

M U N I

M E D

M U N I
M E D

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

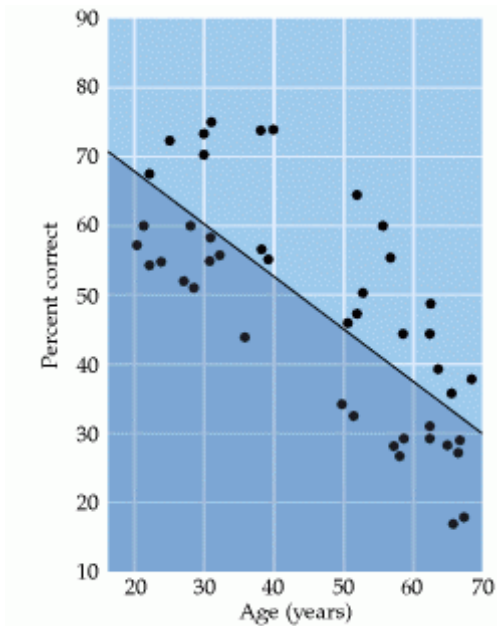
- Schopnost vnímat chemické látky ve vzduchu
- Podmínil rozvoj kůry
- Identifikace místa
- Identifikace potravy

Čich

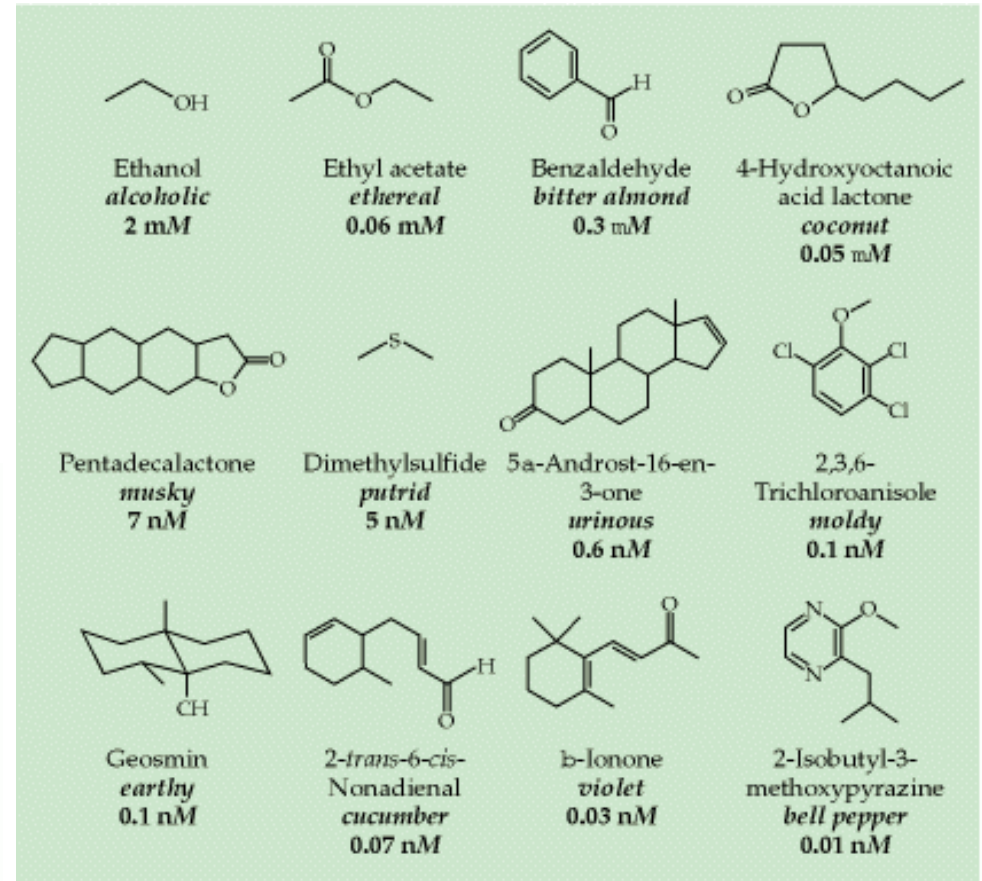
- Schopnost vnímat chemické látky ve vzduchu
- Podmínil rozvoj kůry
- Identifikace místa
- Identifikace potravy
- Člověk je mikroolfaktorický tvor
 - Úbytek analytických schopností vedl k relativnímu zvýraznění psychologické komponenty

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>



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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 |

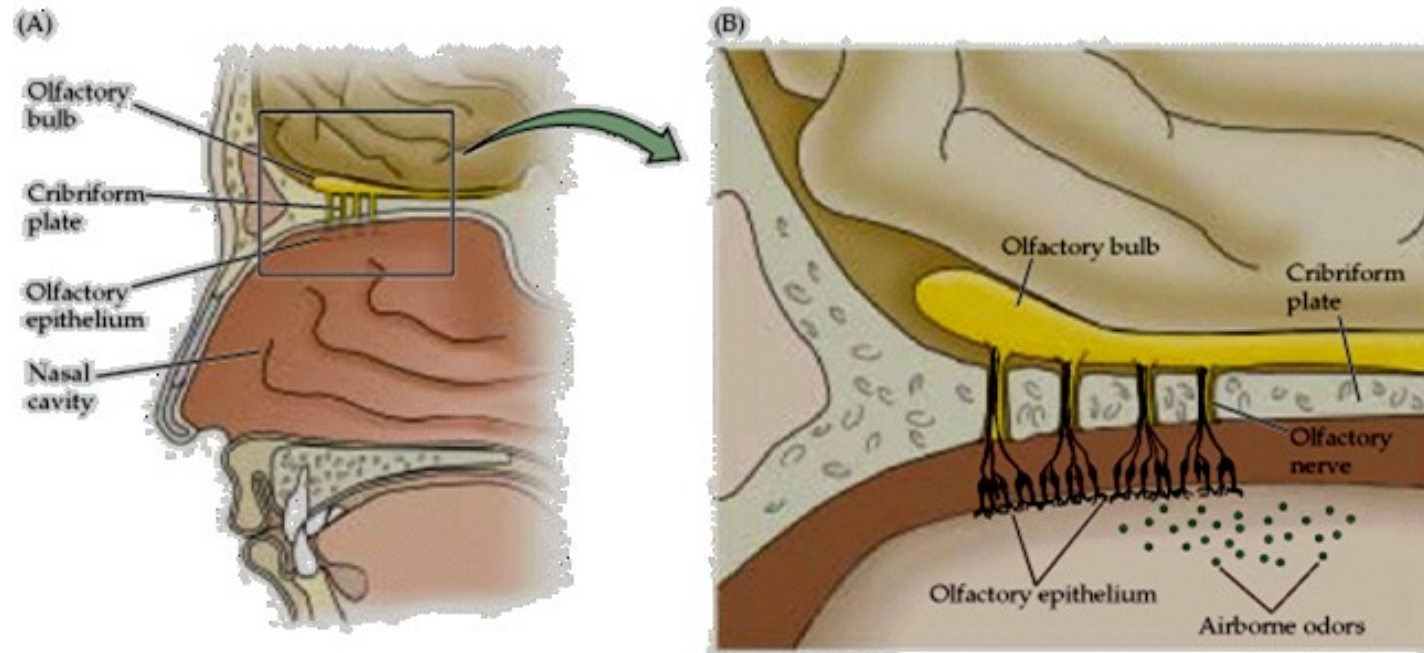
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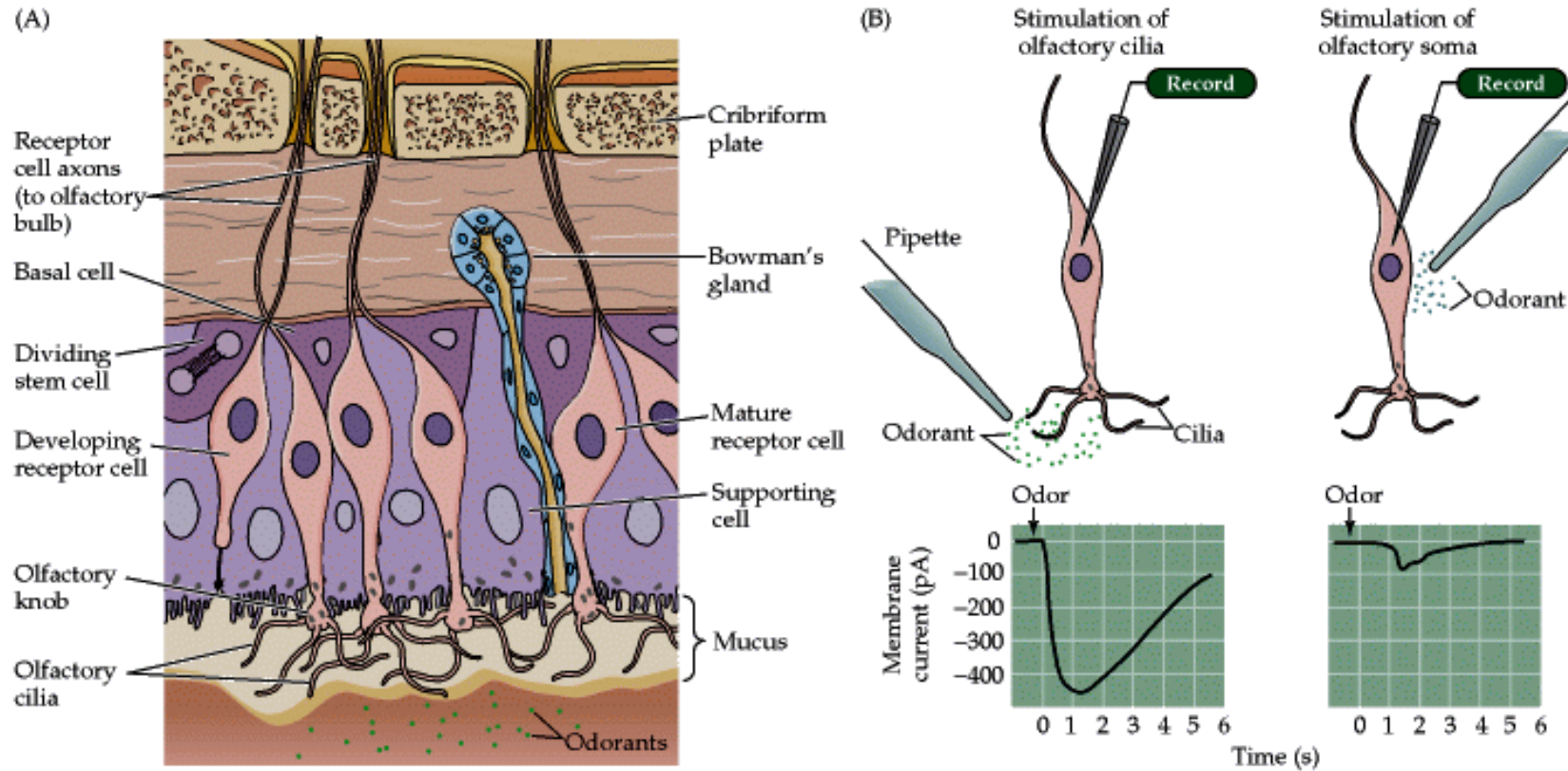
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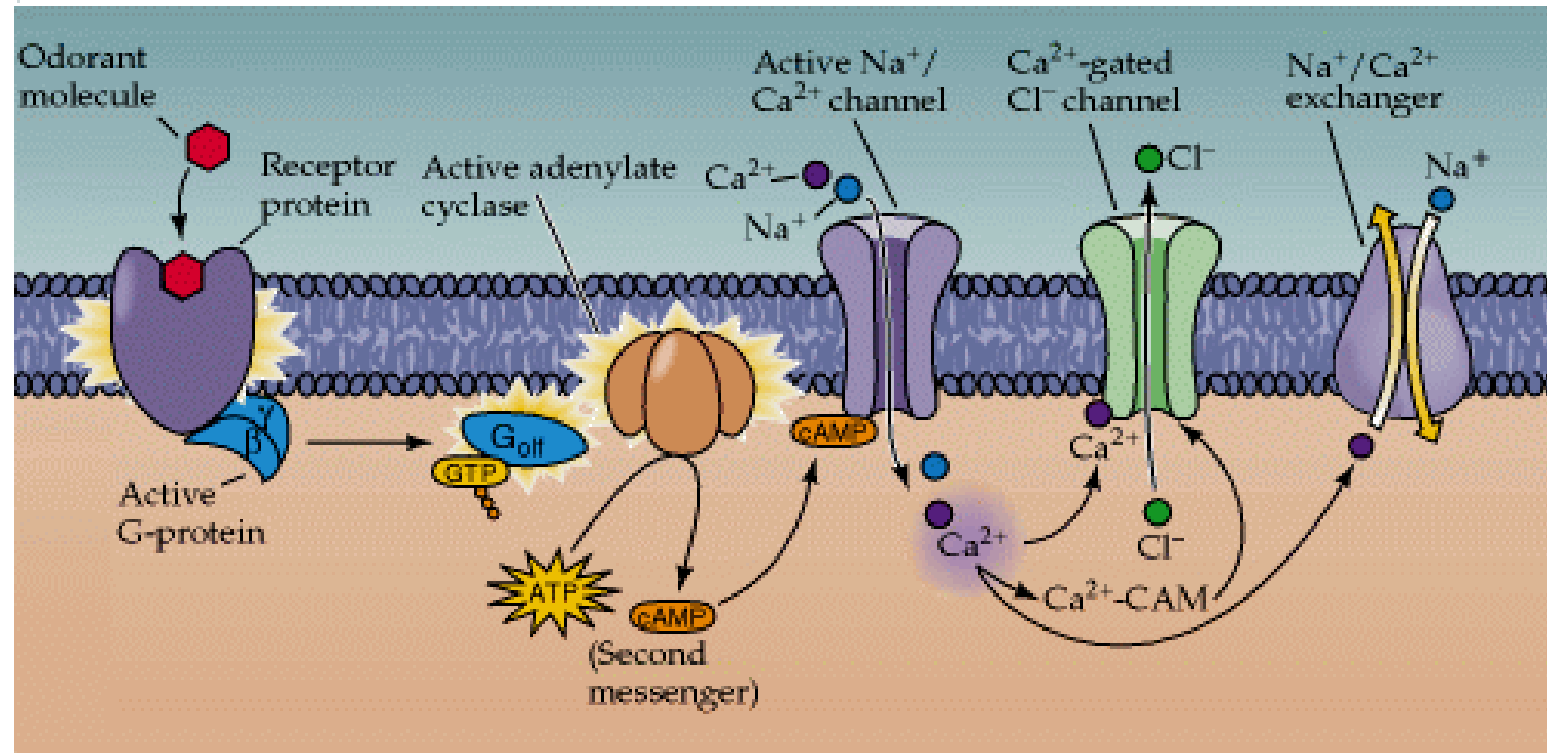
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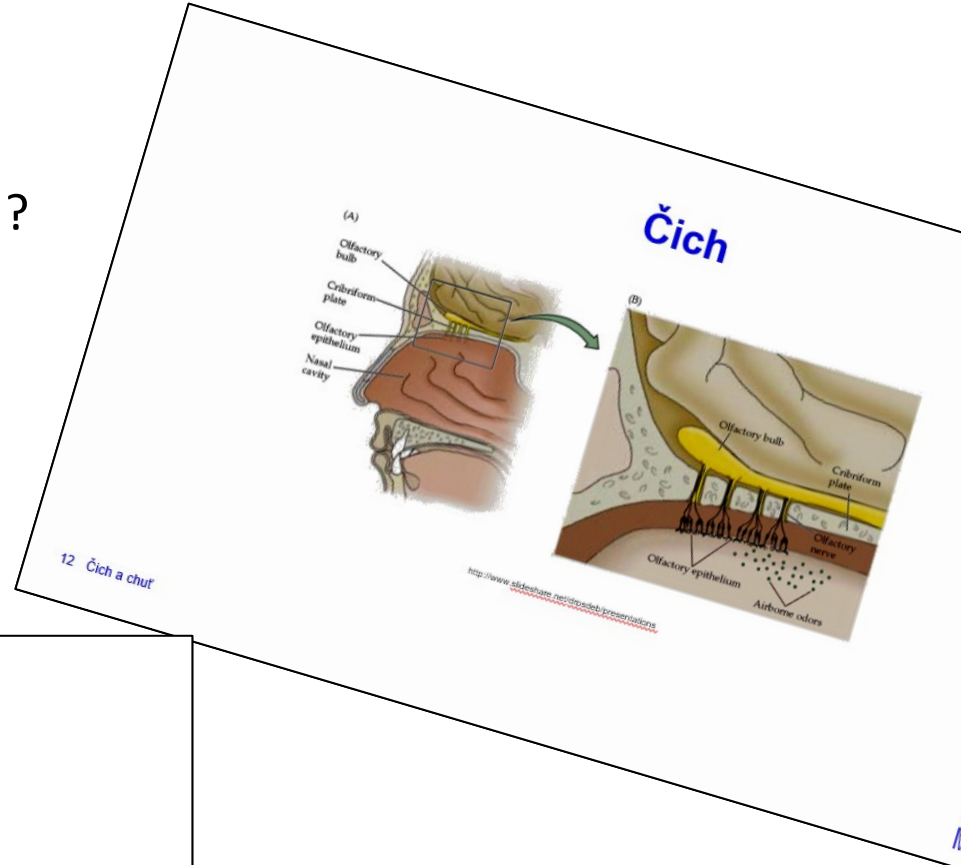
- Detekce struktury molekul ?
 - Funkční skupina ?
 - Tvar molekuly ?

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

| W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 |
|--------------------------|---------------------------|-----------------------|---|--|-------------------|-----------------------------------|------------------------|
| ODDY, RESINOUS | FRUITY, OTHER THAN CITRUS | PUTRID, FOUL, DECAYED | ETHEREAL, ANAESTHETIC, MEDICINAL | MENTH, PEPPERMINT, COOL, COOLING, AROMATIC | VANILLA, FRAGRANT | PEANUT BUTTER, NUTTY (WALNUT ETC) | SICKENING, SICKENING |
| FRUITY, EARTHY, MOLDY | SWEET | RANCID | DISINFECTANT, CARBOLIC, ACID | SHARP, PUNGENT, FRAGRANT | FRAGRANT | BURNED, SMOKY, BUTTER | FRUITY, CITRUS, ORANGE |
| CEDARWOOD | FRAGRANT | SWEATY | SOUR, VINEGAR, CARBOLIC, ACID | SHARP, PUNGENT, FRAGRANT | FRAGRANT | NUTTY (WALNUT ETC) | FRUITY, CITRUS, ORANGE |
| HERBAL, GREEN, CUT GRASS | FRAGRANT | LIGHT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |
| FRAGRANT | FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |
| AROMATIC | FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |
| LIGHT | FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |
| HEAVY | FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |
| AL, GREEN, GRASS | FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |
| MOLETS | FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID, FECAL (LIKE MANURE) | GASOLINE, SOLVENT, PAINT | MEDICINAL, SWEET | ALMOND, HEAVY | SWEET |

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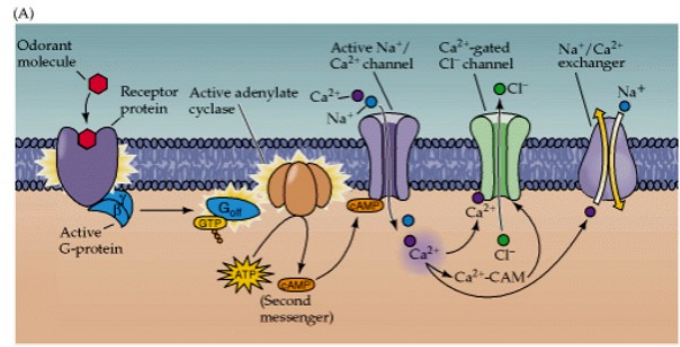
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14 Čich a chuť

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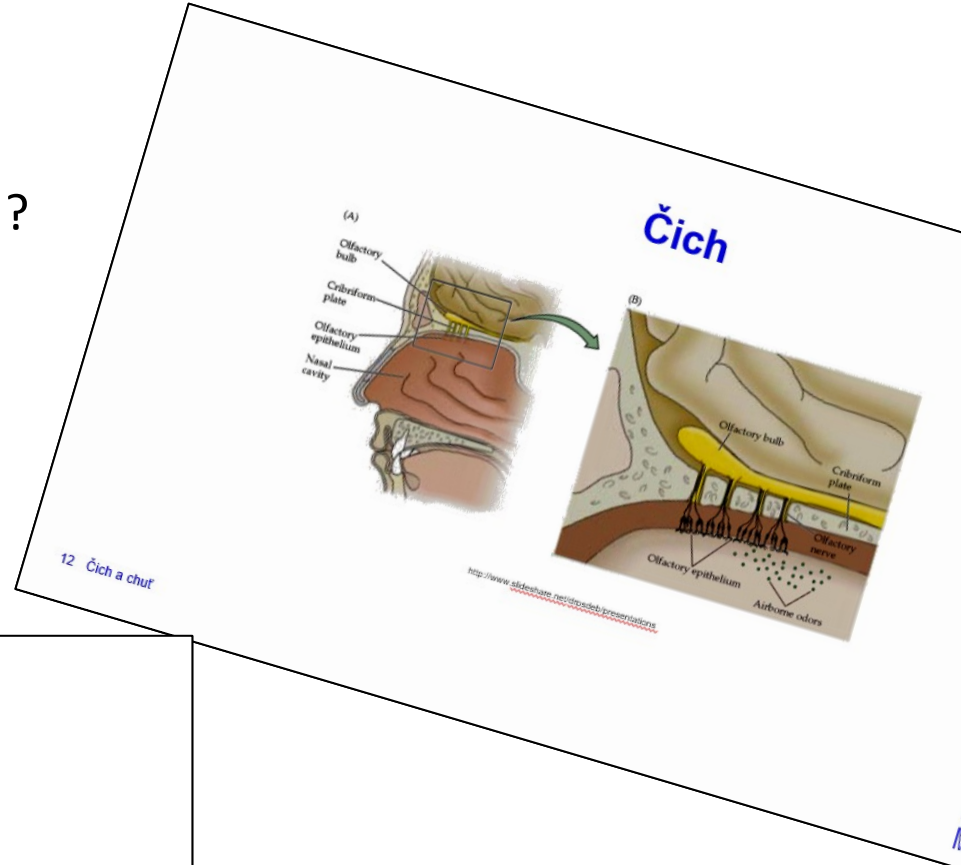
- Detekce struktury molekul ?
 - Funkční skupina ?
 - Tvar molekuly ?
- Detekce vibrace molekul ?

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

| | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 |
|--------------------------|---------------------------|-----------------------|----------------------------------|----------------------------------|----------|----------|---------------|----------------|
| ODDY, RESINOUS | FRUITY, OTHER THAN CITRUS | PUTRID, FOUL, DECAYED | ETHEREAL, ANAESTHETIC, MEDICINAL | MENTH, PEPPERMENT, COOL, COOLING | SWEET | VANILLA | BURNED, SMOKY | SICKENING |
| BUSTY, EARTHY, MOLDY | FRAGRANT | SWEATY | DISINFECTANT, CARBOLIC ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| CEDARWOOD | AROMATIC | SOUR, VINEGAR | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| HERBAL, GREEN, CUT GRASS | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| FRAGRANT | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| AROMATIC | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| LIGHT | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| HEAVY | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| AL, GREEN, GRASS | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |
| MOLETS | FRAGRANT | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | SHARP, PUNGENT, ACID | AROMATIC | FRAGRANT | PEANUT BUTTER | FRUITY, CITRUS |

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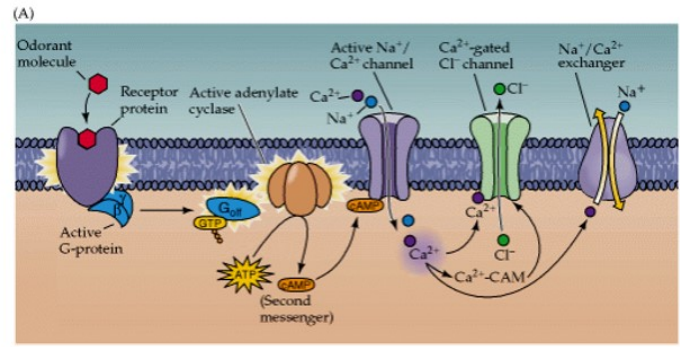
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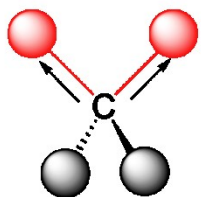
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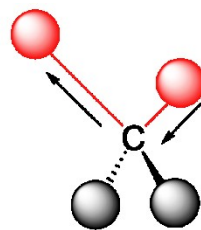
16 Čich a chuť

Vibrace molekul

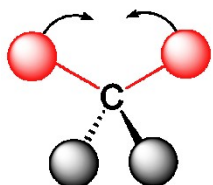
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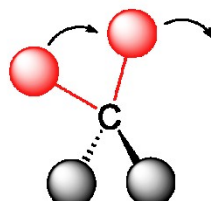
symmetric stretching



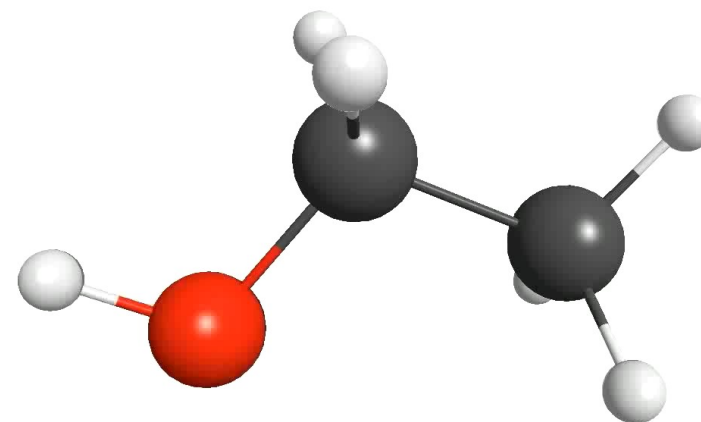
asymmetric stretching



scissoring

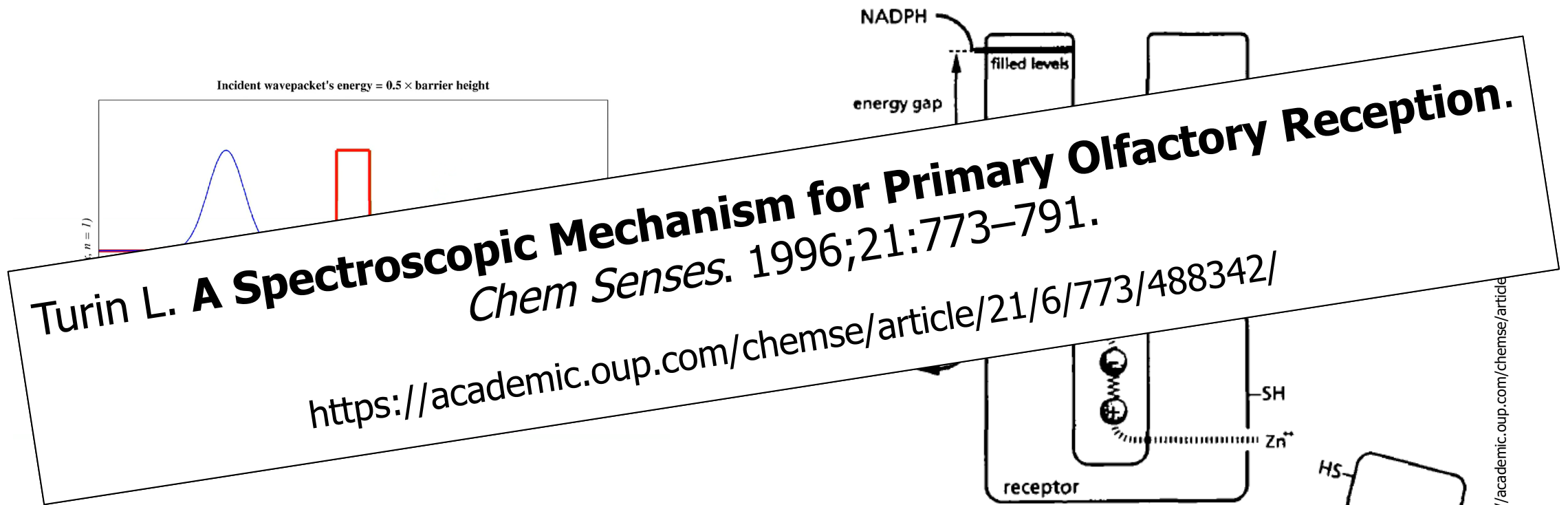


rocking



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

Kvantová teorie čichu



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

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.

Kvantová teorie čichu

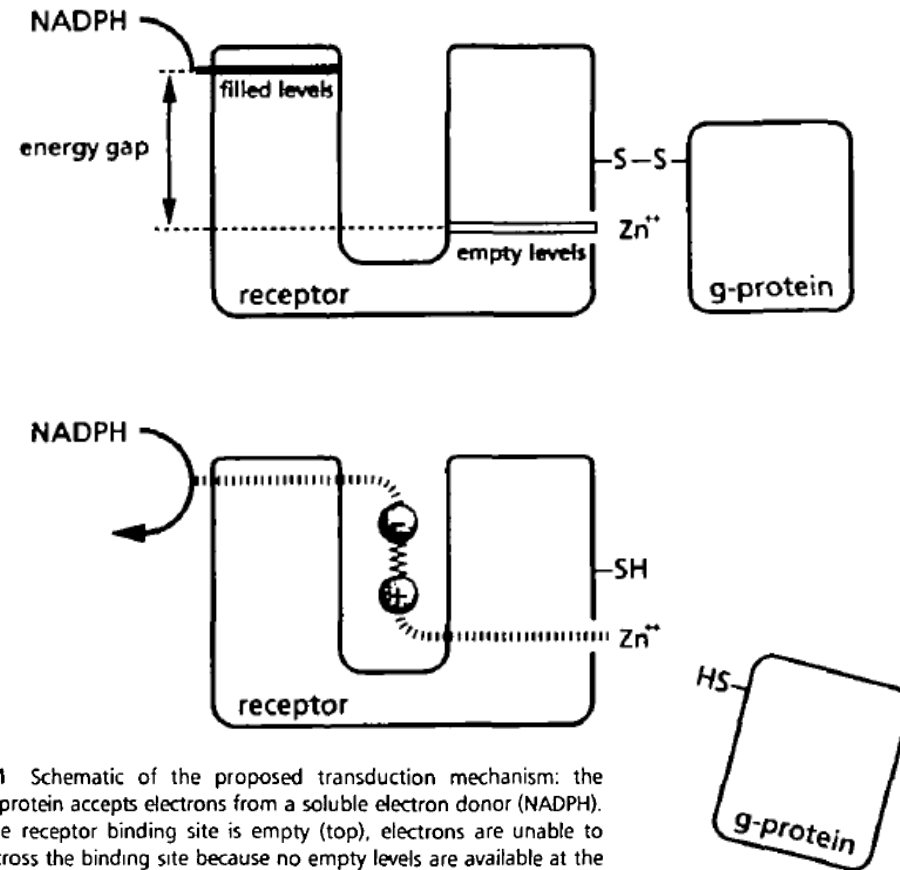
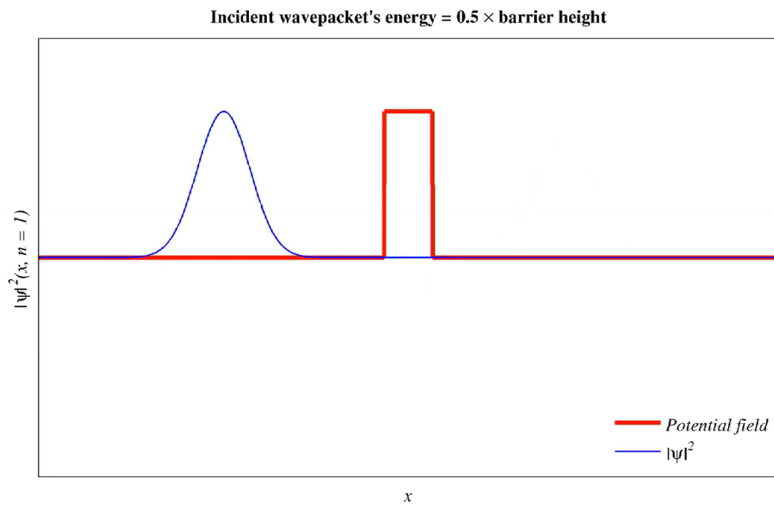
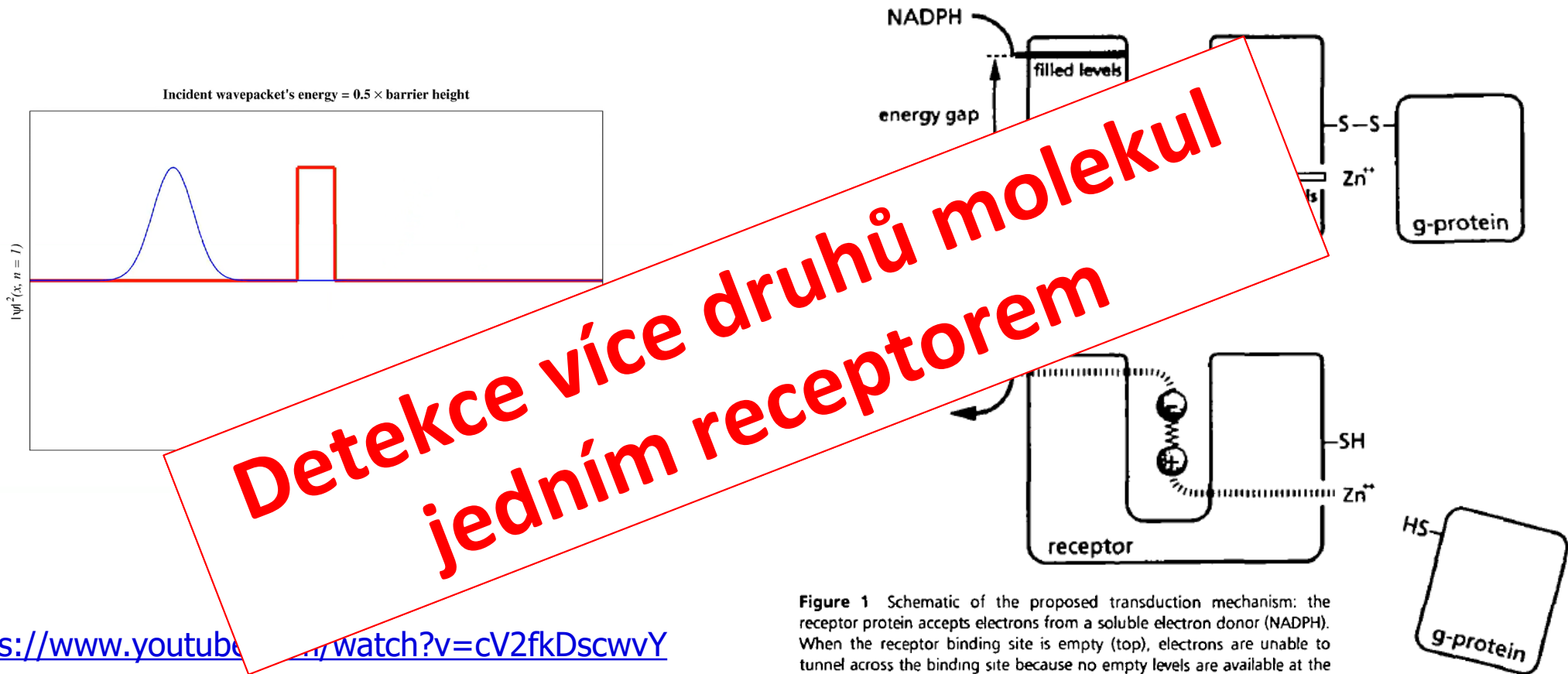


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<https://academic.oup.com/chemse/article/21/6/773/488342/>

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

Kvantová teorie čichu



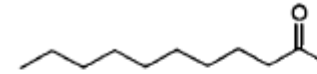
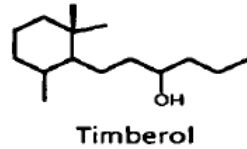
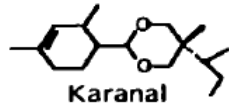
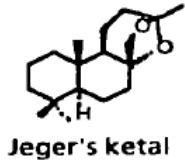
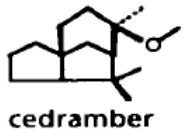
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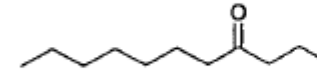
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Kvantová teorie čich

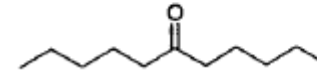
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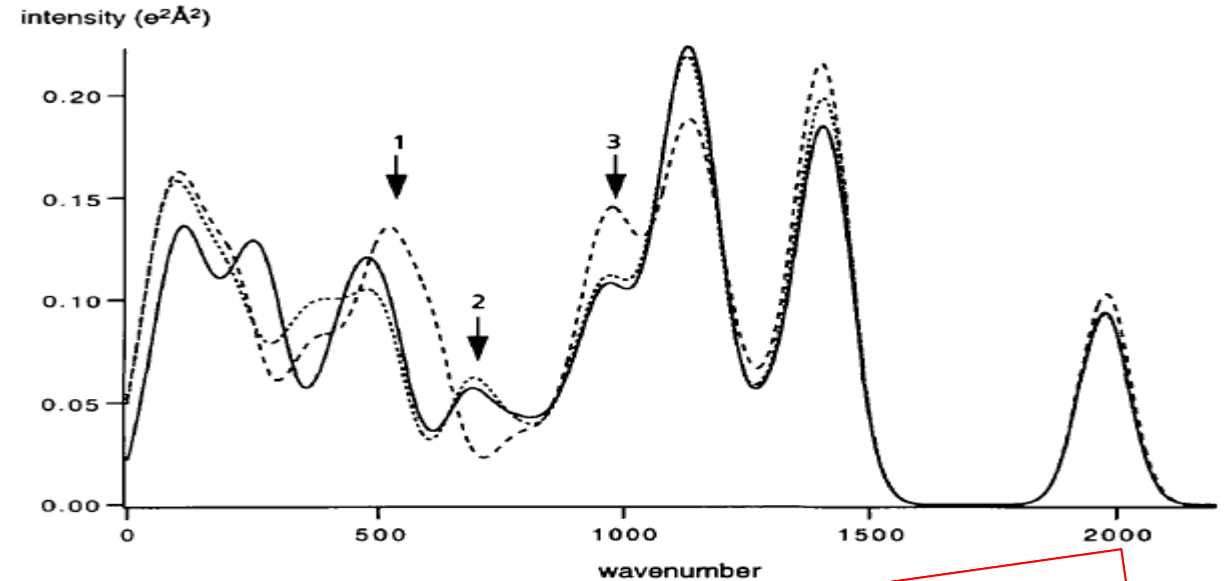
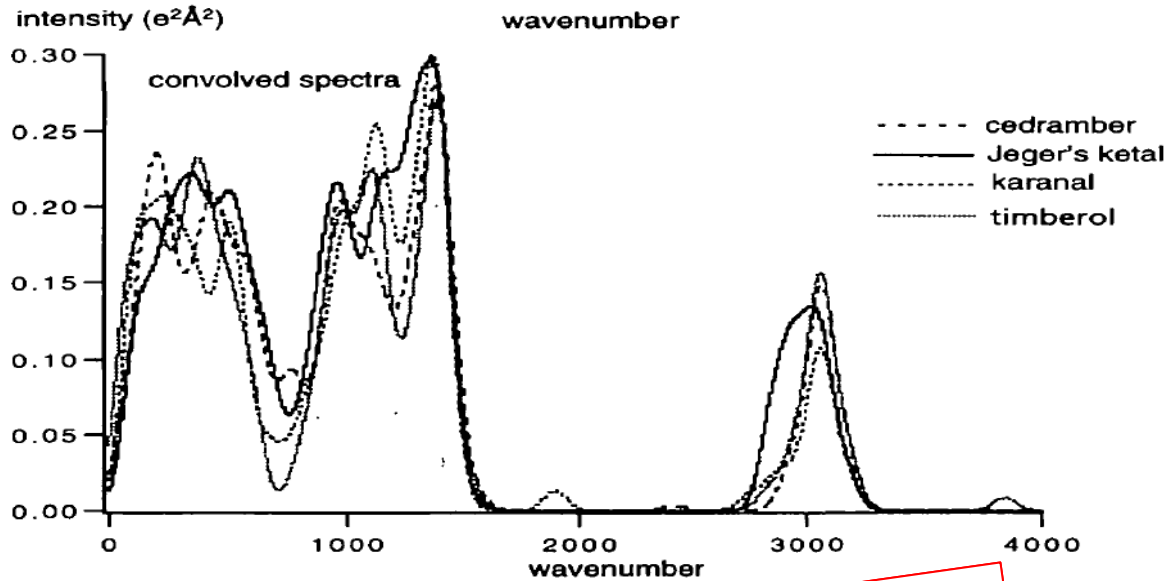
2-undecanone



4-undecanone



6-undecanone

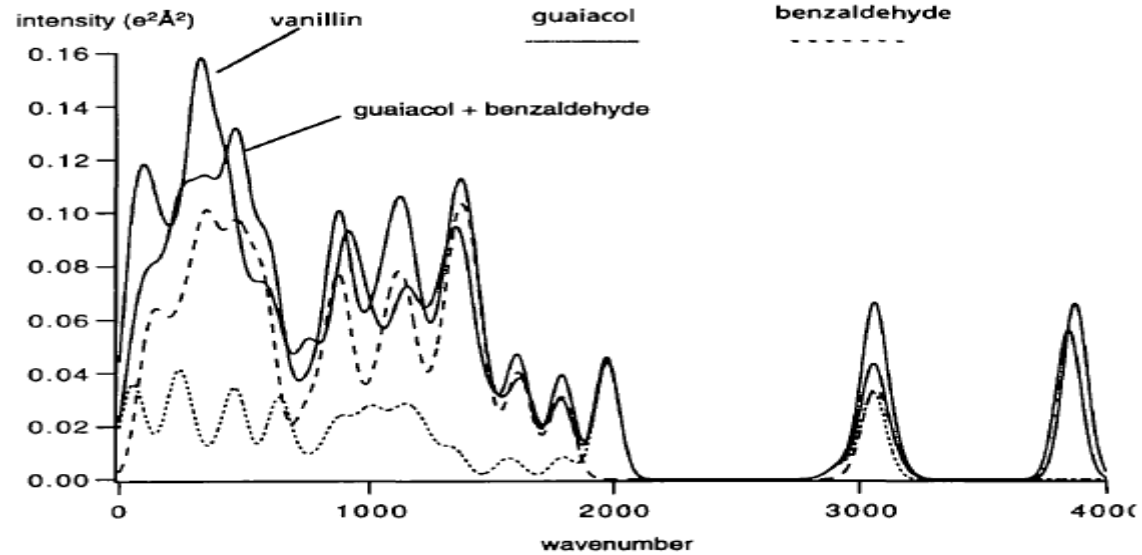
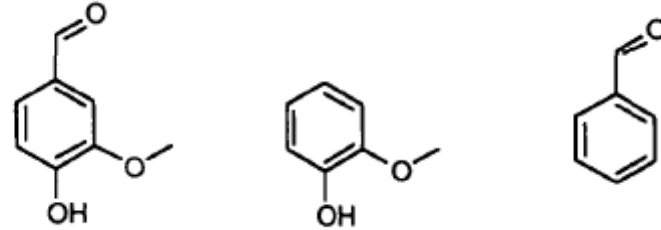


Různé molekuly, podobné vůně

Podobné molekuly, různé vůně

Kvantová teorie čichu

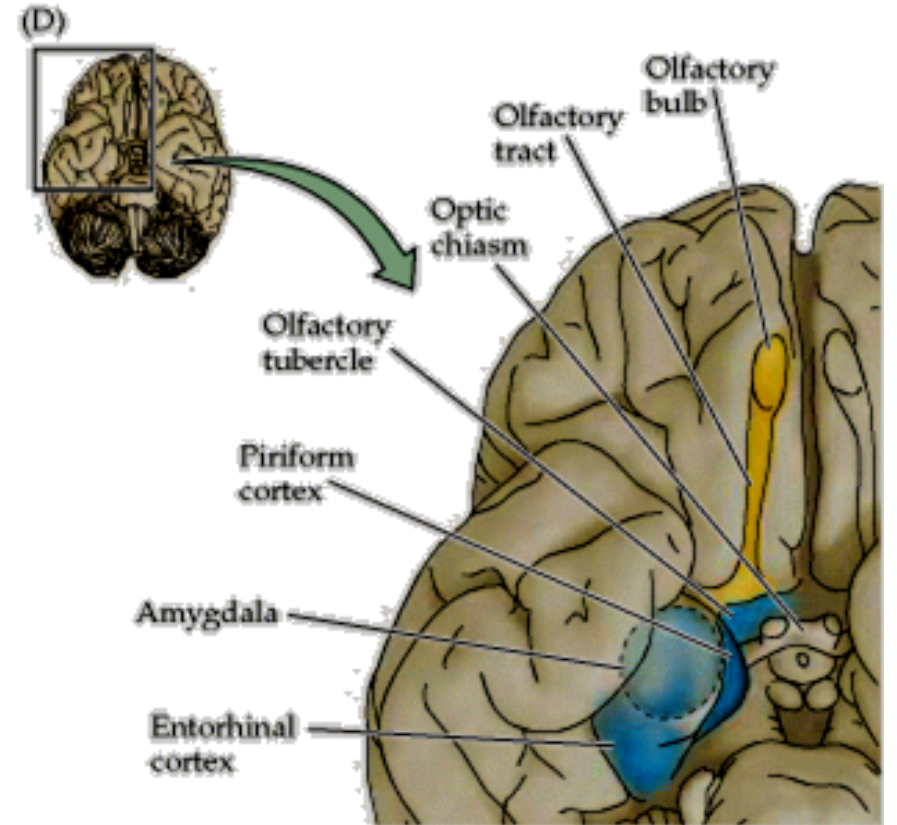
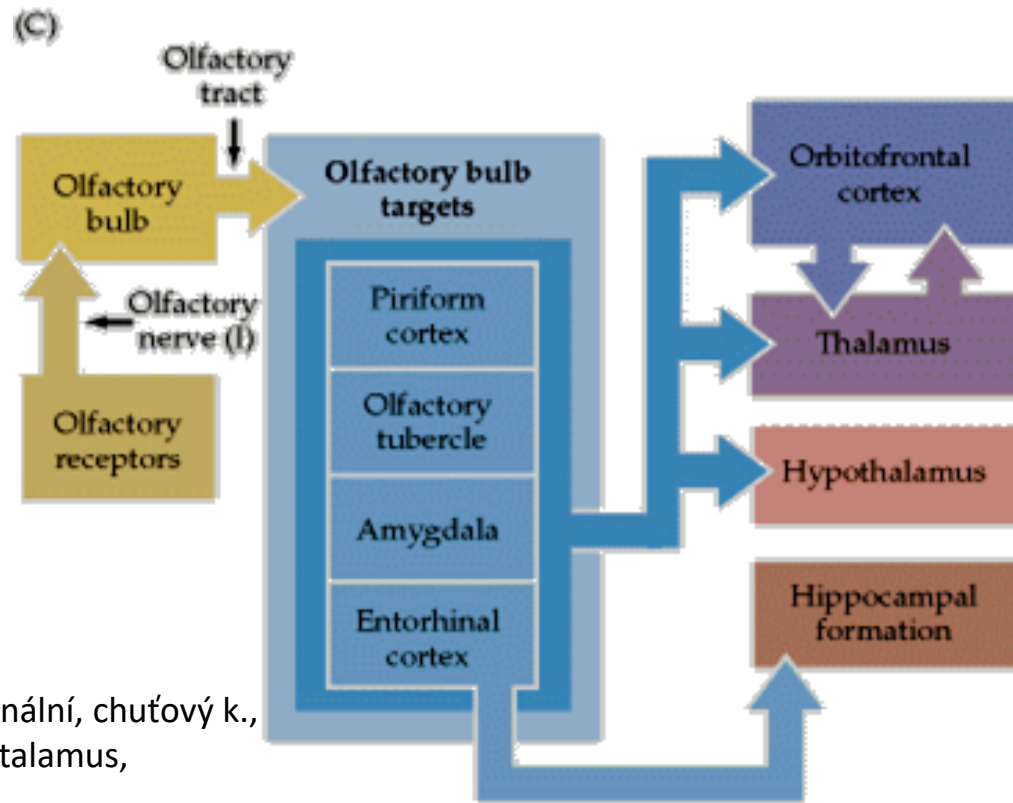
<https://academic.oup.com/chemse/article/21/6/773/488342/>



Aditivní syntéza vůní

Čich

- ✓ Piriformní kortex
 - Percepce
- ✓ Tuberculum olfactorium
 - Systém odměny
 - Napojení na striatum
- ✓ Entorinální kortex
 - Paměť
 - Napojení na hippocampus
- ✓ Amygdala
 - Viz. Limbický systém
- ✓ Orbitofrontální kortex
- ✓ (Prefrontální kortex)
 - Kognitivní funkce
 - Rozhodování
 - Spoje - piriformní, entorinální, chuťový k., sekundární oblasti, hypotalamus, amygdala



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

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

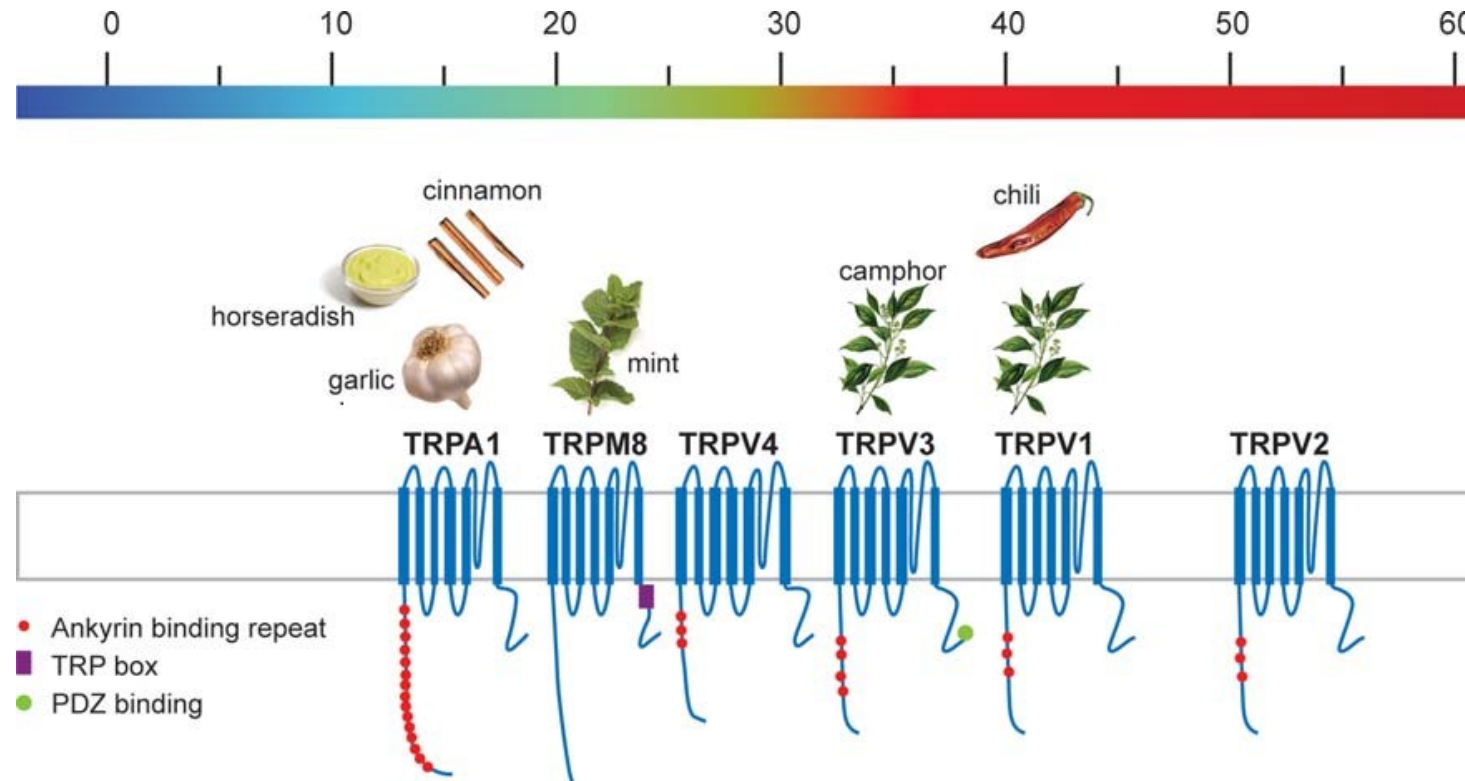
- Schopnost vnímat chemické látky rozpuštěné ve slinách
- Úzká souvislost s čichem
- Identifikace potravy
- Napojení na systém odměny

✓ Sladká
✓ Slaná
✓ Kyselá
✓ Hořká

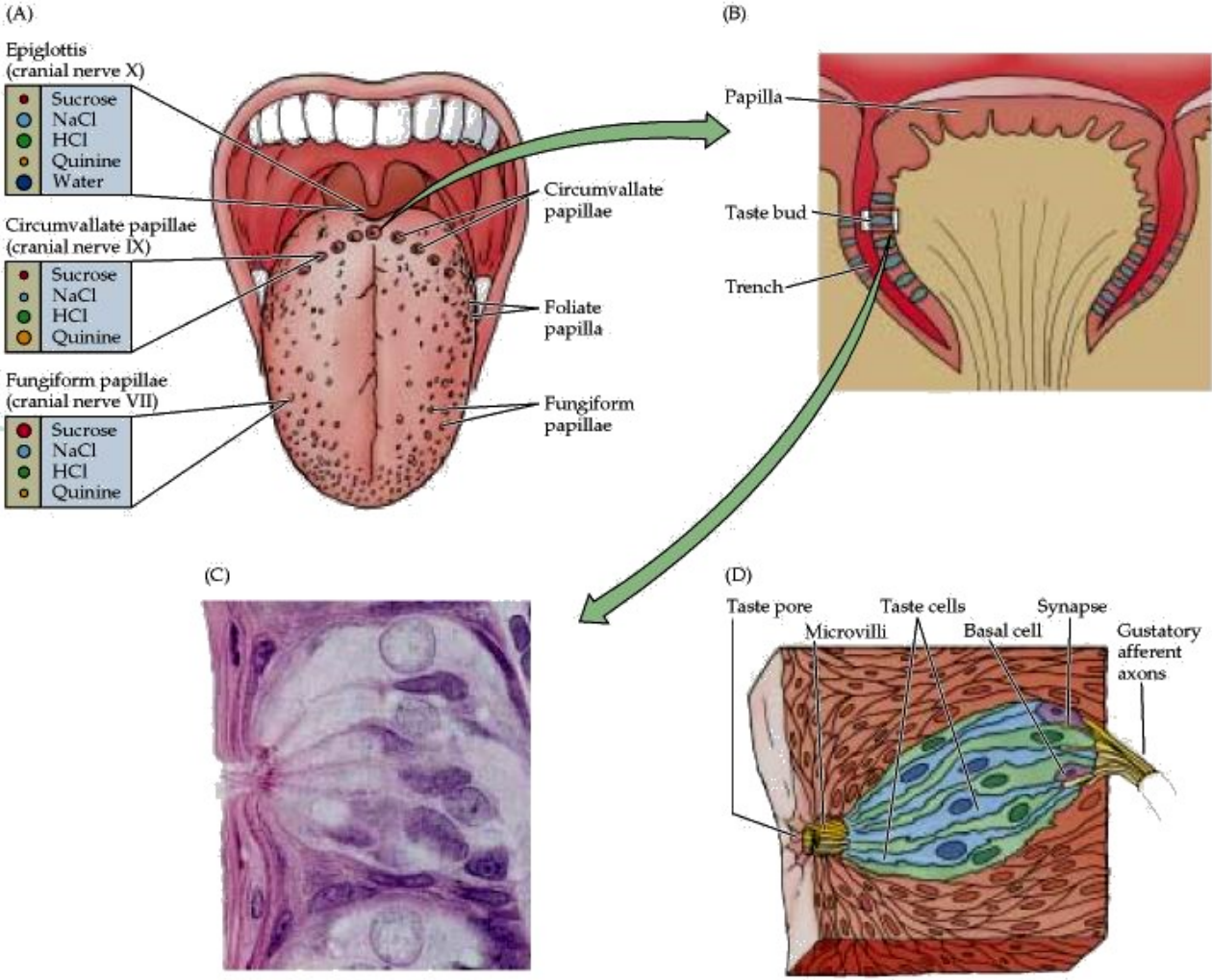
✓ Umami
➤ Taste-mGluR4 receptor – L - glutamáty
✓ Pálivá
➤ Zprostředkovaná nociceptory a termoreceptory

Thermoreceptor

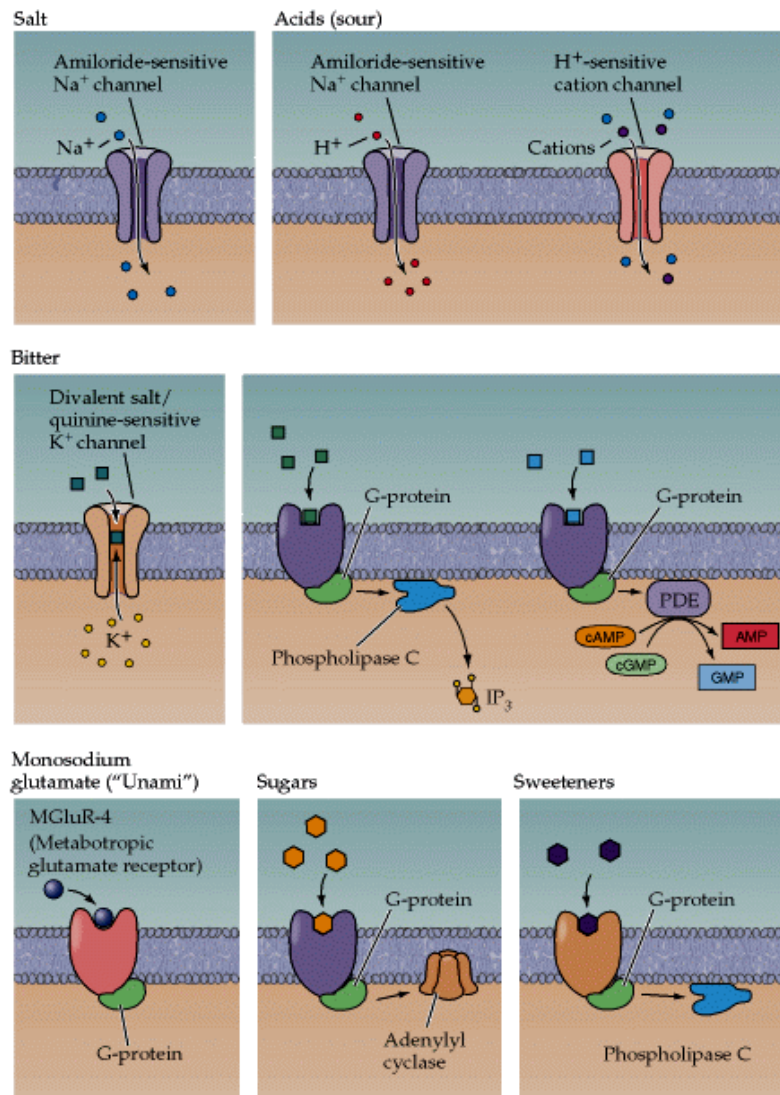
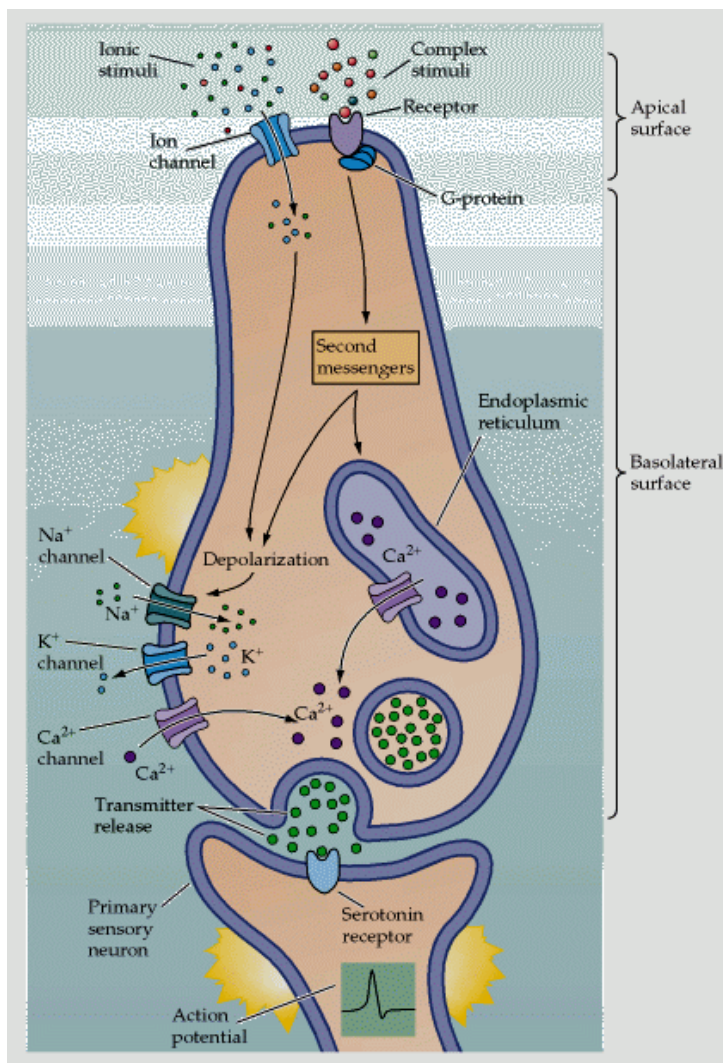
- Volná nervová zakončení senzitivní na teplo
- TRP kanály (transient receptor potential)
 - Polymodální receptor (chemorecepce, termorecepce)
 - Přítomné také v řadě buněk (včetně neuronů, keratinocytů, mechanoreceptorů...)



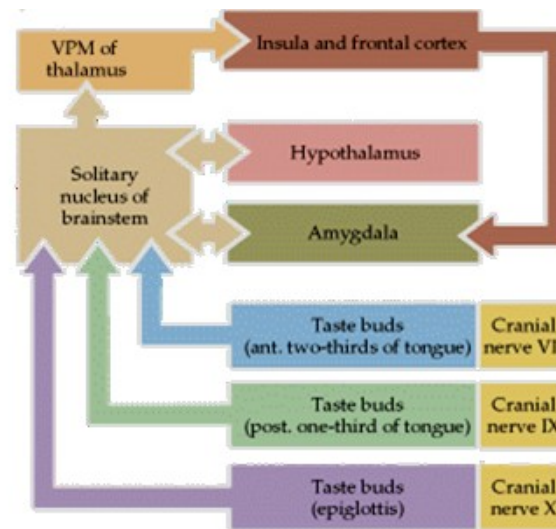
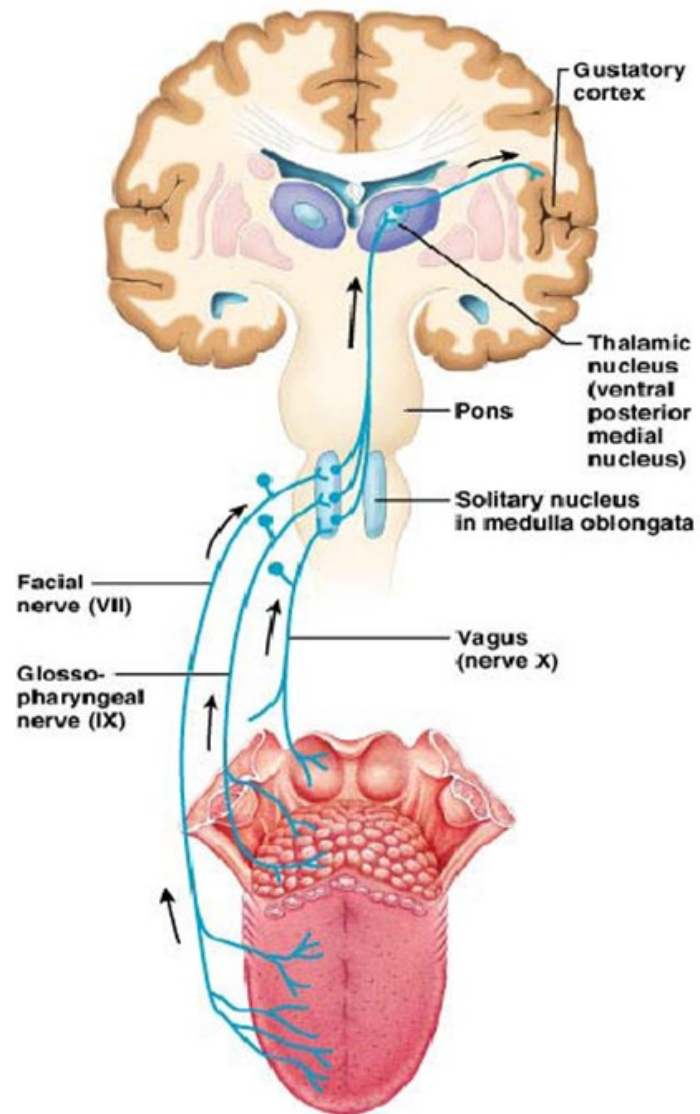
Chuť



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