná nervová zakončení senzitivní na teplo
- TRP kanály (transient receptor potential)
 - Polymodální receptor (chemorecepce, termorecepce)
 - Přítomné také v řadě buněk (včetně neuronů, keratinocytů, mechanoreceptorů...)



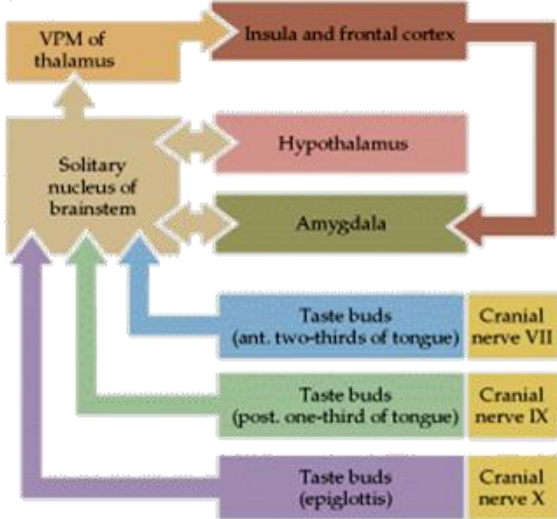
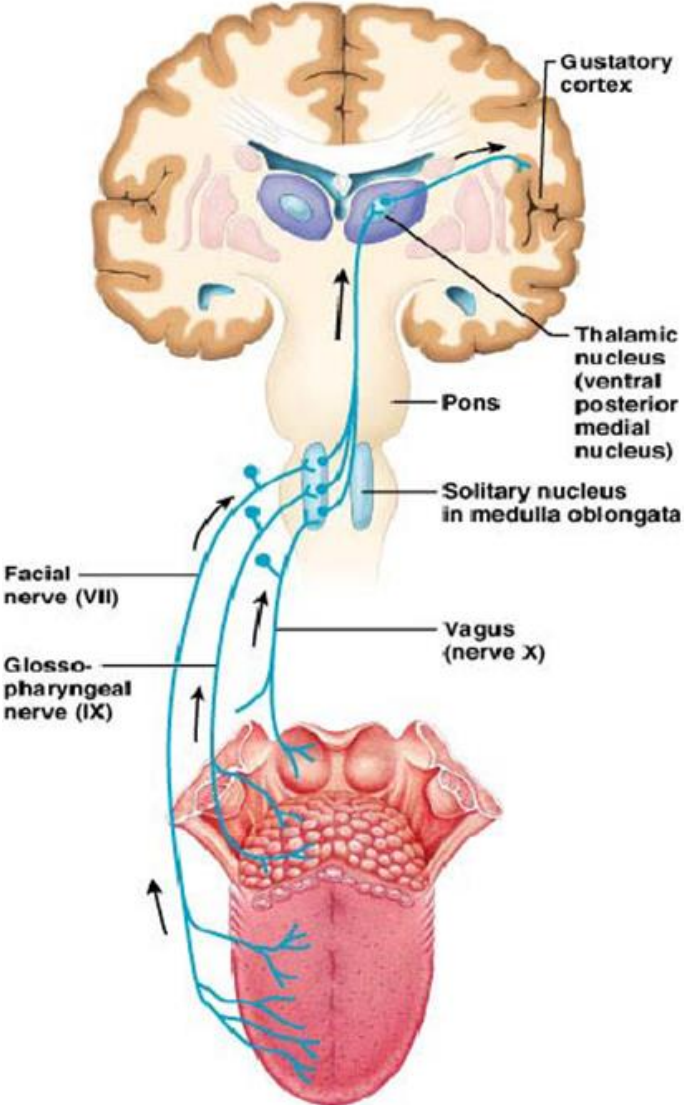
Chut'



Chut'



Chut'



<http://www.slideshare.net/drpsdeb/presentations>

75. Základy fyziologie čichu a chuti – stručná charakteristika dané modality, základní informace o detekci a zpracování signálu

- Chemické smysly – chemická detekce látek přítomných ve vzduchu/slinách
- Čich a chuť spolu úzce souvisí
- Evolučně staré – čich podmínil rozvoj mozkové kůry
 - Analýza pachů vyžaduje paměť a „pokročilé“ zpracování informace
- Základní přehled čichového a chuťového systému
 - Základní charakteristiky čichu a chuti u člověka
 - Člověk je mikroolfaktorický...
 - Příklady kategorií vůní
 - Typy chutí
 - Struktura čichového/chuťového epitelu
 - Mechanismus transdukce signálu - obecně
 - Struktury CNS spojené s čichovým/chuťovým systémem

M U N I

M E D