https://bit.ly/2Ji0YmZ 2019/02/04

What's the smell? — The scent of a molecule

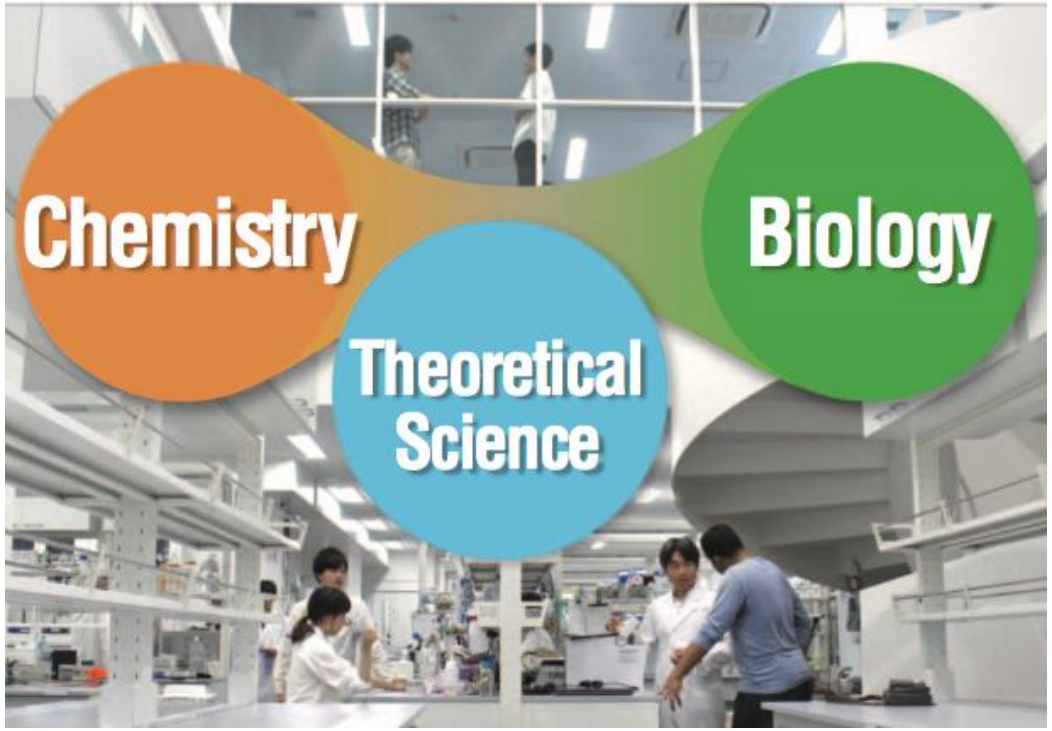
Dr. Asraa Ziadi

27th of November

Introduction: About me

http://www.itbm.nagoya-u.ac.jp/ja/2018_ITbM_Brochure_JP.pdf 2019/02/04

Institute of **T**ransformative **b**io-**M**olecules (**ITbM**)



http://www.itbm.nagoya-u.ac.jp/en/about/environment.php 2019/02/04

My tasks:



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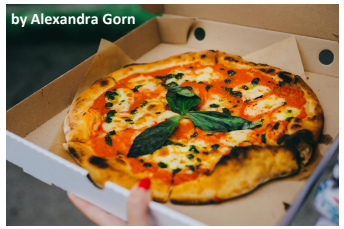

All photos are from Unsplash

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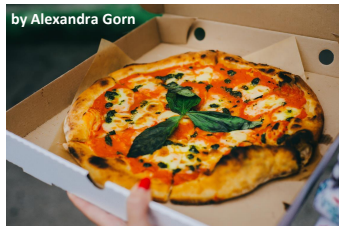

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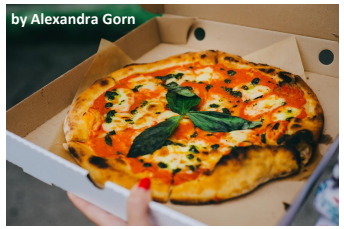

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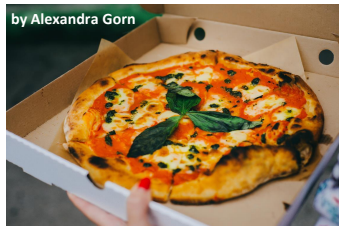

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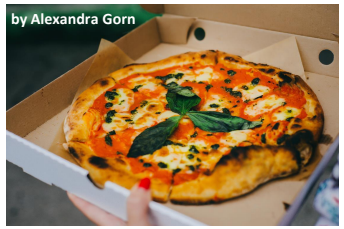

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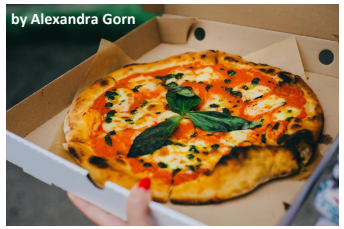

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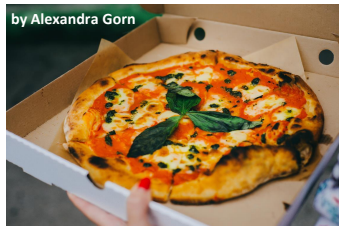

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Products that have smell added to them?

Smell is added to make a product more tasty, awaken different feelings or make you recall a memory.

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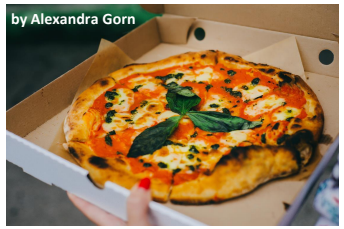

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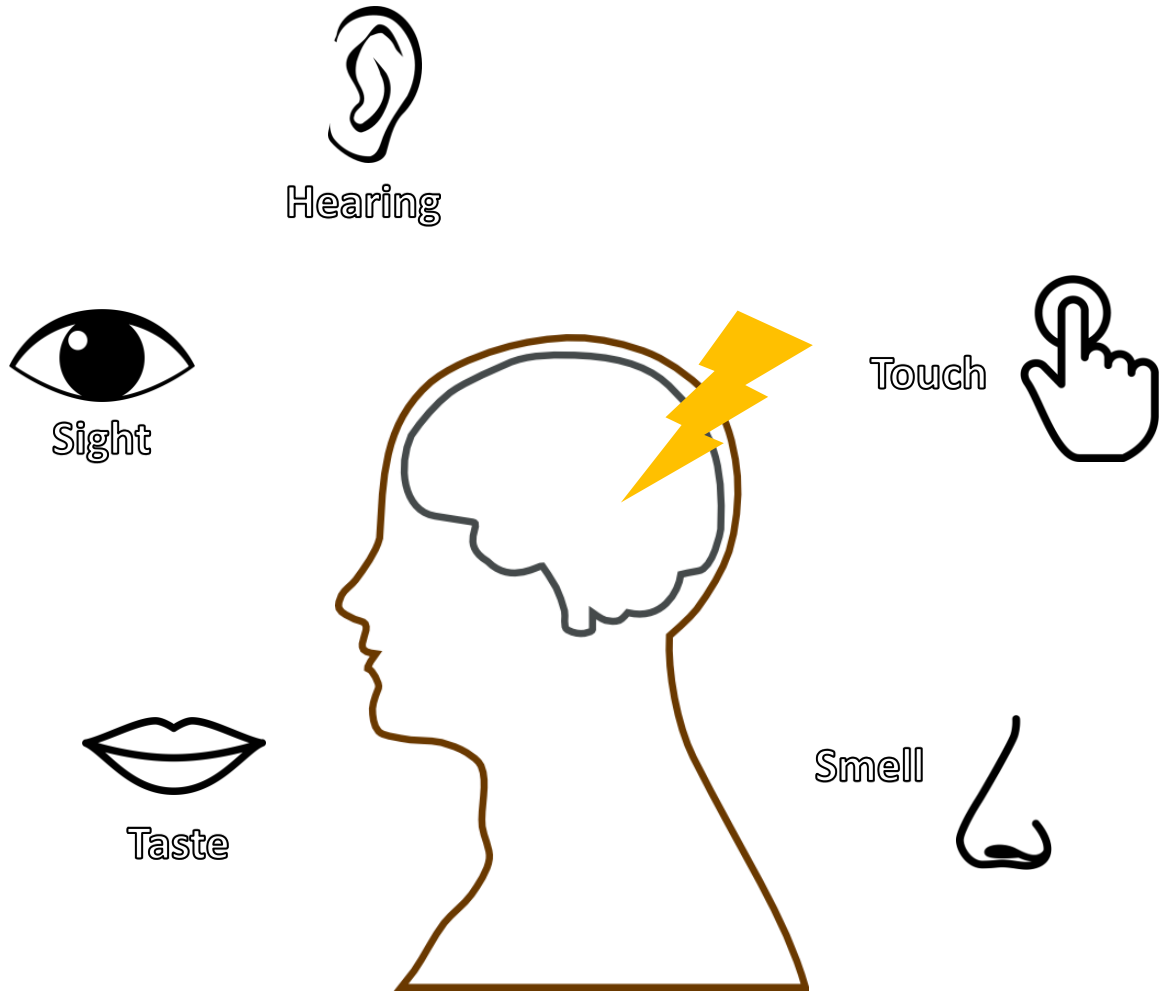
So how does smell work? How does it connect to taste?

But first, let's review what you know about the other senses.

All photos are from Unsplash

Senses – how do they work?



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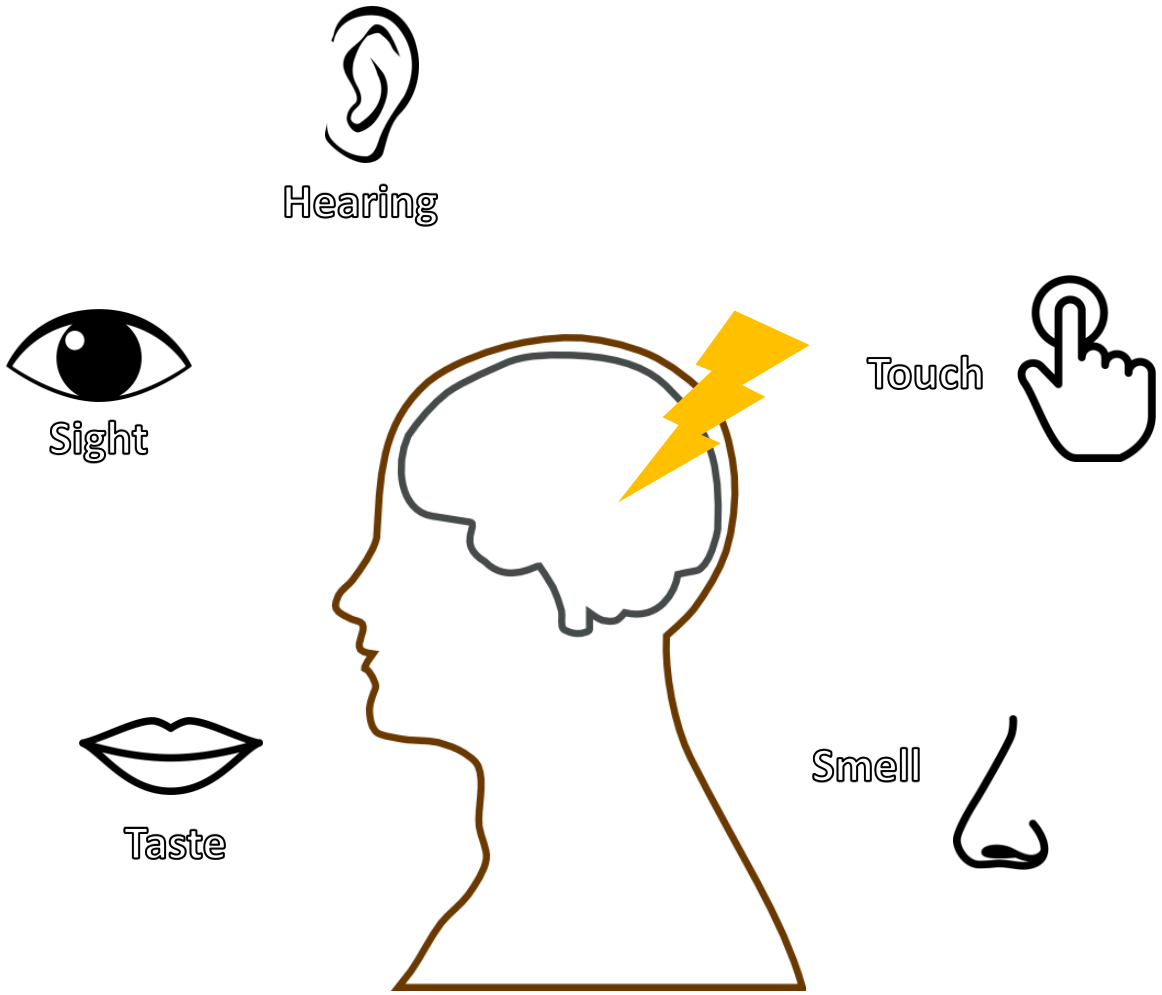

Cells get activated when **molecules** touch our tongues and send a message to our brains.

All photos are from Clipartmax

Senses – how do they work?

Hearing

Cells in our eyes detect the light and send a message to our brain

Sight

Touch

Cells get activated when **molecules** touch our tongues and send a message to our brains.

Taste

Smell

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Cells in our skin detect pressure, temperature, etc. and send a message to our brain

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Cells get activated when **molecules** touch our tongues and send a message to our brains.

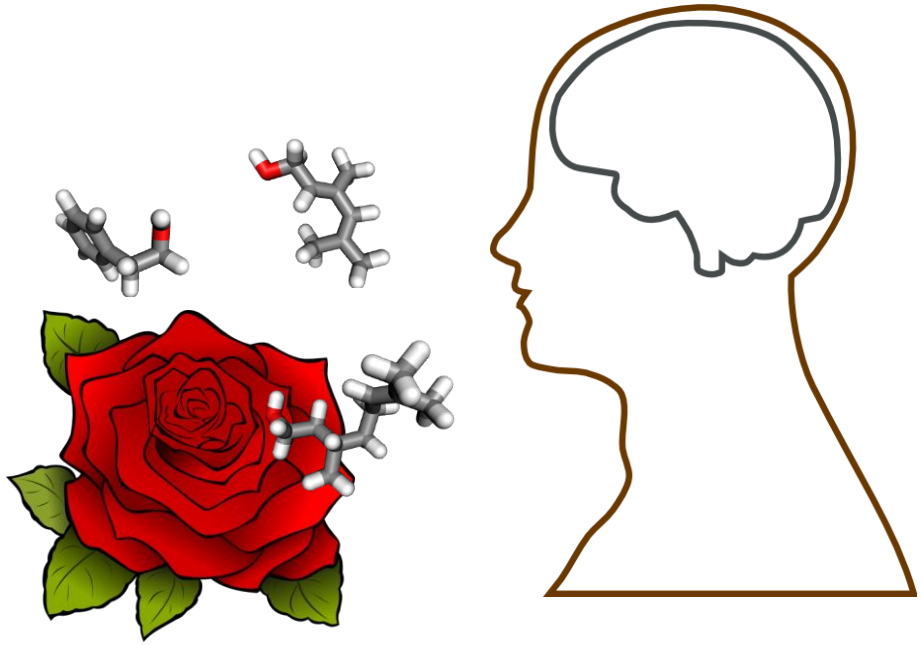
Taste

Smell

Cells get activated by **molecules** that evaporate from objects around us and send a message to our brain

All photos are from Clipartmax

How do you sense these molecules?



Clipart is from Clipartmax
Molecules were made with MolView

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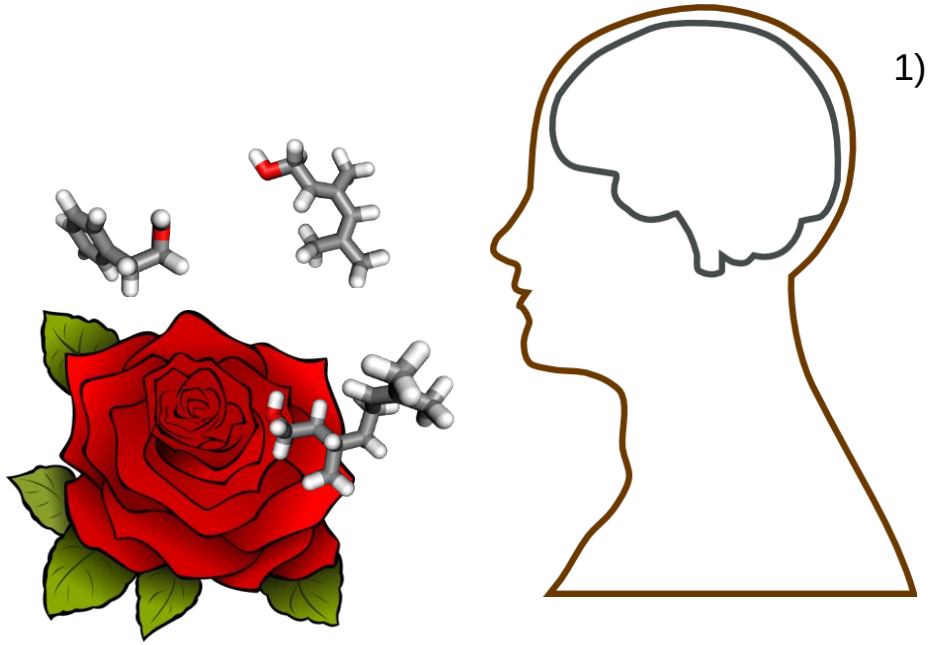

1) Small molecules evaporate

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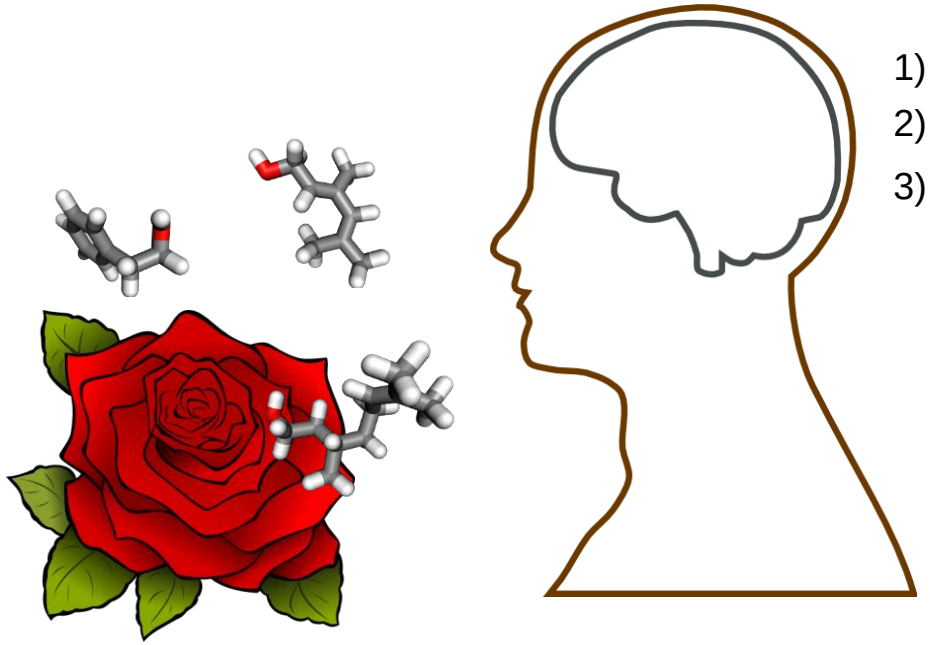
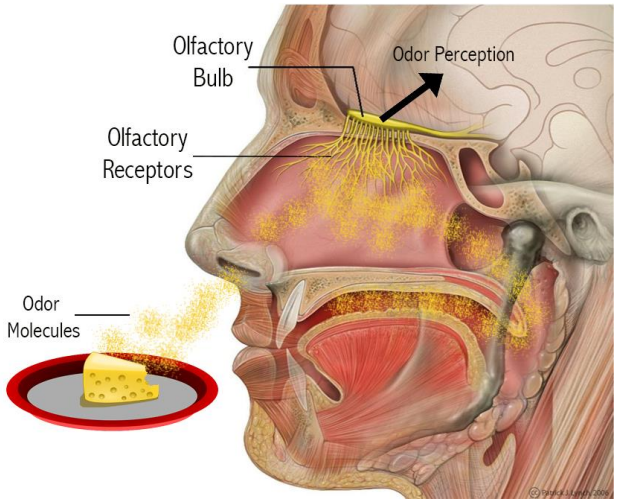


1) Small molecules evaporate
2) They dissolve in mucus, hit the olfactory epithelium
3) They interact with a combination of receptor types.



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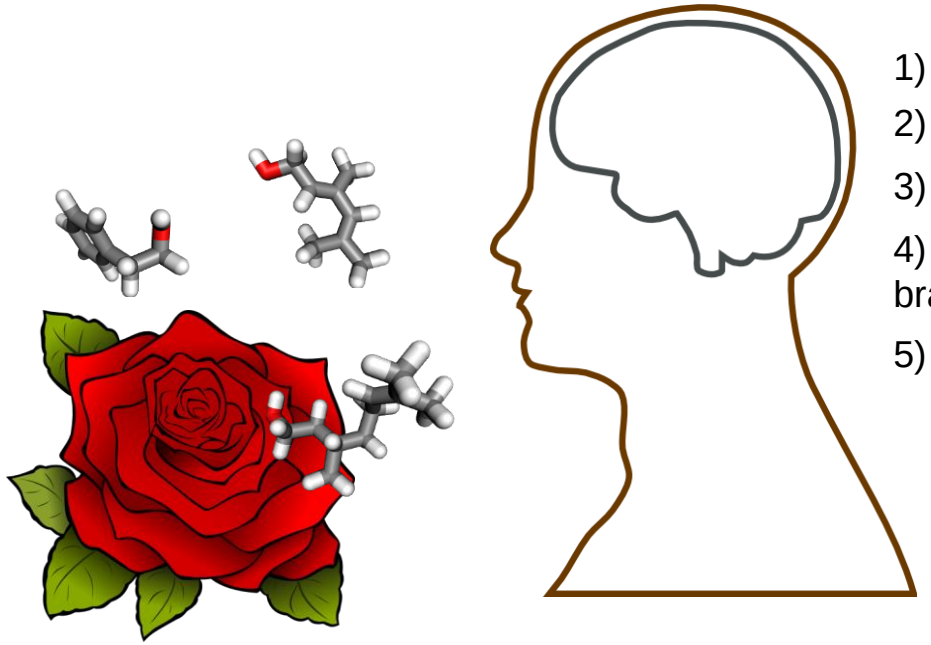

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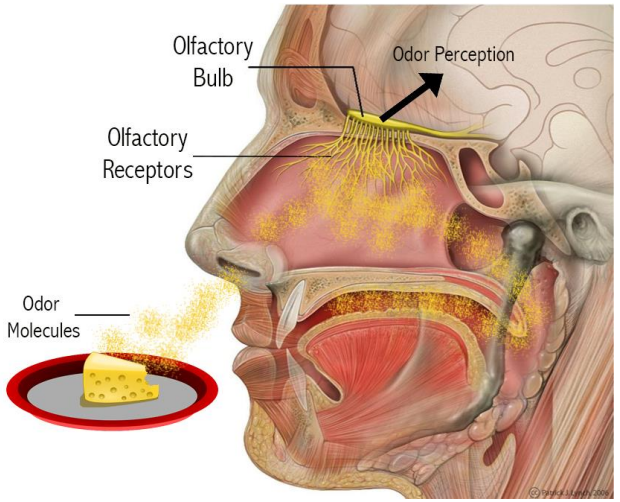
4) The cell get activated and sends a signal to your brain.
5) You recognize the smell of a rose



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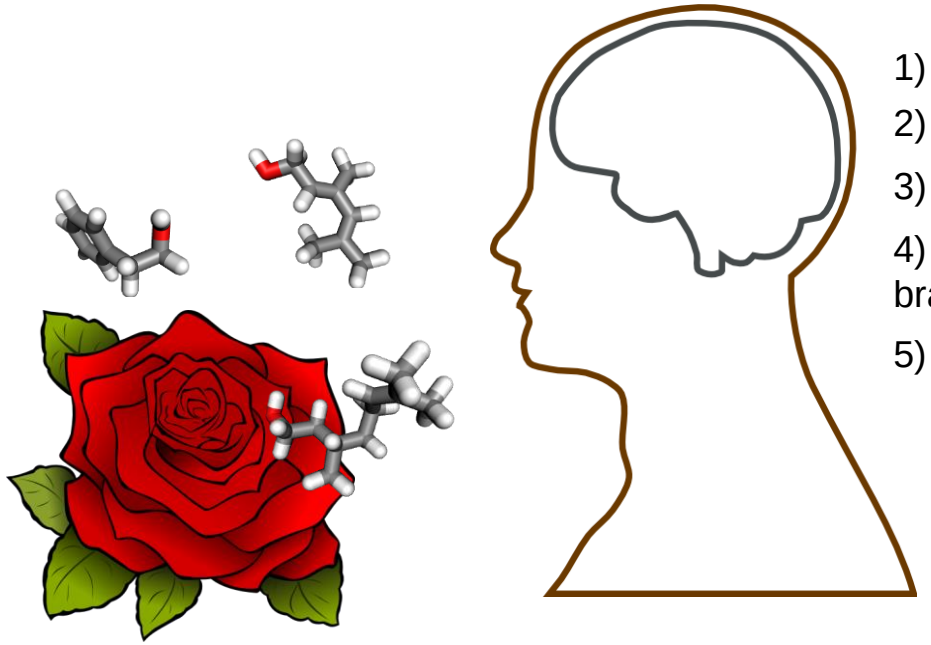

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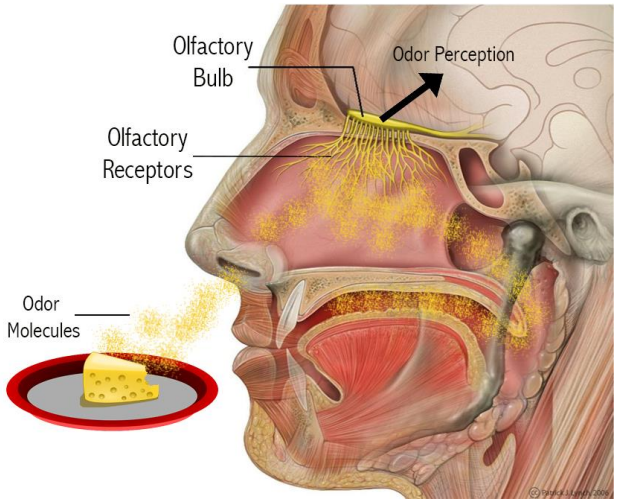

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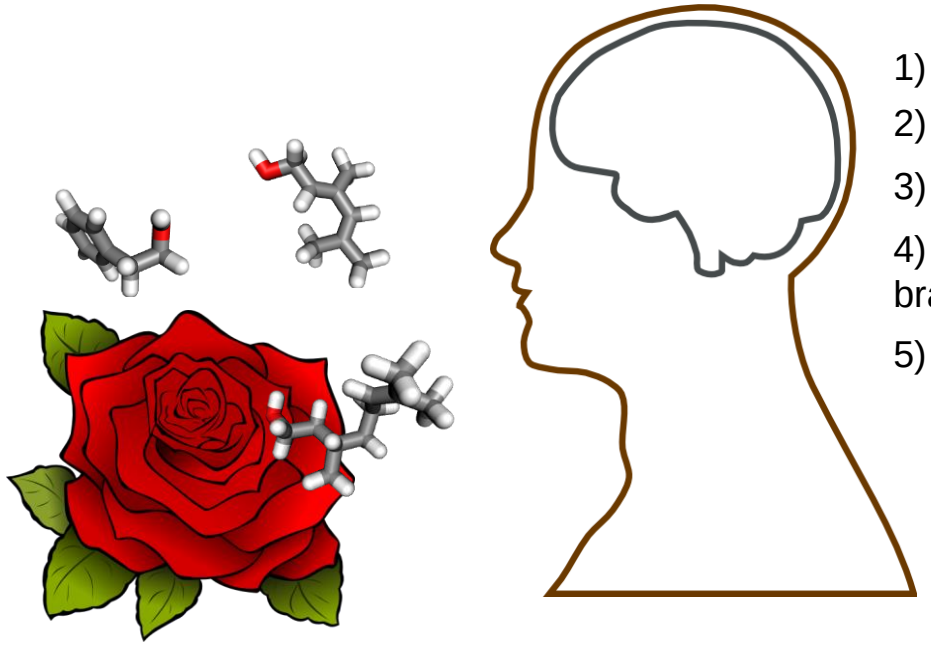

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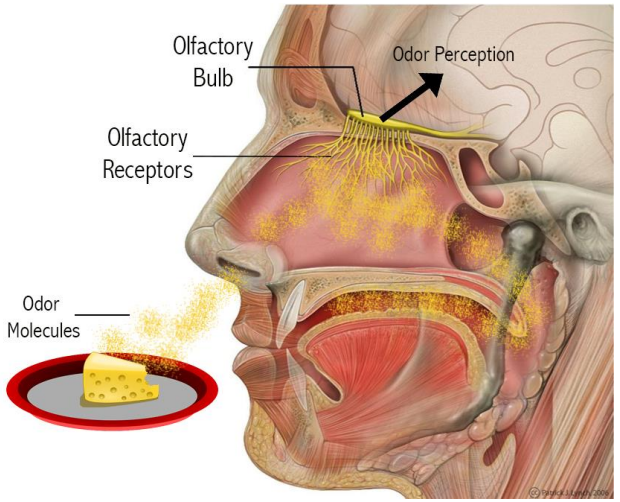

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With the help of this system, humans can distinguish over 10,000 different smells.

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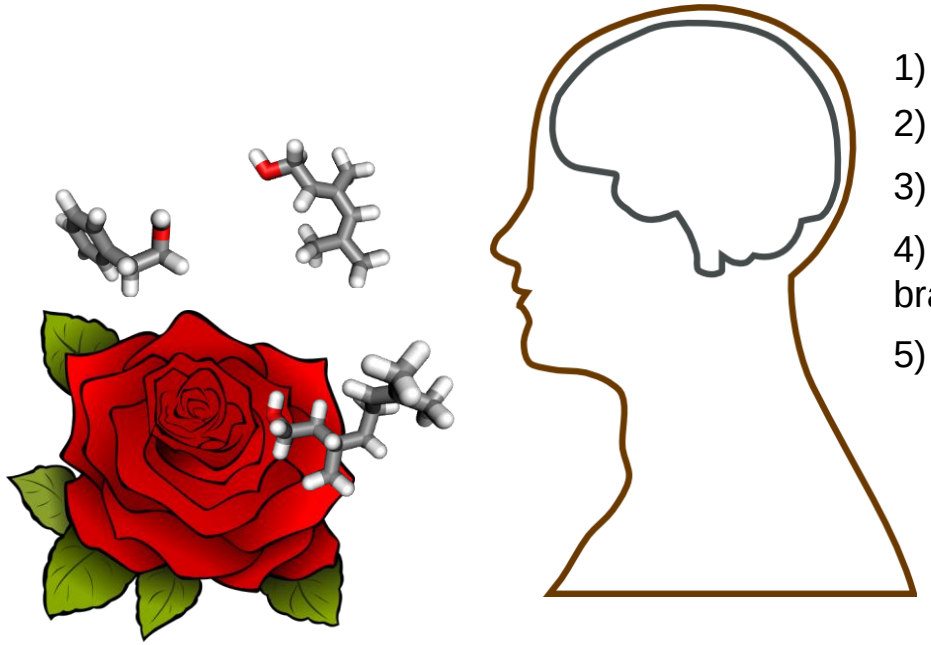

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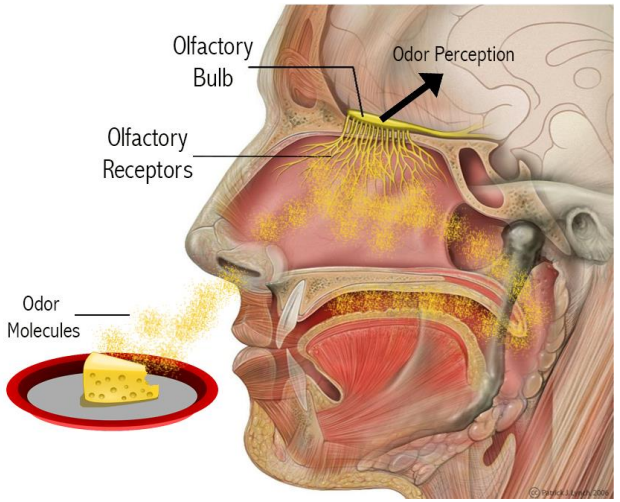

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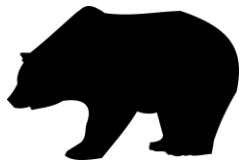
With the help of this system, humans can distinguish over 10,000 different smells.

Not nearly enough as some other animals…

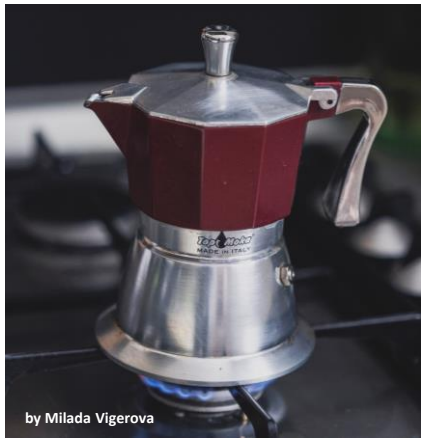


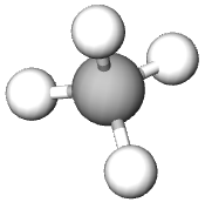
Avg. 100 - 300 times better 2,100 times

This means that they have more receptors than us and can detect odours that humans can't and at lower concentrations.

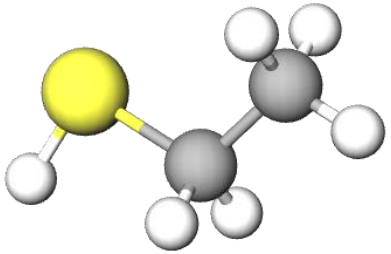
Clipart is from Clipartmax
Molecules were made with MolView

Can you smell everything?





Methane (C_1H_4)



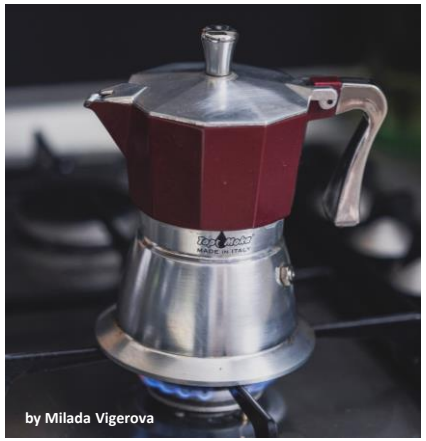
Ethanethiol (C_2H_6S)

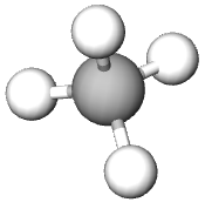
Methane is odorless = we don't have receptors for it.

Ethanethiol (which we can detect at 1:2.8 billion) is added to give it a smell.

All photos are from Unsplash

Can you smell everything?





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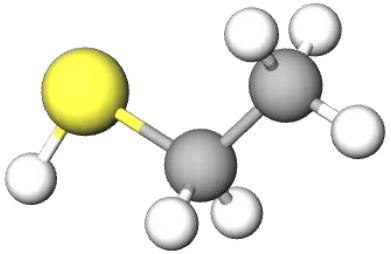

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How about metals? Why does gold not smell?

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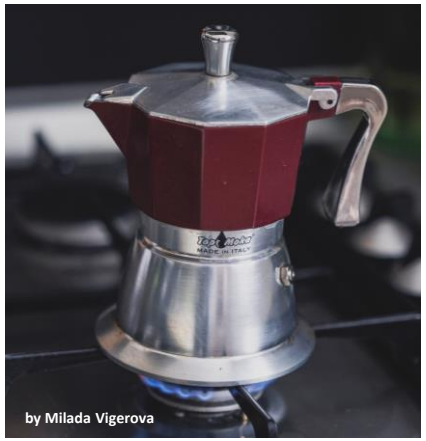

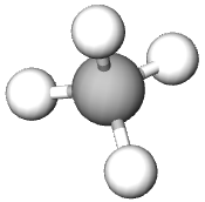

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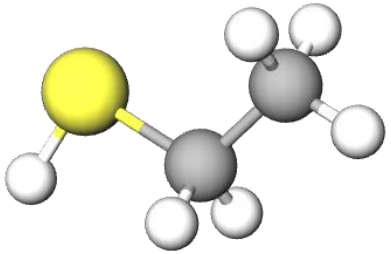

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How about metals? Why does gold not smell?

Generally metals are not volatile, so your olfactory sensors can not detect any molecules. It's not the pure metals that have the smell, but in fact the oxides, sulphides and other chemical compounds formed with the metal.

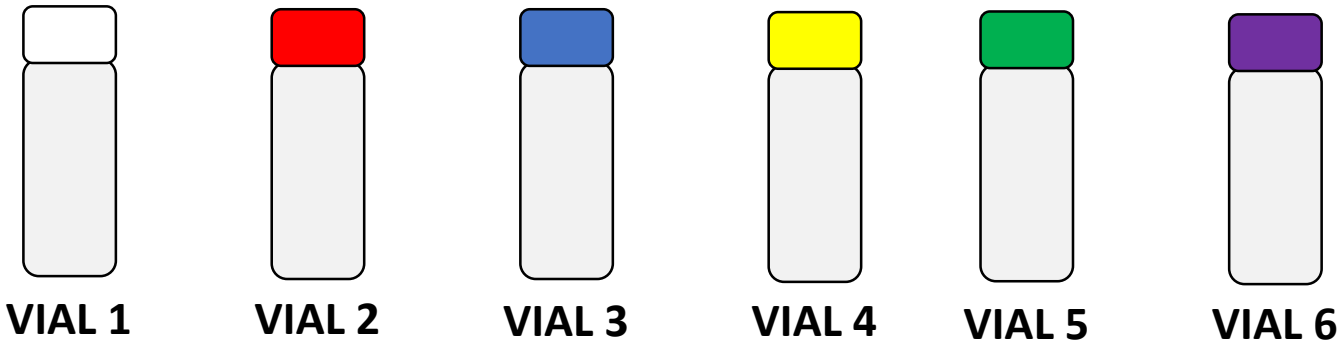
All photos are from Unsplash

Let's take 15 mins and have an aroma exercise!

(1) Open the vial and take a gentle breath. What do you smell?
(2) Discuss with your neighbour. Do you both agree on the smell?
(3) Write down the number of the vial and what you think it smells like.
(4) Can you relate it to a specific memory?

Taste and smell

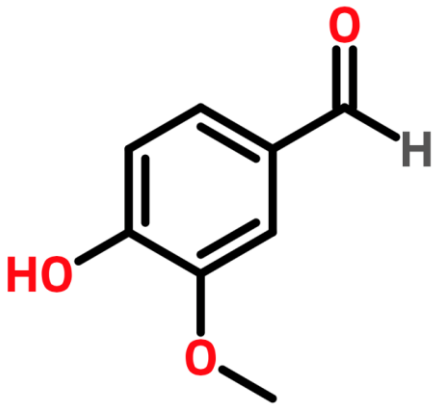
What does it remind you of?

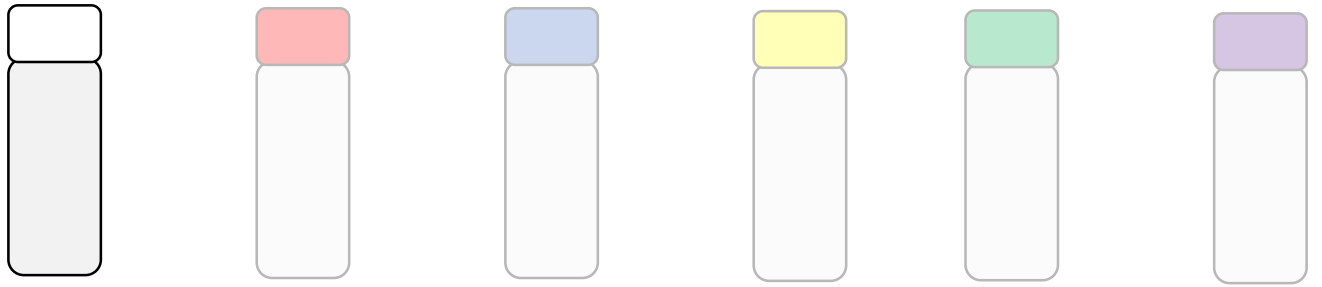


Taste and smell

What does it remind you of?

Vanillin





Vanilla bean

Image is from [Clipartxtras]

Taste and smell

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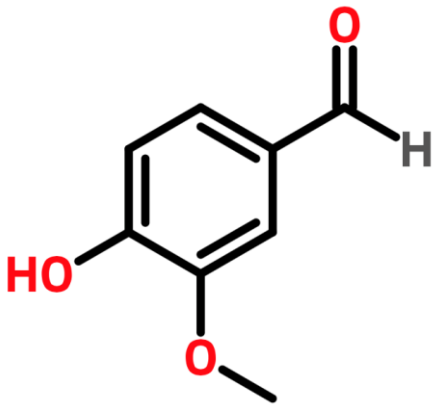

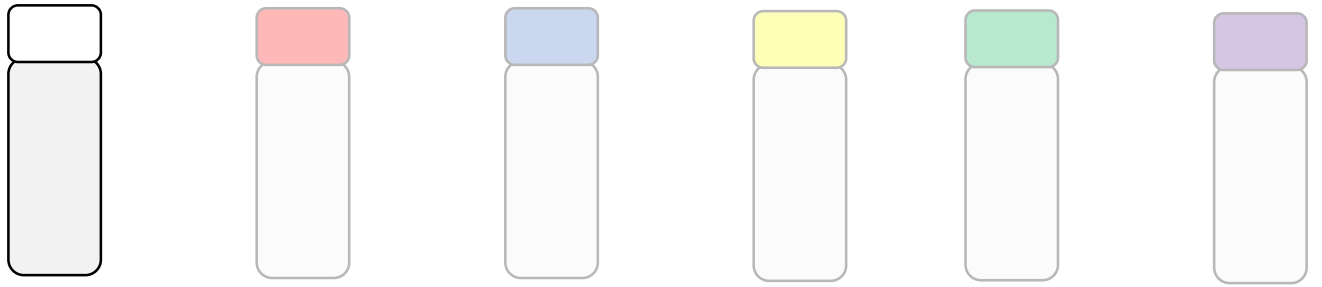

What's the difference between **vanilla** and **vanillin**?

Vanillin is one molecule. It's the major compound in vanilla beans.
Vanilla contains 299 other compounds besides **vanillin**.

Vanilla bean

Image is from Clipartxtras

Taste and smell

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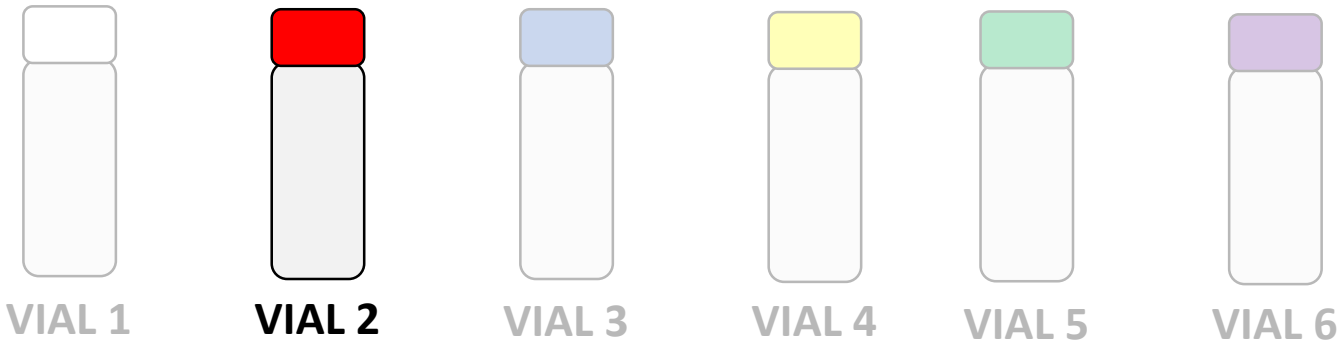
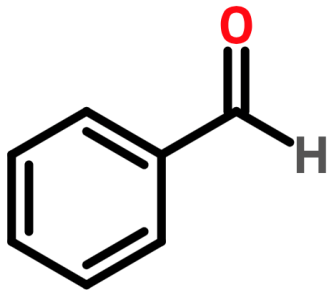


Benzaldehyde



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Taste and smell

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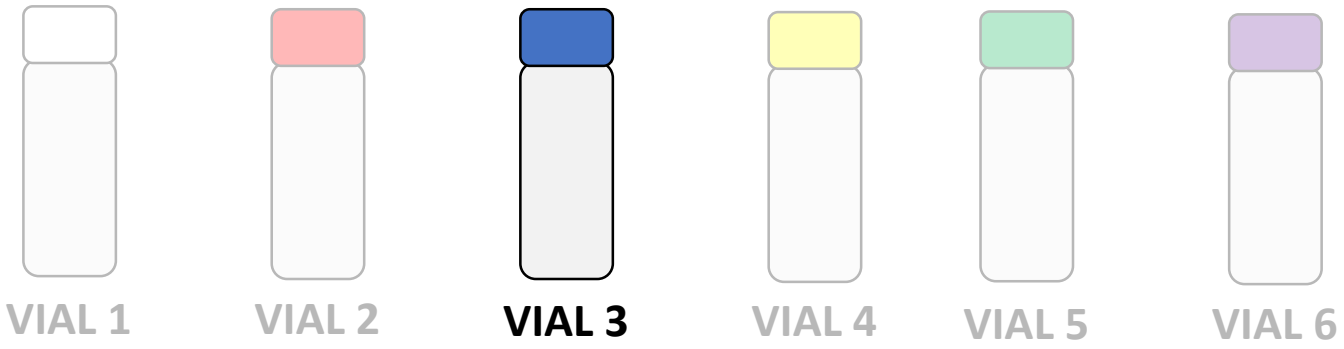
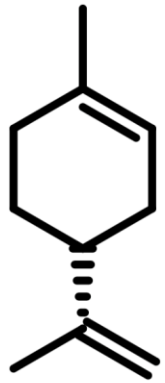


Limonene



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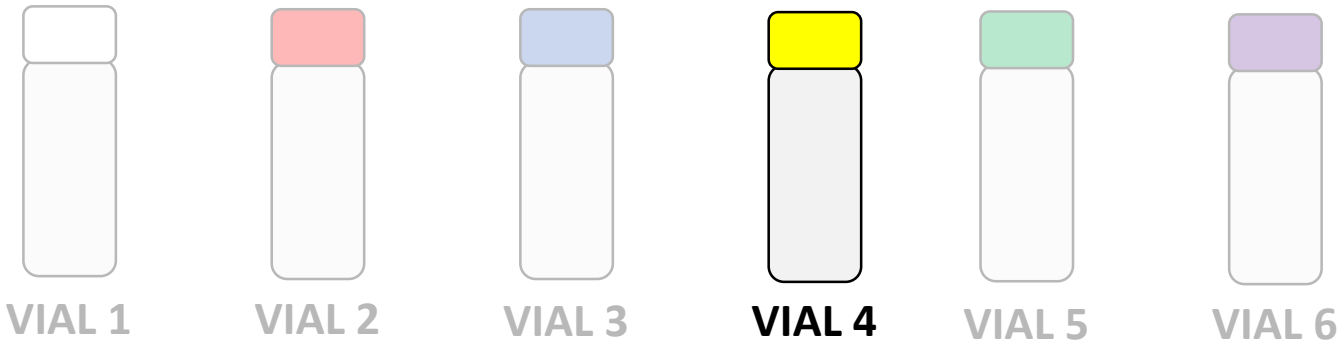
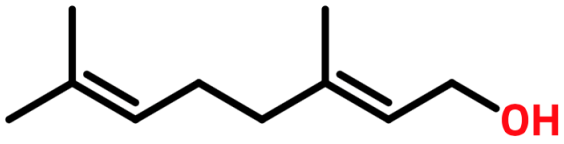


Geraniol



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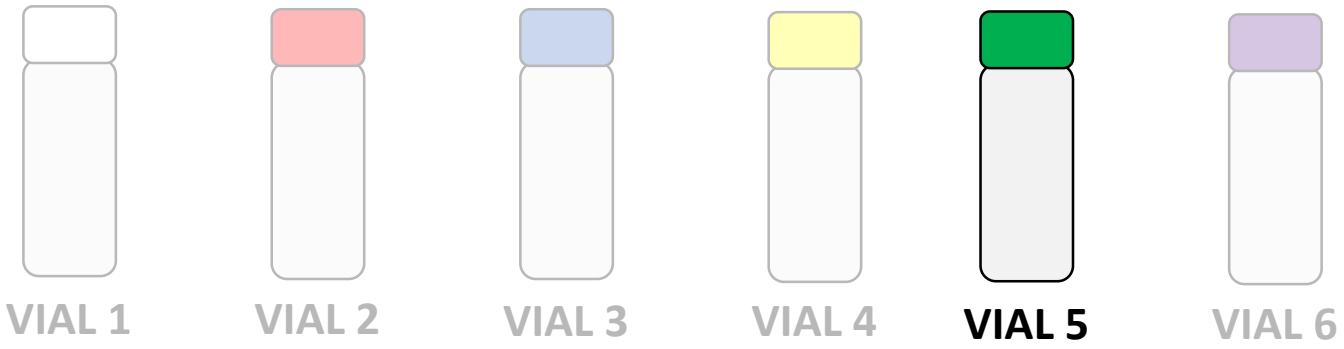
What does it remind you of?



Isoamyl acetate

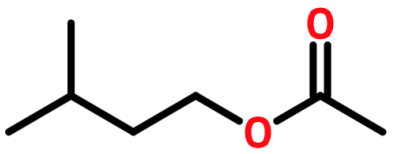
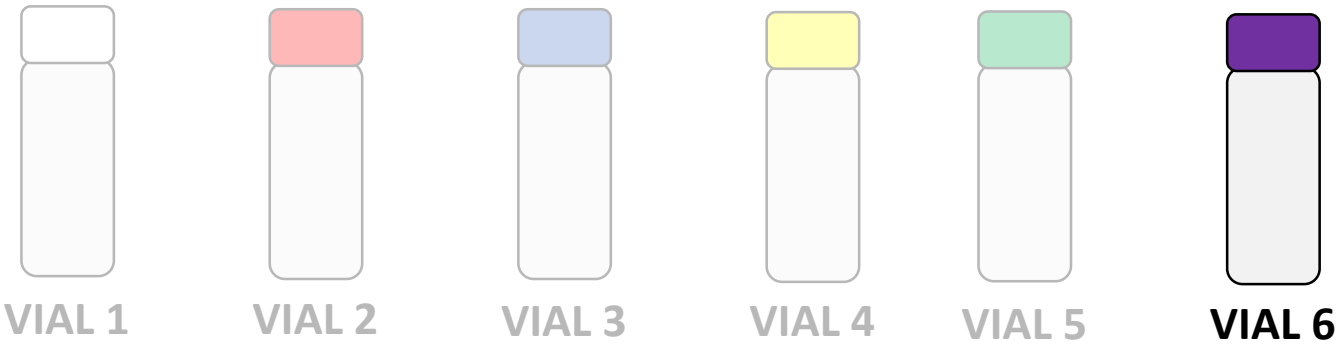


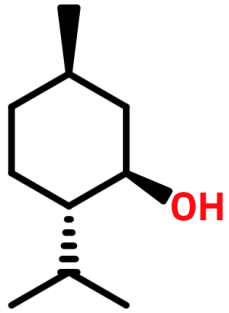
Image is from [Unsplash]

Taste and smell

What does it remind you of?



Menthol



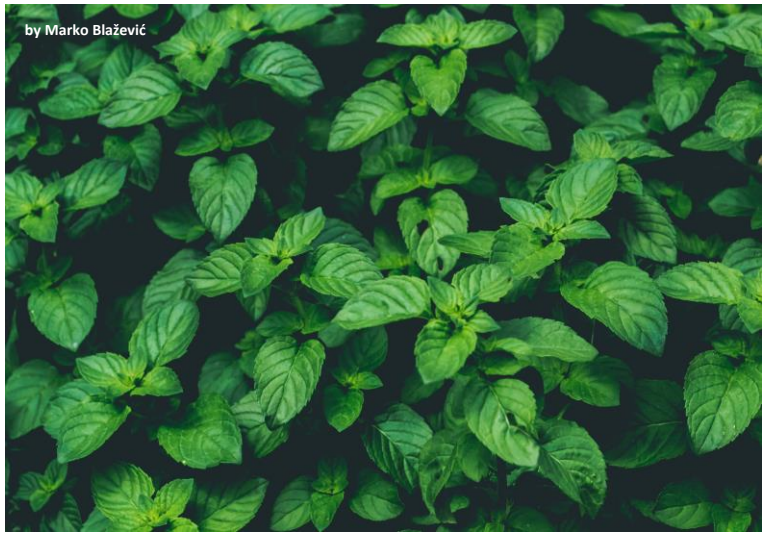
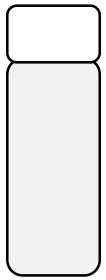
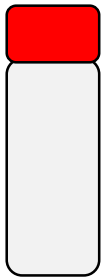


Image is from [Unsplash]

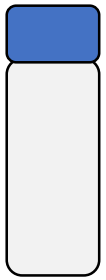
Taste and smell



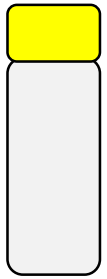
VIAL 1



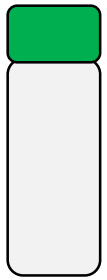
VIAL 2



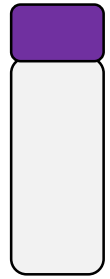
VIAL 3



VIAL 4

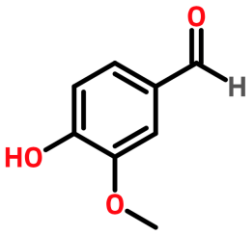


VIAL 5

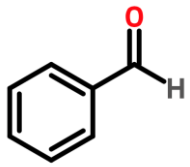


VIAL 6

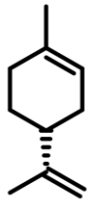
Vanillin



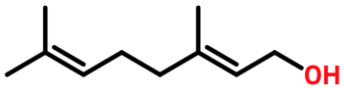
Benzaldehyde



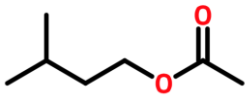
Limonene



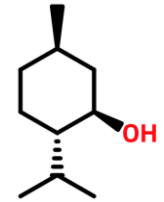
Geraniol



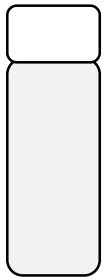
Isoamyl acetate



Menthol

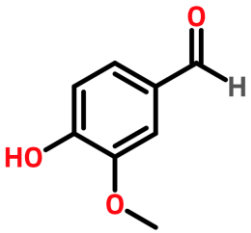


Taste and smell



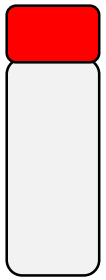
VIAL 1

Vanillin



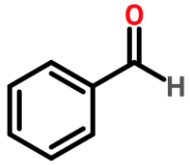
Aromatic and aldehyde

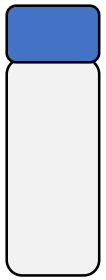
Often found in nuts and spices.



VIAL 2

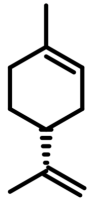
Benzaldehyde





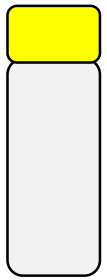
VIAL 3

Limonene



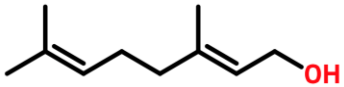
Cyclic terpenes

Often found in lemon/orange or herbs



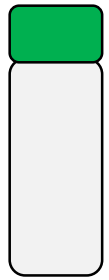
VIAL 4

Geraniol



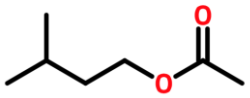
Linear terpenes with alcohols

Often found in flowers/plants.



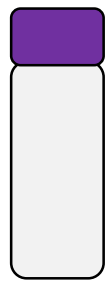
VIAL 5

Isoamyl acetate



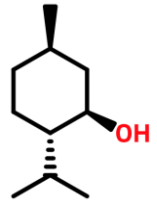
Ester

Often found in fruits



VIAL 6

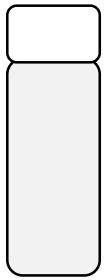
Menthol



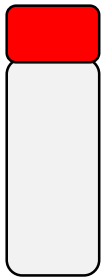
Cyclic terpene with alcohol

Often found in herbs/plants. Strong aroma!

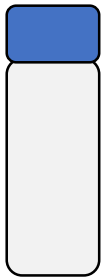
Taste and smell



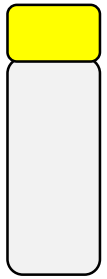
VIAL 1



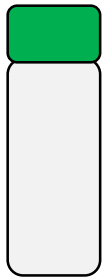
VIAL 2



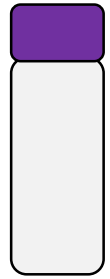
VIAL 3



VIAL 4

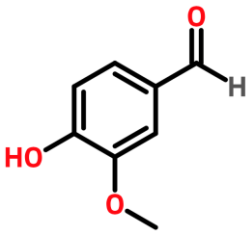


VIAL 5



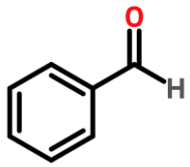
VIAL 6

Vanillin

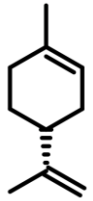


Aromatic and aldehyde

Benzaldehyde

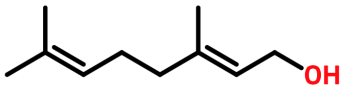


Limonene



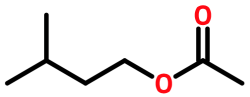
Cyclic terpenes

Geraniol



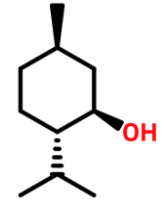
Linear terpenes with alcohols

Isoamyl acetate



Ester

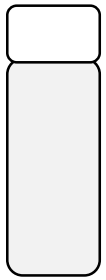
Menthol



Cyclic terpene with alcohol

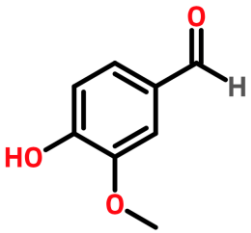
Does that mean that similar molecules smell the same?

Taste and smell

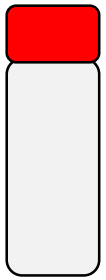


VIAL 1

Vanillin

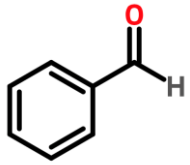


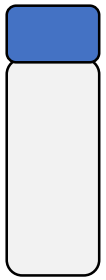
Aromatic and aldehyde



VIAL 2

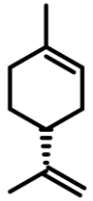
Benzaldehyde



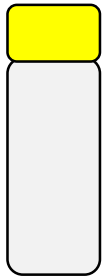


VIAL 3

Limonene

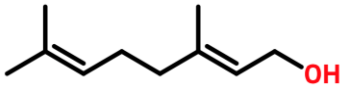


Cyclic terpenes

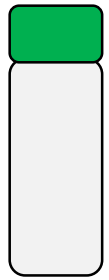


VIAL 4

Geraniol

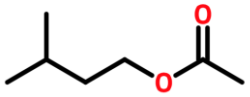


Linear terpenes with alcohols

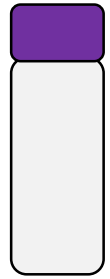


VIAL 5

Isoamyl acetate

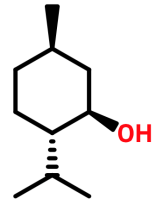


Ester



VIAL 6

Menthol

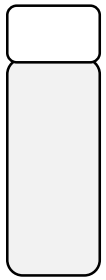


Cyclic terpene with alcohol

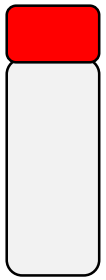
Does that mean that similar molecules smell the same?

NO! similar molecules can give completely different smell. It all depends on how they bind to the receptors and which receptor combination they give.

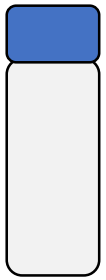
Taste and smell



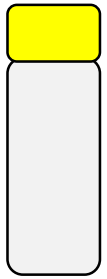
VIAL 1



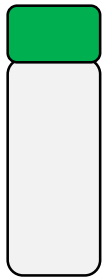
VIAL 2



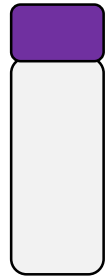
VIAL 3



VIAL 4

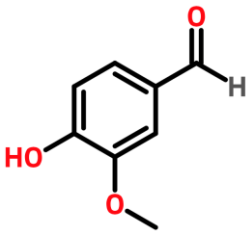


VIAL 5



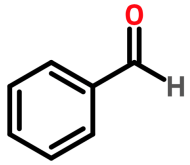
VIAL 6

Vanillin

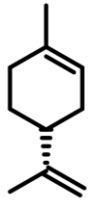


Aromatic and aldehyde

Benzaldehyde

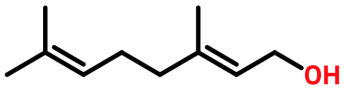


Limonene



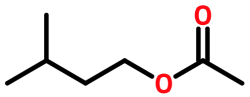
Cyclic terpenes

Geraniol



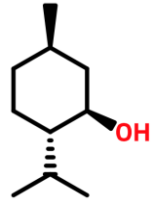
Linear terpenes with alcohols

Isoamyl acetate



Ester

Menthol

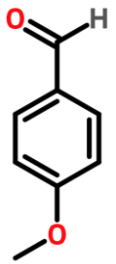


Cyclic terpene with alcohol

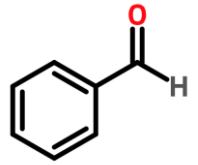
Does that mean that similar molecules smell the same?

NO! similar molecules can give completely different smell. It all depends on how they bind to the receptors and which receptor combination they give.

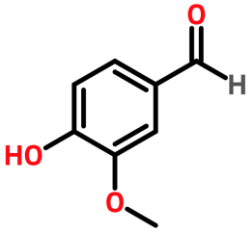
Ex.



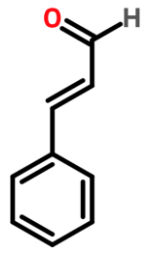
Anis



Almond



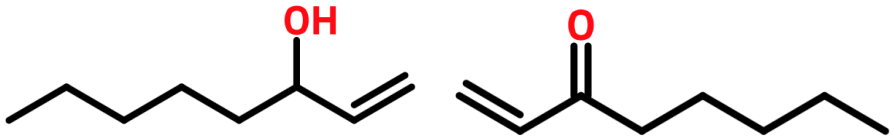
Vanilla



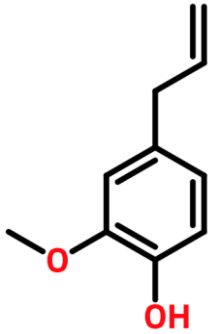
Cinnamon

Final words

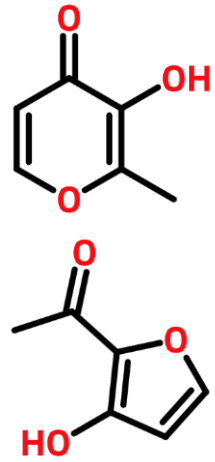
Thank you all for listening!



1-Octen-3-ol and **1-octen-3-one** (Mozzarella)



Eugenol
(Basil)



Maltol and **isomaltol**
(Bread crust)

Image is from Unsplash

All molecule structures in this presentation were made with Chemwriter