

THE SCIENCE OF SHAMPOO



The power of
W (Women x Well-being)
will change the future.



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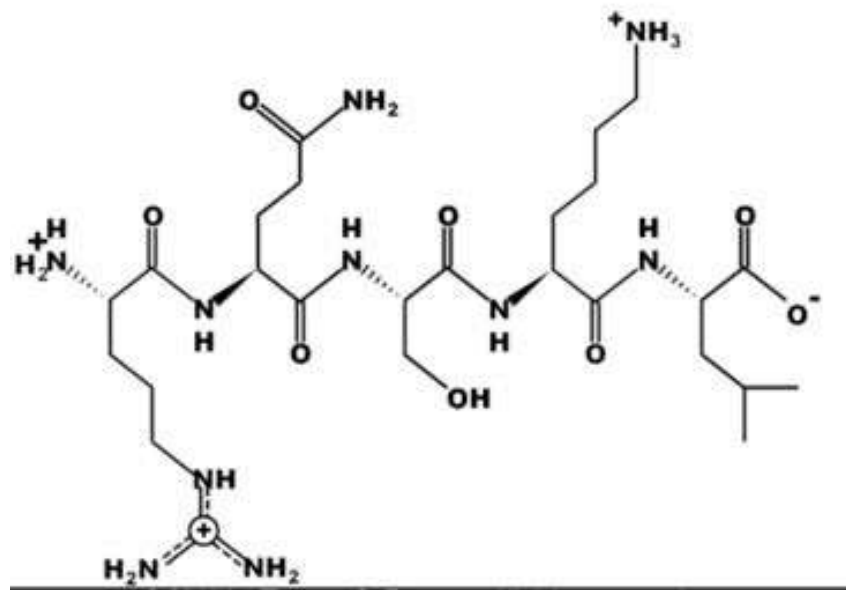
<http://www.leading.nagoya-u.ac.jp/eng/> 2019/1/21(閲覧日以下同)

<http://www.nagoya-u.ac.jp/extra/kisoku/act/frame/frame110000096.htm>

http://www.irasutoya.com/2014/06/blog-post_7158.html

Biography

- BSc Biochemistry (UEA, UK)
- MSc Chemical Biology (Leeds, UK)
- PhD Molecular and Cellular biology (Leeds, UK)



← I made this

Shampoo love

Eczema
(湿疹)

Partner Up!

There will be some questions and discussion during this talk.

Please make pairs!

Question

How many beauty products do you use in one day?



- A) 0-5
- B) 5-10
- C) 10+

http://www.clipartpanda.com/clipart_images/art-images-makeup-clipart-65425524

<http://www.clipartkid.com/clip-art-on-pinterest-machine-embroidery-designs-clip-art-and-E3Dlzu-clipart/>

<http://clipart-library.com/clipart/134430.htm>

Global market

\$460 Billion
Beauty

\$20 Billion
(Japan)



\$867.4 Billion
Soft drinks



\$4 Billion
Consumer electronics



\$1,184.6 Billion
Automobile



Beauty market

Use every day

Brand loyal



Buy often

Pay for good products

Question

- How long on average does it take to create a new beauty product?

- A) 1 - 3 years
- B) 3 - 5 years
- C) 5 – 10 years



The Scientists of Shampoo

SyntheNc chemist



FormulaNon chemist



CosmeNc chemist

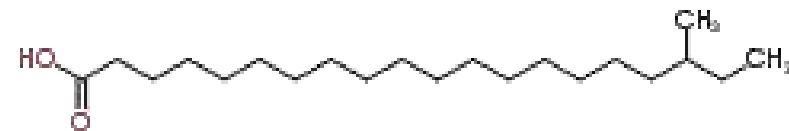
The Target

Know thy enemy

Hair Structure



- 18-methyl eicosanoic acid
- Hydrophobic surface
(疎水性の)
- Attracts oil
- Ex Sebum (natural oils)



Hates water!

Hair Structure

- Skin makes Sebum (皮脂)
- Sebum coats hair
- Protects and makes shiny
- ✦ Attracts dirt and smells
- ✦ Some people make too much



Shampoo History

Hair cleansing

- Washed hair with water



Tsubaki
(椿)



Egg
(卵)



Vinegar
(酢)



Beer
(ビール)



Coconut
(ココナッツ)

The First Shampoo



Mid Edo period
1700-1800



chāmpo
(चाँपो)
<Hindi>

Head massage + oil



+



Soap



Residue on hair
(残基)
Difficult to brush
Removes too
Much oil

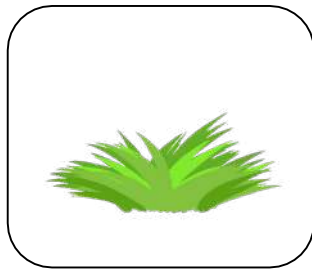
http://irasutoya.blogspot.jp/2015/10/blog-post_5.html

http://www.irasutoya.com/2012/06/blog-post_30.html

<http://free-illustrations.gatag.net/2014/07/08/120000.html>

The First Shampoo

England 1900's (late Meiji)



Herbs
(草)



Soap
(石鹼)

Boiled



1930's USA
Proctor and Gamble
(P&G)

<http://free-illustrations.gatag.net/2014/07/08/120000.html>

Let's make!

Shampoo/シャンプー

Remove dirt and
oils from hair

Easy rinsing

Looks/smells
good



Good finish a^er
washing hair

Minimal skin/
eye irritaNon
(刺激)

No damage to hair

What's in Shampoo?

Water, Sodium Laureth Sulfate, cocamidopropyl betaine, sorbitol, glycolic distearate, guar hydroxypropyltrimonium chloride, (trimonium chloride acrylamide / dimethyl acrylamide) copolymer, arginine, lauroyl glutamate di (phytosteryl / octyldodecyl), Sodium chloride , Sodium acetyl hyaluronate, hydrolysis conchiolin, Sodium sulphate, laurate PEG-2, DPG, lauric acid, dimethiconol, citric acid, salicylic acid, EDTA-2 Na, Sodium lauryl sulfate , cocoyl methyl taurine Na, BG, tocopherol, phenoxyethanol, Sodium benzoic acid, perfume, yellow 5, yellow 4

水,ラウレス硫酸Na,コカミドプロピルベタイン,ソルビトール,ジステアリン酸グリコール,グアーヒドロキシプロピルトリモニウムクロリド,(プロピルトリモニウムクロリドアクリルアミド/ジメチルアクリルアミド)コポリマー,アルギニン,ラウロイルグルタミン酸ジ(フィトステリル/オクチルドデシル),塩化Na,アセチルヒアルロン酸Na,加水分解コンキオリン,硫酸Na,ラウリン酸PEG-2,DPG,ラウリン酸,ジメチコノール,クエン酸,サリチル酸,EDTA-2Na,ラウリル硫酸Na,ココイルメチルタウリンタウリンNa,BG,トコフェロール,フェノキシエタノール,安息香酸Na,香料,黄5,黄4

Components

Preservative
(防腐剤)

pH buffer
(緩衝剤)

Surfactant
(洗剤)

Thickener
(増粘剤)

Water
(70-80%)

Stabilizer
(スタビライザー)

Extras



Question

- How does shampoo work?



Magic!



Surfactant

Allows oil to be removed by water

- Oils can be removed from hair, clothing etc.
- Mixtures of different detergents give different results

Sodium laureth sulphate

Sodium Lauryl sulphate



http://www.kao.com/jp/bioreu/bru_bioreu_01.html

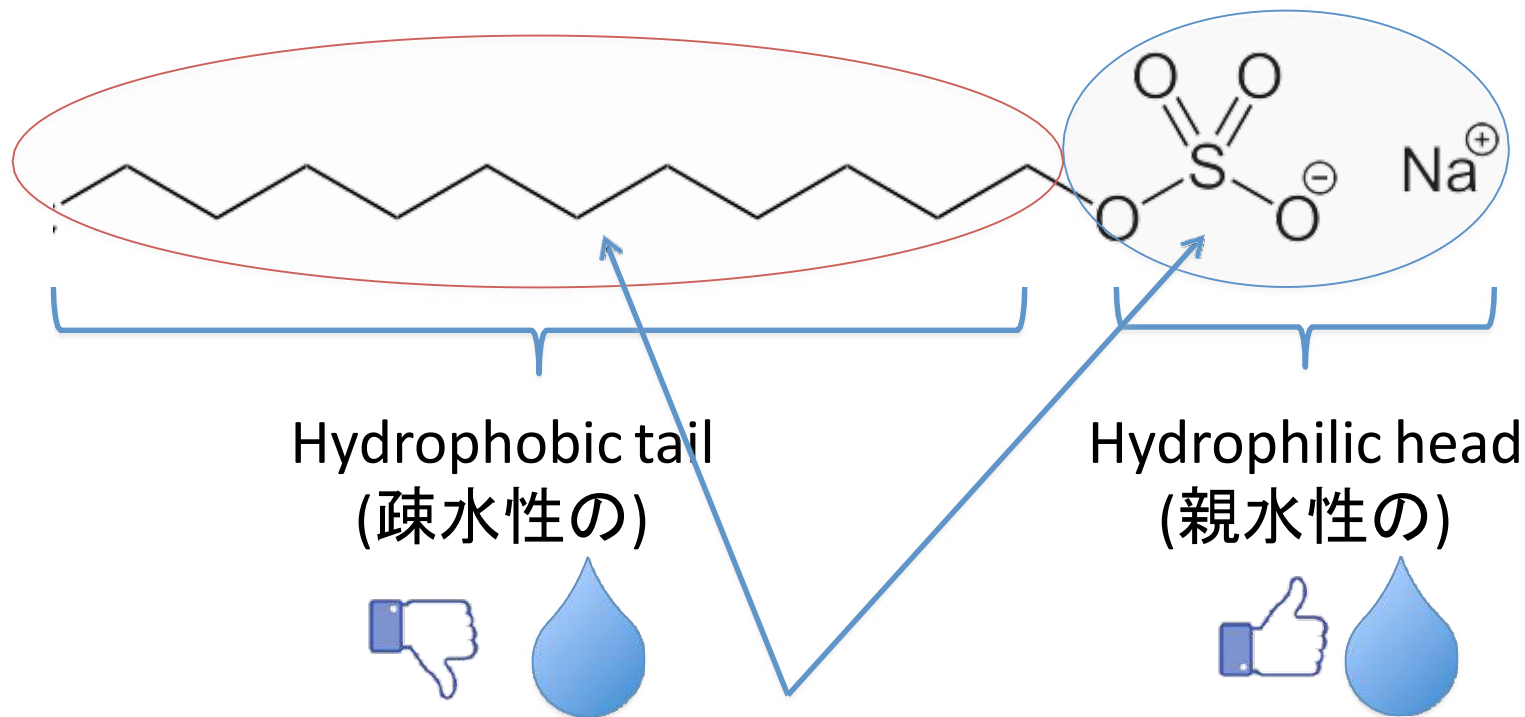
<https://www.myrepi.com/tag/myrepi-joy-joy-product-jyokin>

<https://www.shiseido.co.jp/tsubaki/products/red.html>

<https://www.shiseido.co.jp/tsubaki/products/red.html>

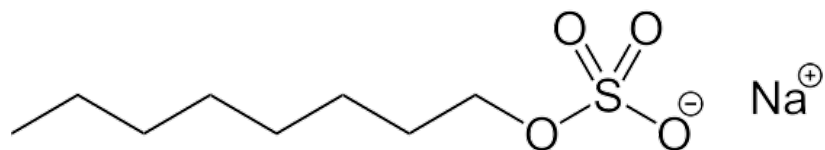
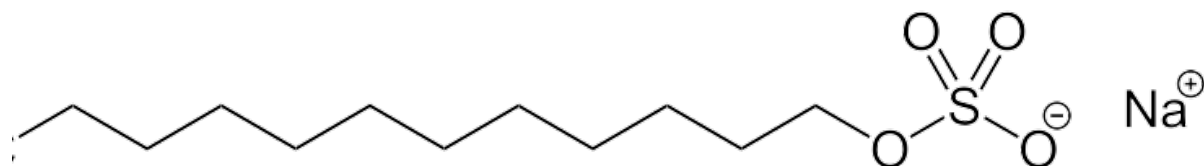
Surfactant

Sodium lauryl sulfate

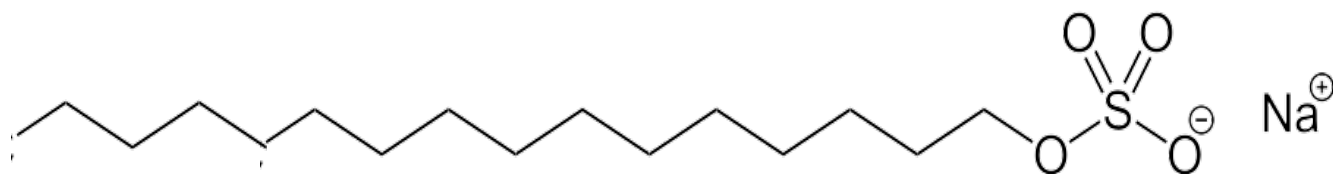


Changing these groups changes properties

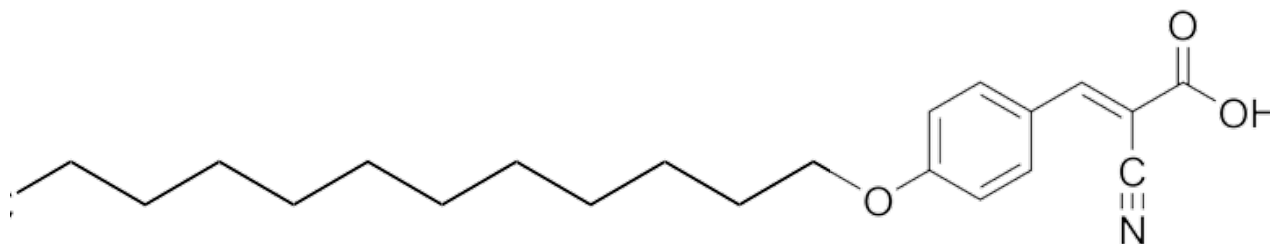
Synthetic Chemist



Shorter?

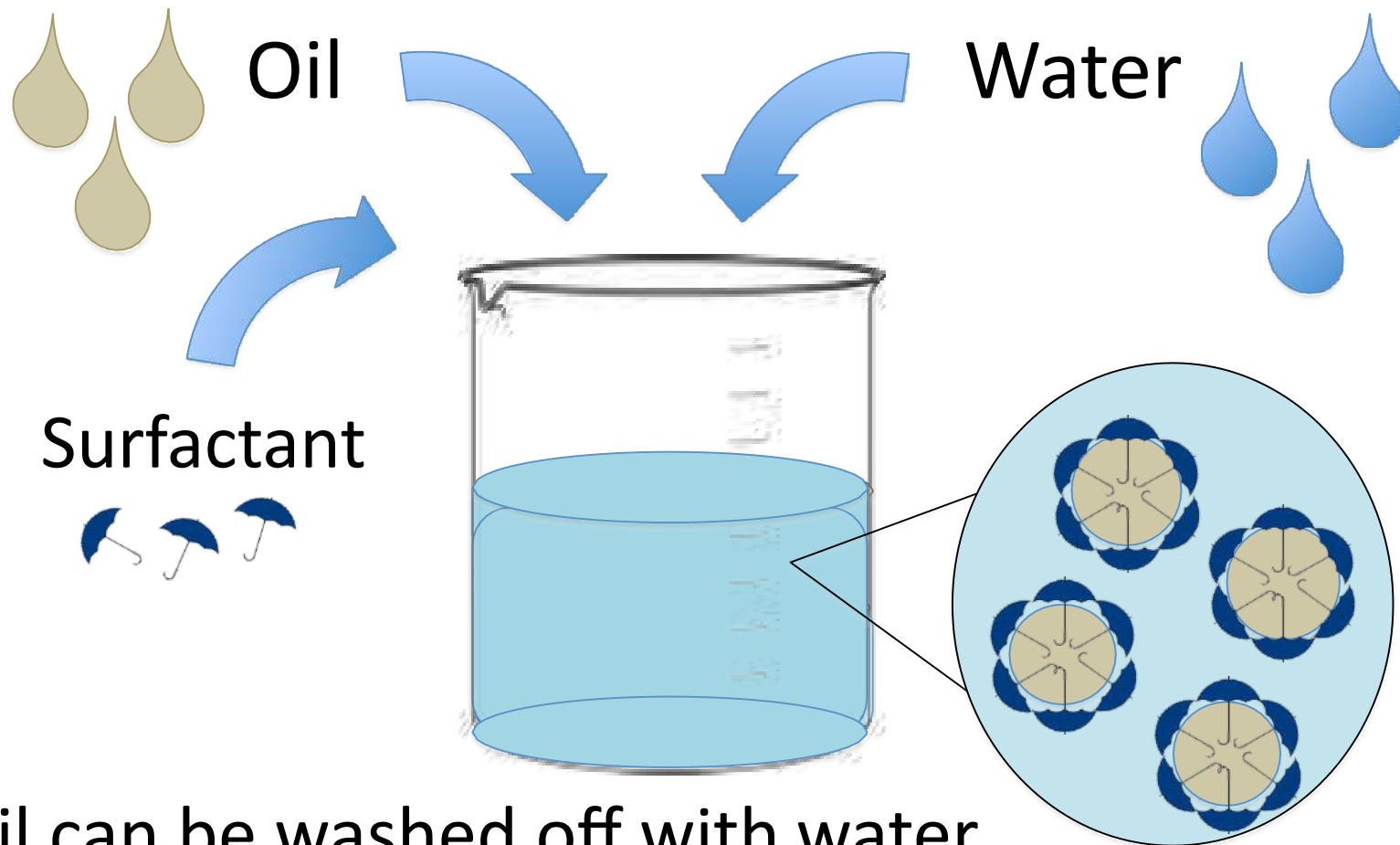


Longer?



Change?

Surfactant



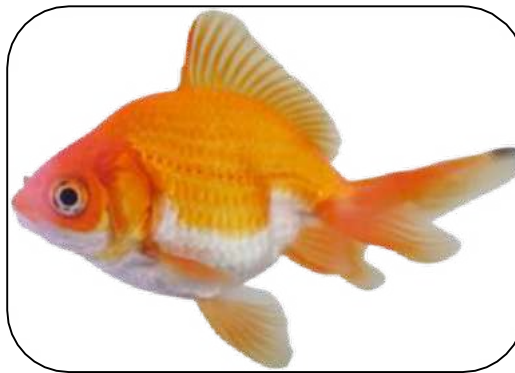
Oil can be washed off with water

Question

- Which of the following is a natural source of surfactants used in shampoo?



A) Coconuts
(ココナッツ)



B) Fish
(魚)



C) Banana
(バナナ)

Synthesis



Petroleum (石油)



Coconut (ココナツ)

Palm oil (ヤシ油)

Fatty acid

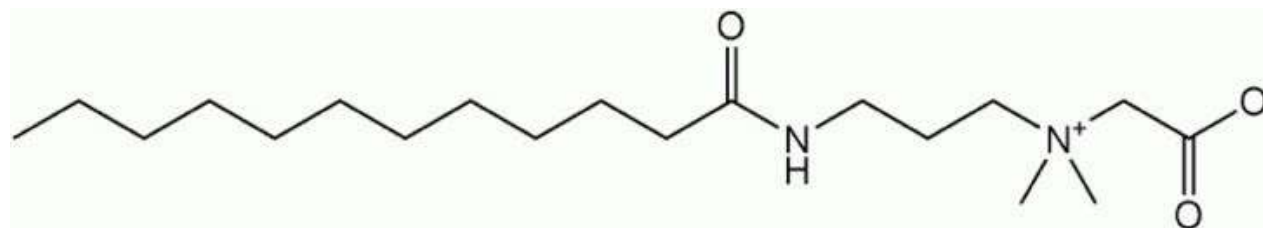
Fatty alcohol

Surfactant



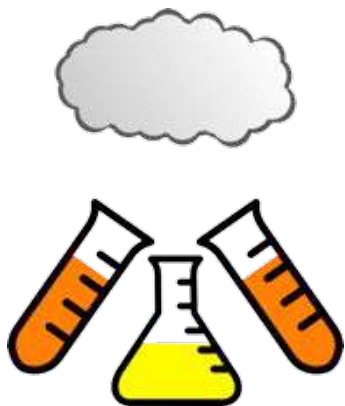
Foam

- People like foam!
- Foam = 'good shampoo'
- Other surfactants are added to increase foam!



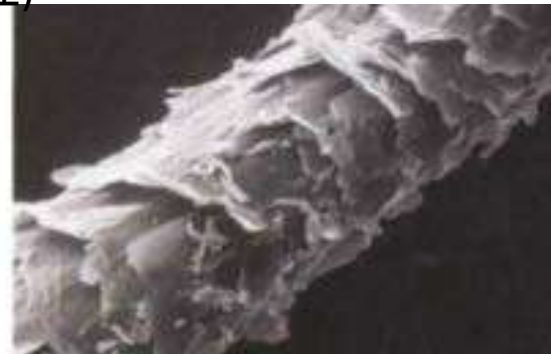
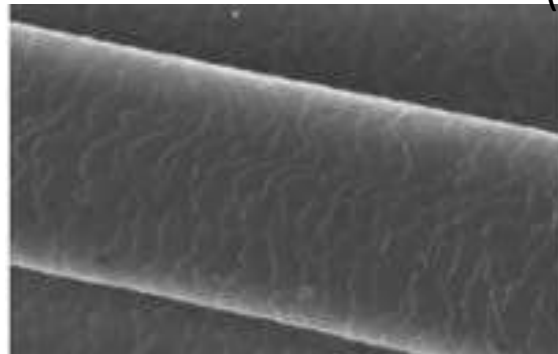
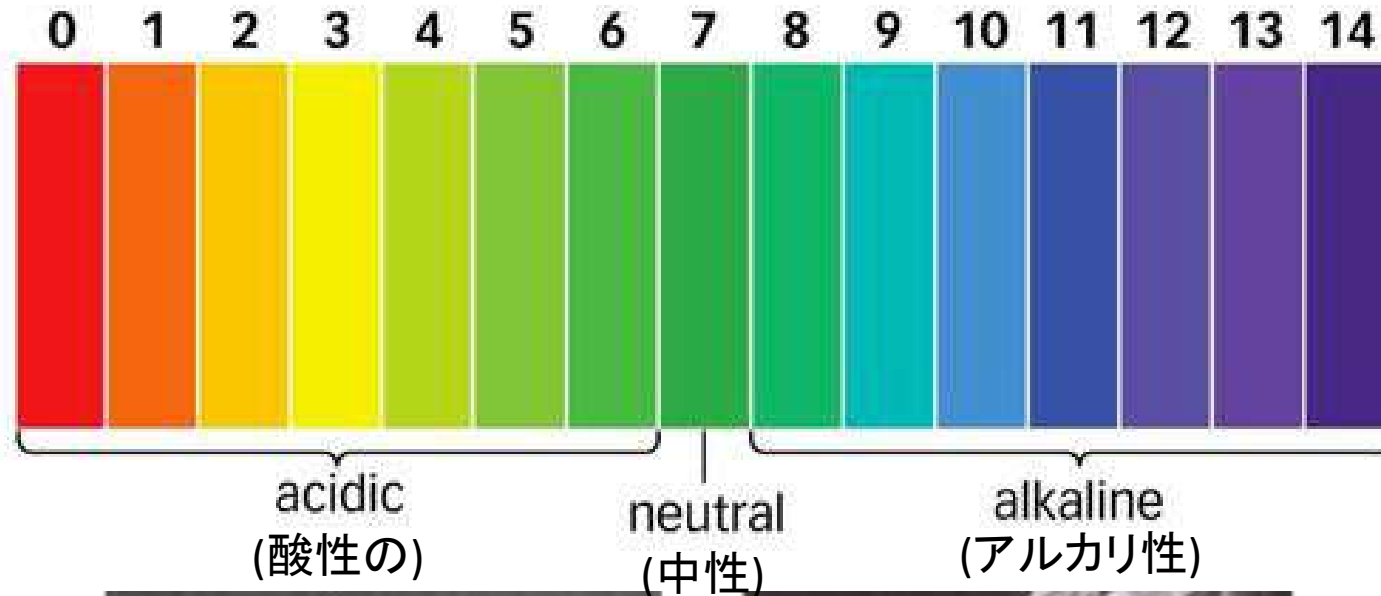
Cocamidopropyl betaine

Formulation



NG shampoo

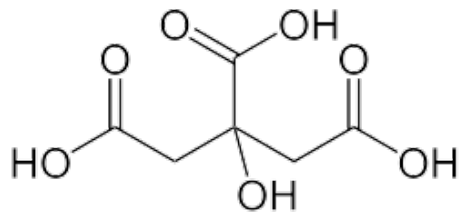
The importance of pH



*Dias et al, Int J Trichology. 2014 Jul-Sep; 6(3): 95–99.

Balancing pH

- Surfactants alkaline (pH 7-9)
- Bring pH to skin/hair friendly level



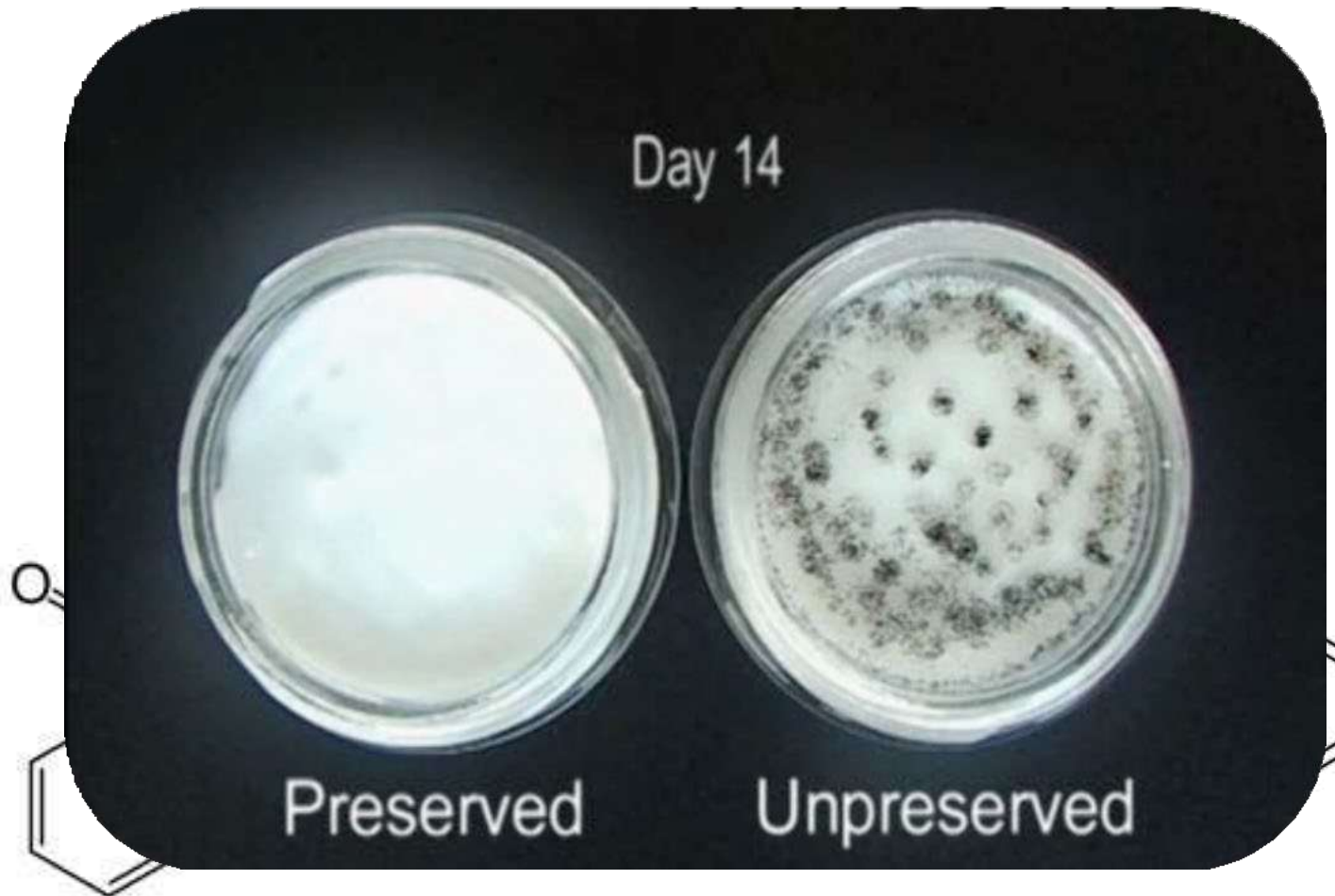
Citric acid



Citrus fruits

- Citric acid very commonly used pH adjuster
- Also helps maintain pH/preservative

Preservative



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

Appearance



Smell (香り)

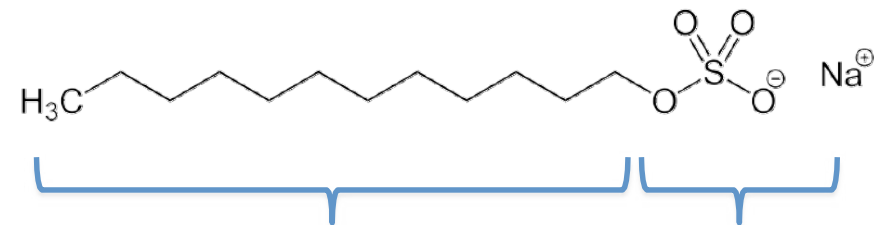
Color (色)



Thick/luxurious
(厚いです/豪華な)

Pearl finish
(真珠)

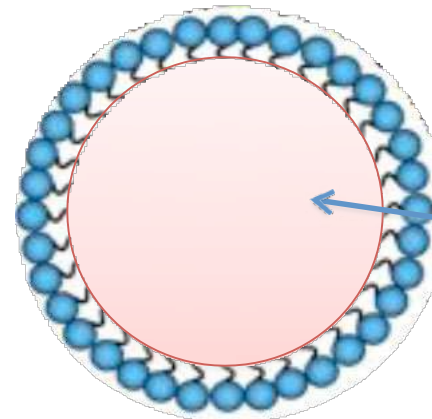
Thickener



Hates water

Likes water

In water



Shielded from water

Micelle (ミセル)

Thickener



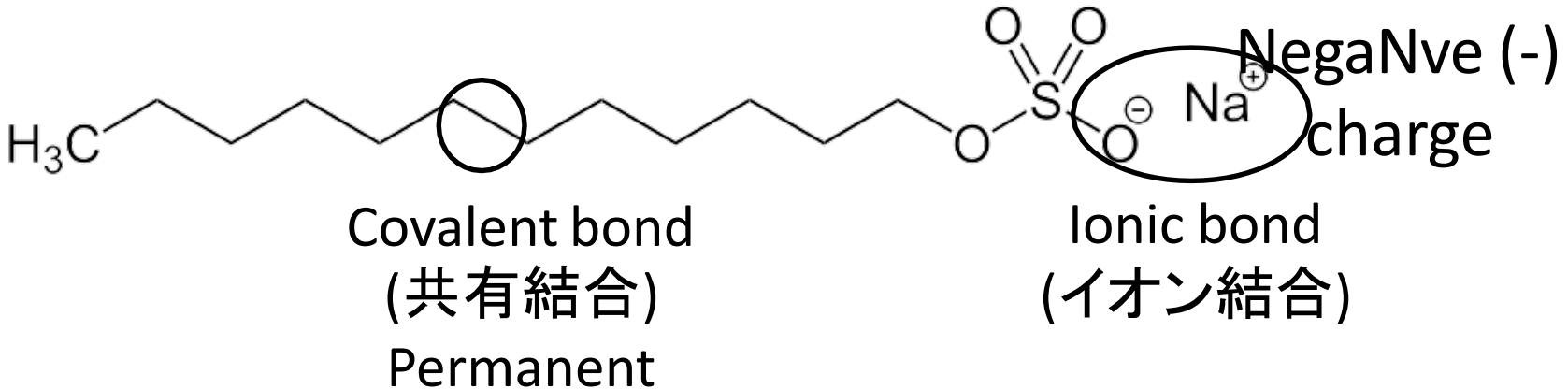
Don't like you



Same charge

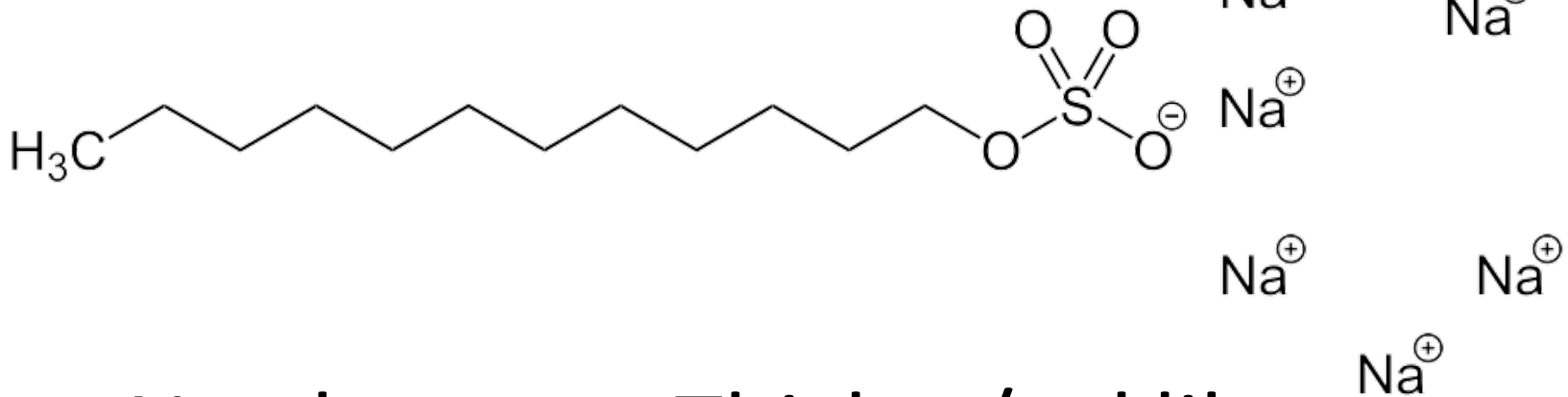
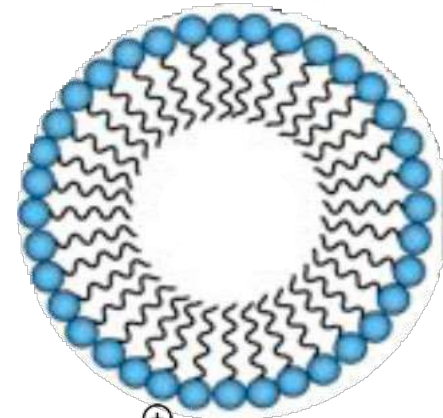


Don't like you



Thickener

+ NaCl (塩)



No charge -> Thicker/gel like

http://www.idc-online.com/technical_references/pdfs/chemical_engineering/The_Hydrophobic_Effect.pdf p3 (picture of micelle)

The Pearl effect

TOP SECRET

and

effect

Color and smell

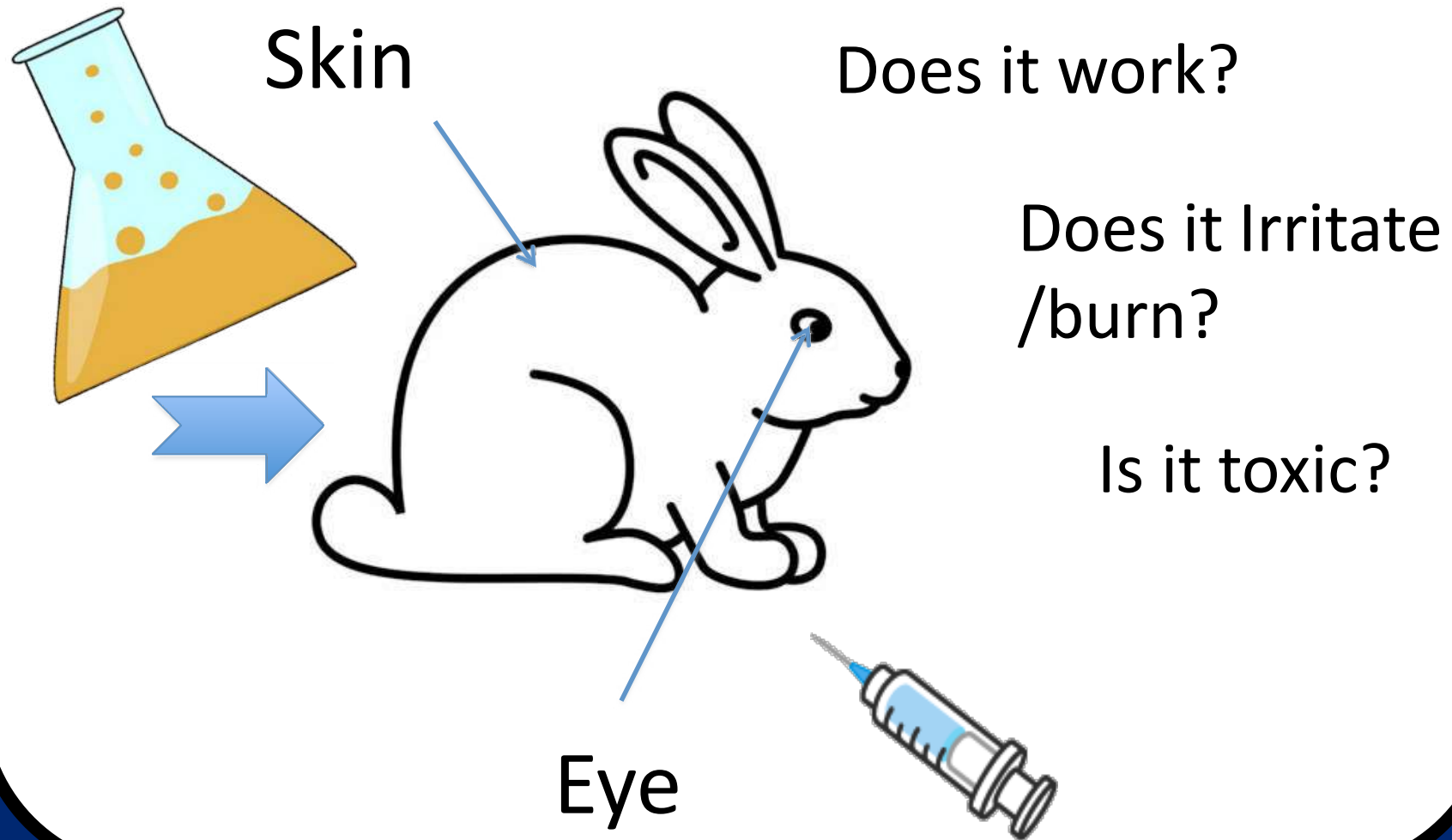
**'TOP
SECRET'**

Final product?



Safe/Effective?

Animal Testing

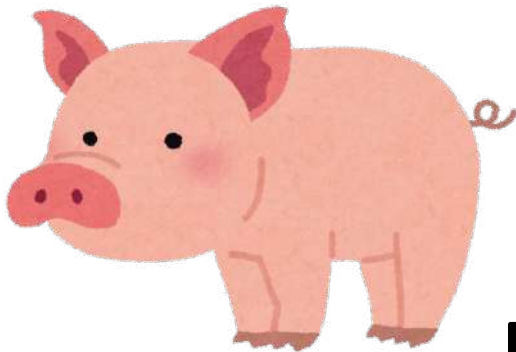
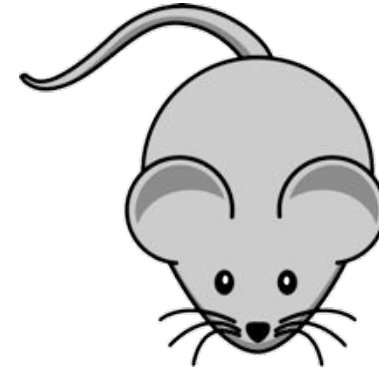
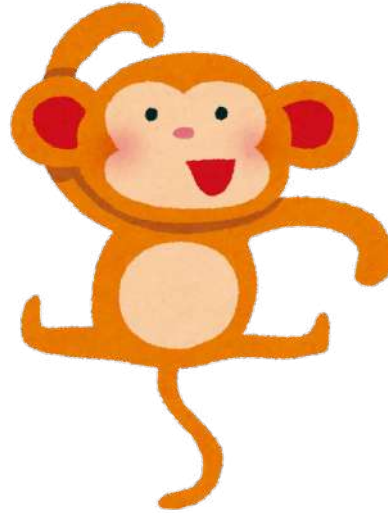
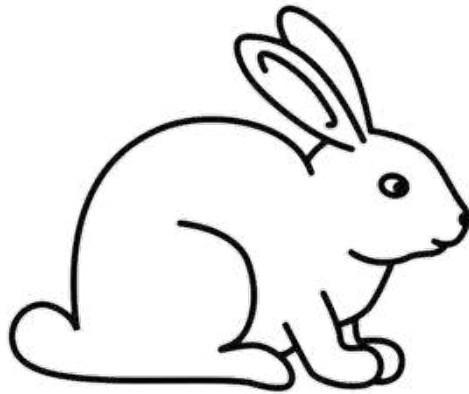


https://img.clipartfest.com/345ff73d7e71dc5e7a9aacdc1bb00f5e_for-kids-loring-clipart-rabbit-black-and-white-clipart_1024-768.jpeg

<http://cliparts.co/clipart/2586866>

<http://www.fancyparts.com/fancyparts/oyakusoku.html>

Animal Testing



- 1 product tested in many different animals
 - Animals live only for P.S. Come study in the UK!
- t h i s

https://img.clipartfest.com/345ff73d7e71dc5e7a9aacdc1bb00f5e_for-kids-loring-clipart-rabbit-black-and-white-clipart_1024-768.jpeg

http://4.bp.blogspot.com/-7PNxLAJCI24/VnzMBKF5MfI/AAAAAAAAA2Kw/jnP0Jr2aWB8/s800/eto_remake_saru.png

<http://free-illustrations.gatag.net/tag/鼠-ネズミ/page/2>

http://1.bp.blogspot.com/-41u0_S90Ppg/U8XkAkPE-gl/AAAAAAAAAipE/hIYV_yYlwKA/s800/animal_pig_buta.png

Reaction!

*Allergic reaction to hair dye

Reaction!

Animal Testing

Highly Controversial

- Animals can be:
 - Blinded (盲検化)
 - Poisoned (毒入りの)
 - Scarred (瘢痕)
- Animals are killed after experiments (No reuse)
- Considered unnecessary and inhumane
- Banned in many countries

Discussion

- What alternatives can you think of to animal testing?



Safe?

Animal testing

FANCL



Ingredients
declared safe in
the past (Animal
tested) <no new
testing>

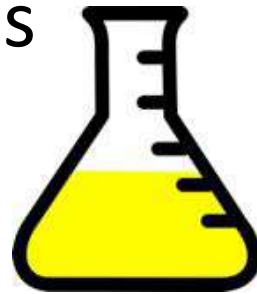
Use alternative
testing systems

Alternatives



Alternatives

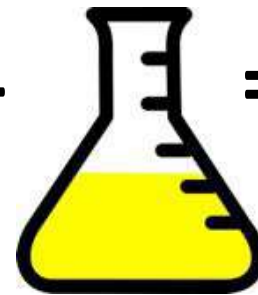
Computer simulations



1% OK 2% NG



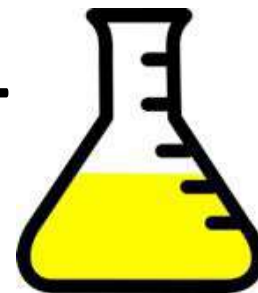
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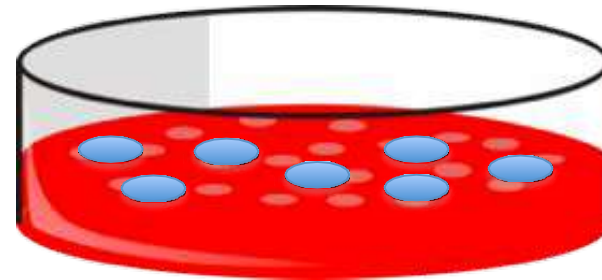
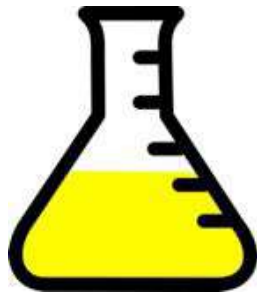
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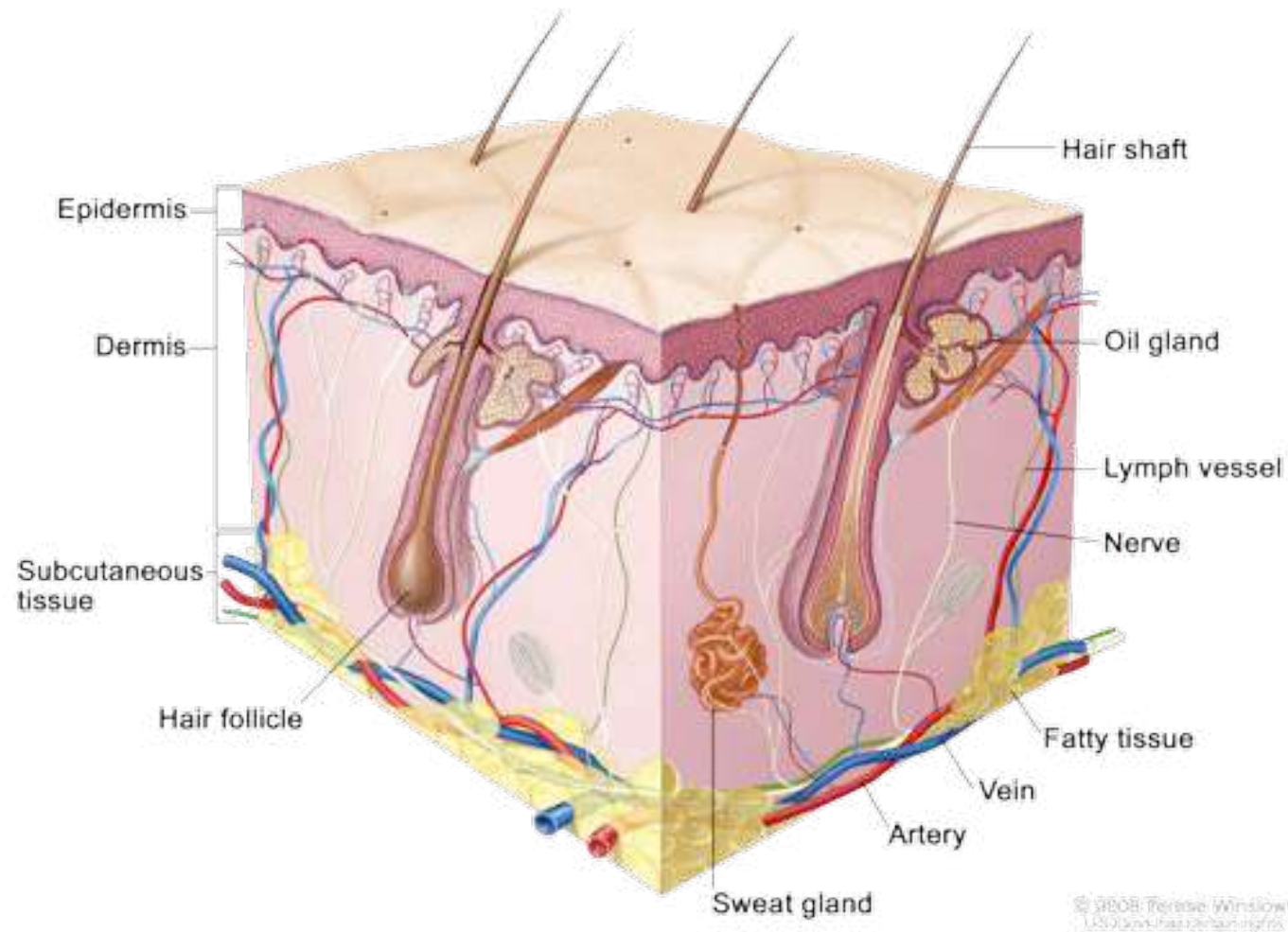
Alternatives

In vitro cell culture

- Cells grown on dish (1 layer)
- Add
- Check for reacNon



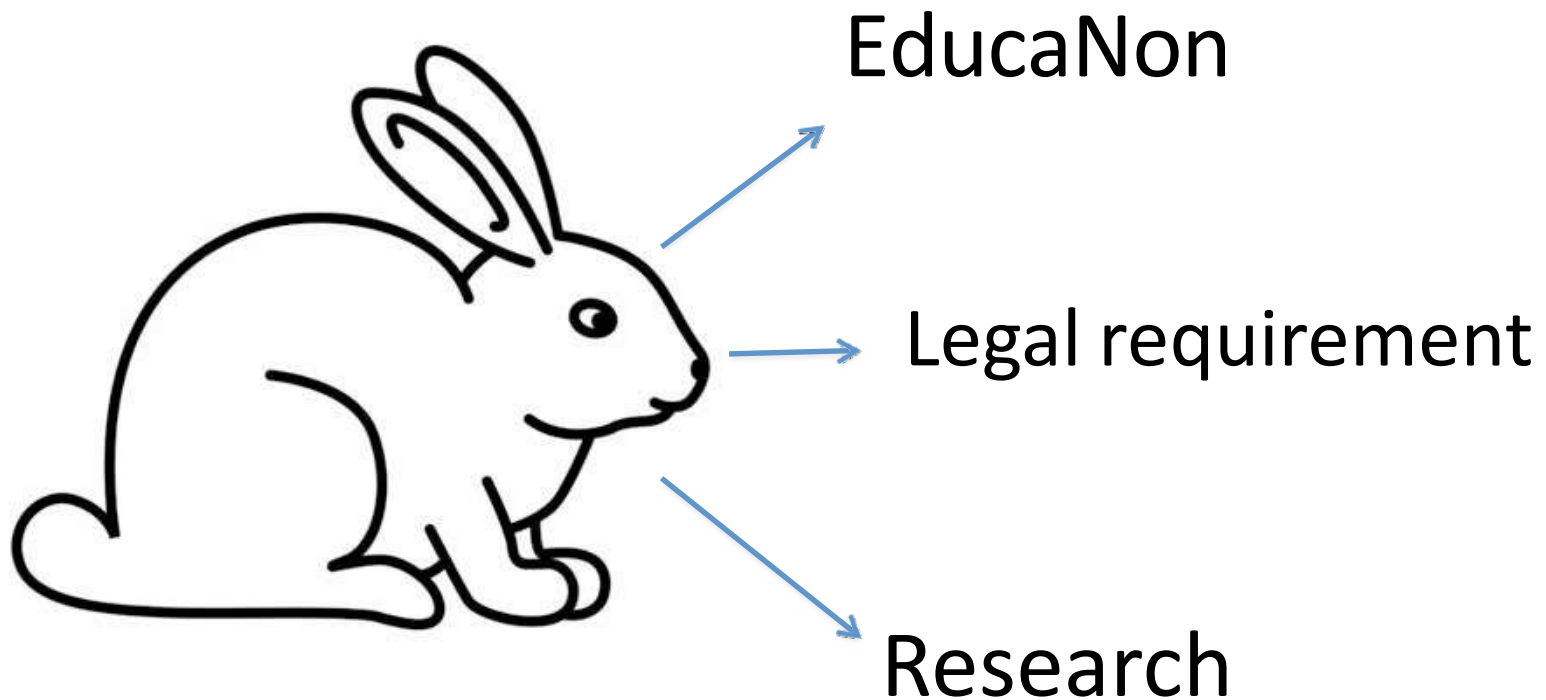
Alternatives



Alternatives

- 3D Skin models
 - Skinethic
 - Episkin
- Lab made cell layers that represent skin.
- Normal, oily, Eczema
- Approved by EU

No more?



The end?



- Research and creaNon takes 2-4 years
- Market research
- Human trials
- AdverNsing
- Into shops!

Question

Do we need shampoo?

The End

Thanks for listening!