Novel Cosmetic Surfactant Systems

Cosmetic Formulation

Perry Romanowski
Element 44 Inc.
May 3, 2015

Novel Cosmetic Surfactant Systems

Cosmetic Formulation

Perry Romanowski
Element 44 Inc.
May 3, 2015

Perry Romanowski

- Element 44 Inc.
- Brains Publishing Inc.
- Cosmetic Chemist
  - Formulator
  - Inventor
- Writer
- Instructor
- Professional Blogger

The BeautyBrains

Real Scientists Answer Your Beauty Questions

FEATURED

Why Teens Don't Need Wrinkle Creams

by LEFT BRAIN on June 26, 2011 · 3 Comments

Cathy's question...My face is really gross at the moment. My cheeks are flaming with weird red blotchy bumps that I can't seem to get rid of! It's not acne! I've been using Guinot anti-redness treatment but it doesn't seem like its working these bumps are really worrying me. Also I have some small faint delicate multi-wrinkles up there are there any wrinkle cream suitable for 16 years old? I don't want to be 60 and none of the wrinkle creams would work on me cause when I was little I was so accustomed to heavy creams.

The Left Brain Replies:

Cathy, I don't know what's causing your blotchy skin bumps, but it sounds like you should see a dermatologist. As far as wrinkles are concerned, I wouldn't be

http://thebeautybrains.com

CHEMISTS CORNER
The Cosmetic Chemist's Resource Site

7 Non Formulating Skills Every Cosmetic Chemist Needs to Develop

by PERRY ROMANOWSKI [EDIT]

If you want to succeed in the world of cosmetic science, it typically requires more than knowing raw materials and being a brilliant formulator. Success in any company will require general knowledge of business and people skills. Here are some of the most useful skills to develop.

1. Getting along with all people

As far as career success goes there is nothing more important than learning how to deal with other people. In truth, the people who succeed best at a job (even cosmetic formulating) are the ones who know how to get along with as many different people as possible. This means you do everything in your power not to make enemies with anyone at your company. There will be plenty of people that you may not like but never let that be known. The better you get along with people, the more likely you will be to succeed at your job. This is not the kind of thing you learn in science classes but it is a lesson that everyone should learn.

Cosmetic Science Forum

From The Cosmetic Chemist' Resource Site

All Discussions | My Bookmarks 9 | My Discussions 92

Start a New Discussion

Welcome to the Forum
Announcement 70 comments Most recent by PerryR October 2 General

How to use the forum
Announcement 2 comments Most recent by PerryR May 3 General

Supposedly "better" emulsions
2 comments Most recent by PerryR 8:00AM Cosmetic Industry

What paraben-free and formaldehide releaser-free conservative to use?
3 comments Most recent by Duncan 3:24AM Skin Care products

Substitution of SLES and SLS
10 comments Most recent by Duncan 3:16AM Cosmetic Science talk

Tanning beds increase melanoma in young women
3 comments Most recent by Duncan 3:07AM Cosmetic Industry

Water based hair/scalp tonic - still need an emulsifier
3 comments Most recent by dess October 11 Hair Care products

Formulate Differently
4 comments Most recent by Eliza October 11 Innovation

Natural? Organic? Weigh-in please.
3 comments Most recent by Eliza October 11 Cosmetic Science talk

Natural/Organic Preservative for toothpaste
5 comments Most recent by Yulya October 10 Cosmetic Science talk

Material/Actives for Formulators
1 comment Started by FormulatorSamples October 10 Skin Care products

Categories

All Discussions	313
Career	15
Cosmetic Industry	44
Chemists Corner Podcast	8
Cosmetic Science talk	71
General	42
Hair Care products	24
Innovation	9
Makeup products	11
Member-to-Member Joint Ventures	2
Questions for Mentors	26
Resources	24
Skin Care products	37

Bookmarked Discussions

Water based hair/scalp tonic - still need an emulsifier
3 October 11 dess

Testing of handmade soaps, anhydrous products and products containing more than 35% ethanol

PRACTICAL COSMETIC FORMULATING

Modules

Course Description

Practical Cosmetic Formulation is designed to introduce the student to the principles of cosmetic science and formulation, including: understanding cosmetic form and function, the basics of cosmetic chemistry, cosmetic terminology and techniques, the product development process, formulation of specific cosmetics, an understanding of raw materials and their use, cosmetic product testing, product scale-up and government regulations affecting cosmetics and the consumer.

Course Frequency

New lessons will be published every other week. A Q&A session will be held monthly.

Modules

If you want to get up to speed on the basic Math, Biology, and Chemistry you will need to

Free Bonuses

If you want to download your free bonuses, just click here.

NAVIGATION

Resources
Pre-lessons
Career
Forum

http://chemistscorner.com/members

Contact

Vice President Brains Publishing Inc.

Email: Perry.Romanowski@gmail.com

LinkedIn: PerryRomanowski

Phone: 708-207-7642

Twitter: @chemistscorner

Facebook

Objectives

- Learn about cosmetic technologies
- Understand the raw materials used
- Learn the different formulation forms
- Cover specific formulations
  - Cleaning products
  - Moisturizing products

Agenda

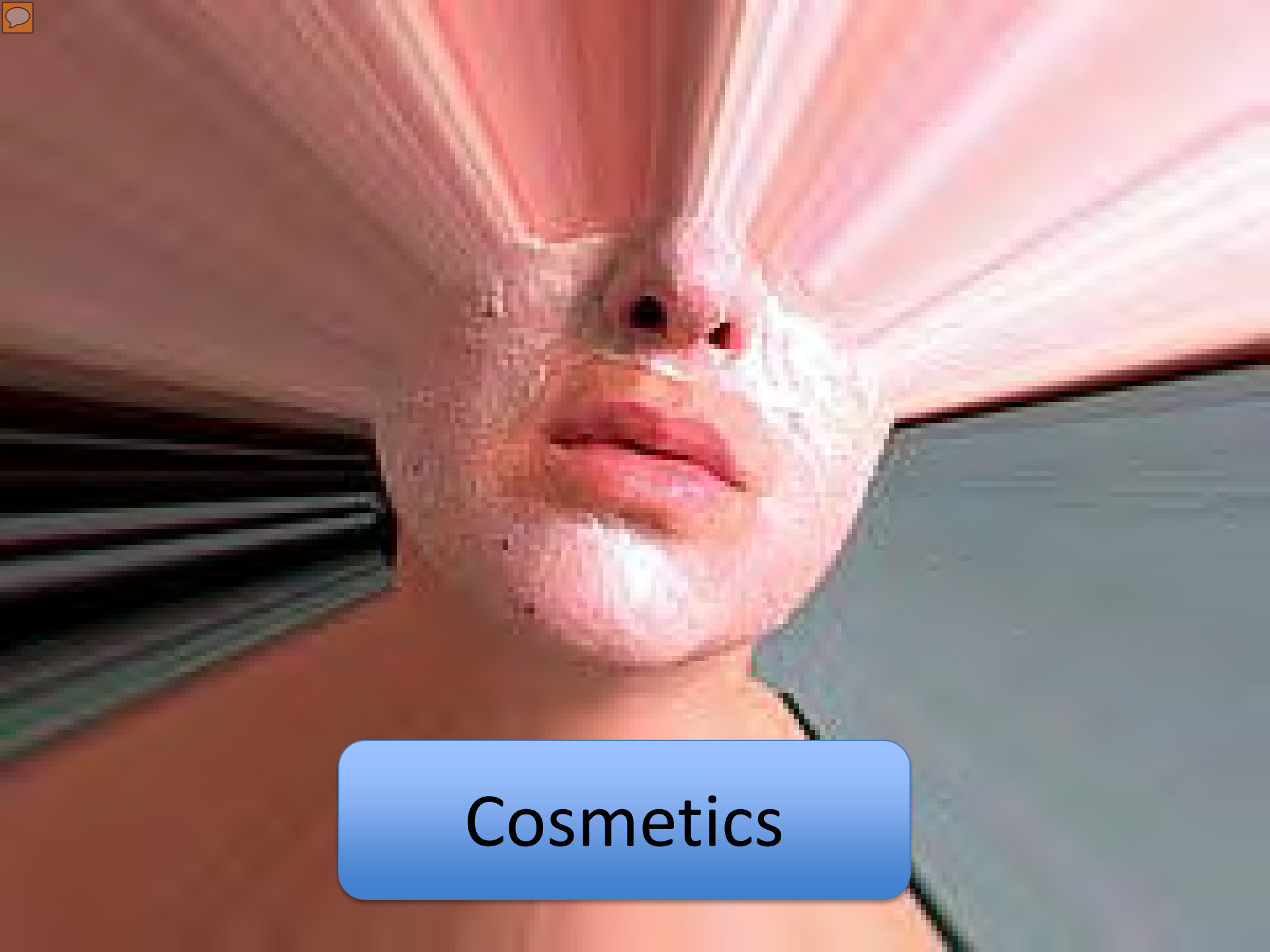
- 9:00 – 9:30 Introduction to cosmetics
- 9:30 – 10:30 Cosmetic ingredients
- 10:30 – 10:45 Break
- 10:45 – 11:45 Cosmetic formulations
- 11:45 – 12:30 Formulation process

My mission

Educate

Inspire

Entertain

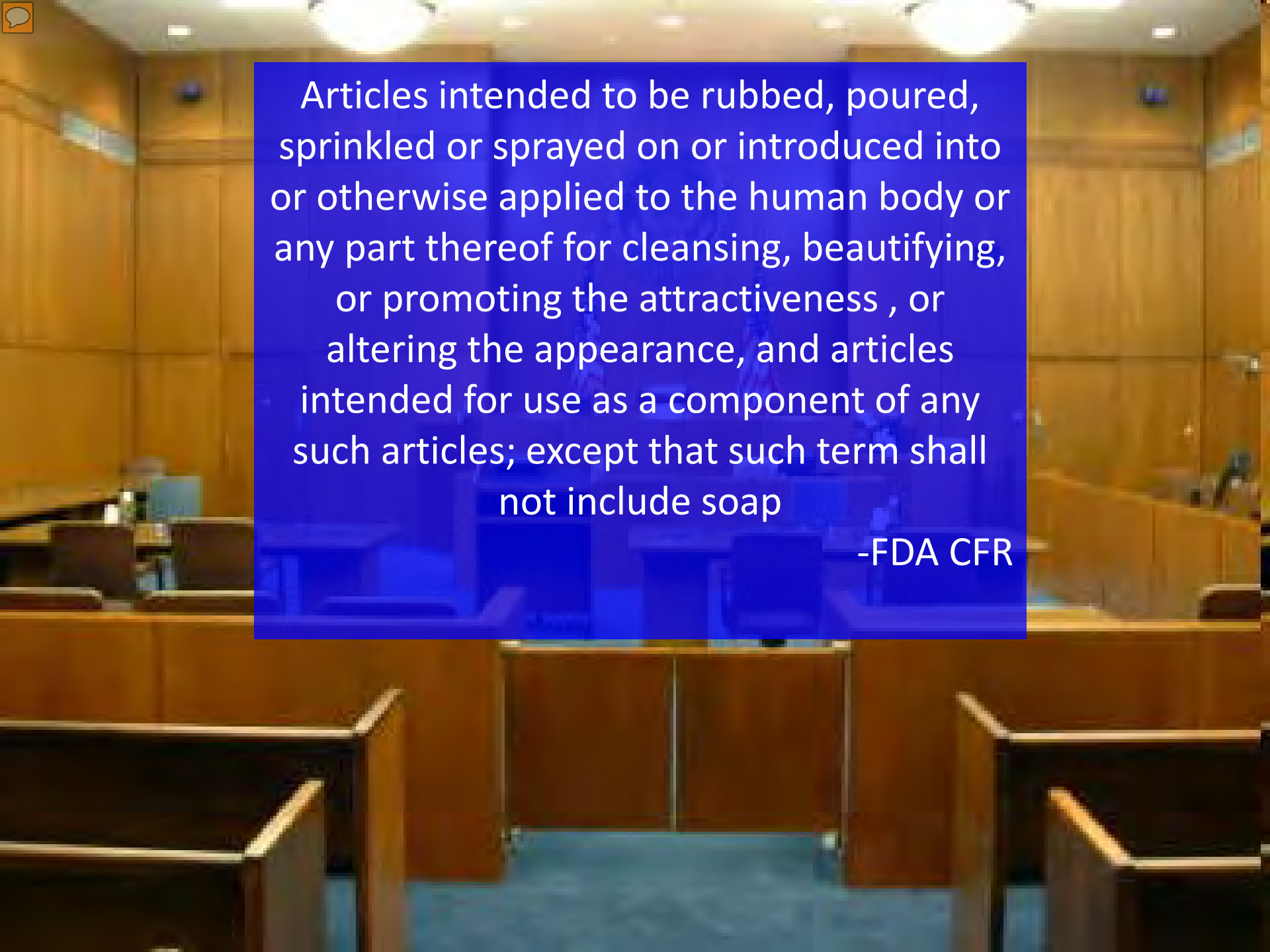

Cosmetics

Purposes of Cosmetics

- Improve your…

- Appearence
- Skin Feel
- Odor


What are
Cosmetics?


Articles intended to be rubbed, poured, sprinkled or sprayed on or introduced into or otherwise applied to the human body or any part thereof for cleansing, beautifying, or promoting the attractiveness , or altering the appearance, and articles intended for use as a component of any such articles; except that such term shall not include soap
-FDA CFR

Color Cosmetics

Hair Products


Skin
Products

Perfume & Fragrances


Oral care
Products

Cosmetics aren’t drugs

- Drugs = Treat disease

- Cosmetics = Improve appearance

  Can't interfere with metabolism

www.fda.gov/Cosmetics/default.htm

U.S. Department of Health & Human Services

a A A

U.S. Food and Drug Administration

Protecting and Promoting *Your* Health

A to Z Index | Follow FDA | FDA Voice Blog

SEARCH

Most Popular Searches

Home | Food | Drugs | Medical Devices | Radiation-Emitting Products | Vaccines, Blood & Biologics | Animal & Veterinary | Cosmetics | Tobacco Products

Cosmetics

Home > Cosmetics

Temporary Tattoos May Put You at Risk
Think they're just harmless fun? Think again.

1 2 3

Spotlight

- Cosmetics Q&A
- Voluntary Cosmetic Registration Program (VCRP)
- Color Additives and Cosmetics
- Cosmetic Labeling Manual
- Imports & Exports

Recalls & Alerts

- Cosmetics Warning Letters
- FDA Recall Policy for Cosmetics

Top Picks

- Preparation for International

Navigate the Cosmetics Section

Cosmetic Labeling & Label Claims
What cosmetic labels can say and what they must say; what label claims mean

Guidance, Compliance & Regulatory Information
Resources on legal, regulatory, enforcement, and policy issues related to cosmetics

International Activities

News & Events
What's new, meetings & workshops

Product and Ingredient Safety
Information on cosmetic products, ingredients, testing, recall policy, and more

Resources for You
At-a-glance menus for consumers, industry, and more

http://www.fda.gov/Cosmetics

Personal Care Products Council

International Regulatory bodies

- European Commission
- Health Canada
- Ministry of Health (Japan)
- Department of Health & Ageing (Australia)
- CFDA - China

General Problems addressed by cosmetics

- Appearance
- Feel
- Smell

Top 10 skin problems

1. Dry itchy skin
2. Wrinkles
3. Acne
4. Sagging Skin
5. Age spots
6. Skin lightening
7. Tattoo removal
8. Eczema / Dermatitis
9. Psoriasis
10. Cellulite

Top 10 hair problems

1. Hair Loss
2. Unwanted Hair
3. Gray Hair
4. Hair color change
5. Hair feels bad
6. Frizzy, unruly hair
7. Thinning hair
8. Lack of volume
9. Shine
10. Time needed to style

Strategies for Improving Appearance

- Remove dirt from surface
  - Cleansing products
- Change the surface
  - Exfoliating products
- Leave color behind
  - Make-up
- Change color of surface
  - Self tanning products

Strategies for Improving Feel

- Materials that make skin & hair feel better
  - Oils and emollients
- Water attracting compounds
  - Moisturizers
- Conditioning products
  - Film forming material

Strategies for Improving Odor

- Clean odor materials off body
- Cover odors with fragrance
- Kill microbes that cause odor

Lots of interest in Natural Formulating


Greenwashing

Natural has no legal definition

Natural Standards Groups

Major US Natural Standards Groups

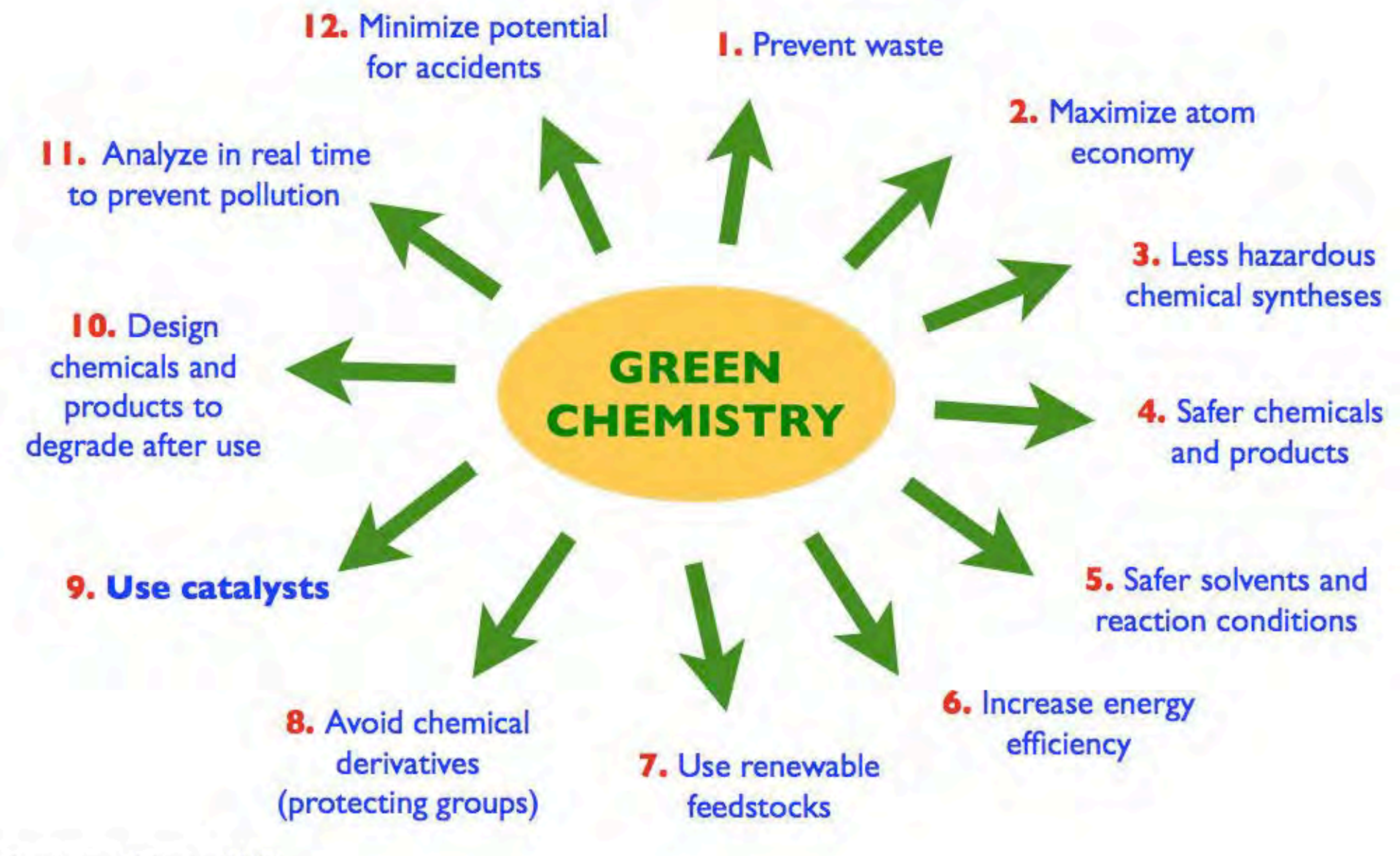
- USDA
- National Sanitation Foundation
- National Product Association
- OASIS

International Natural Standards

COSMOS Standards

- Promote organic agriculture
- Use natural resources
- Clean processing and manufacture
- “Precautionary Principle”
- Integrate Green Chemistry principles

Principles of Green Chemistry



Anastas and Warner (1998)

Basic Definition of Natural

- Not Synthetically Derived or Synthetically processed
- If it's not from a plant, it's not natural
- USDA definition
- Other standards are not as strict

Common Standards

- Water is natural
- Mineral ingredients are natural
- Physically processed agro-materials are natural
- Some chemical processing of agro materials
- Some synthetics allowed

Some Prohibited Ingredients

- Parabens
- Formaldehyde Donors
- Petrolatum & petroleum derived
- Propylene glycols
- Sodium Lauryl Sulfate
- Ethanolamines
- Synthetic Silicones
- Synthetic Fragrances
- Synthetic Polymers
- EDTA

Some Chemistry Allowed

- Distillation
- Esterification & Etherification
- Expression
- Extraction
- Fat Splitting
- Fermentation
- Hydrogenation
- Protein Hydrolysis
- Saponification
- Sulfation – (no SLS)

Cosmetic Science Quiz

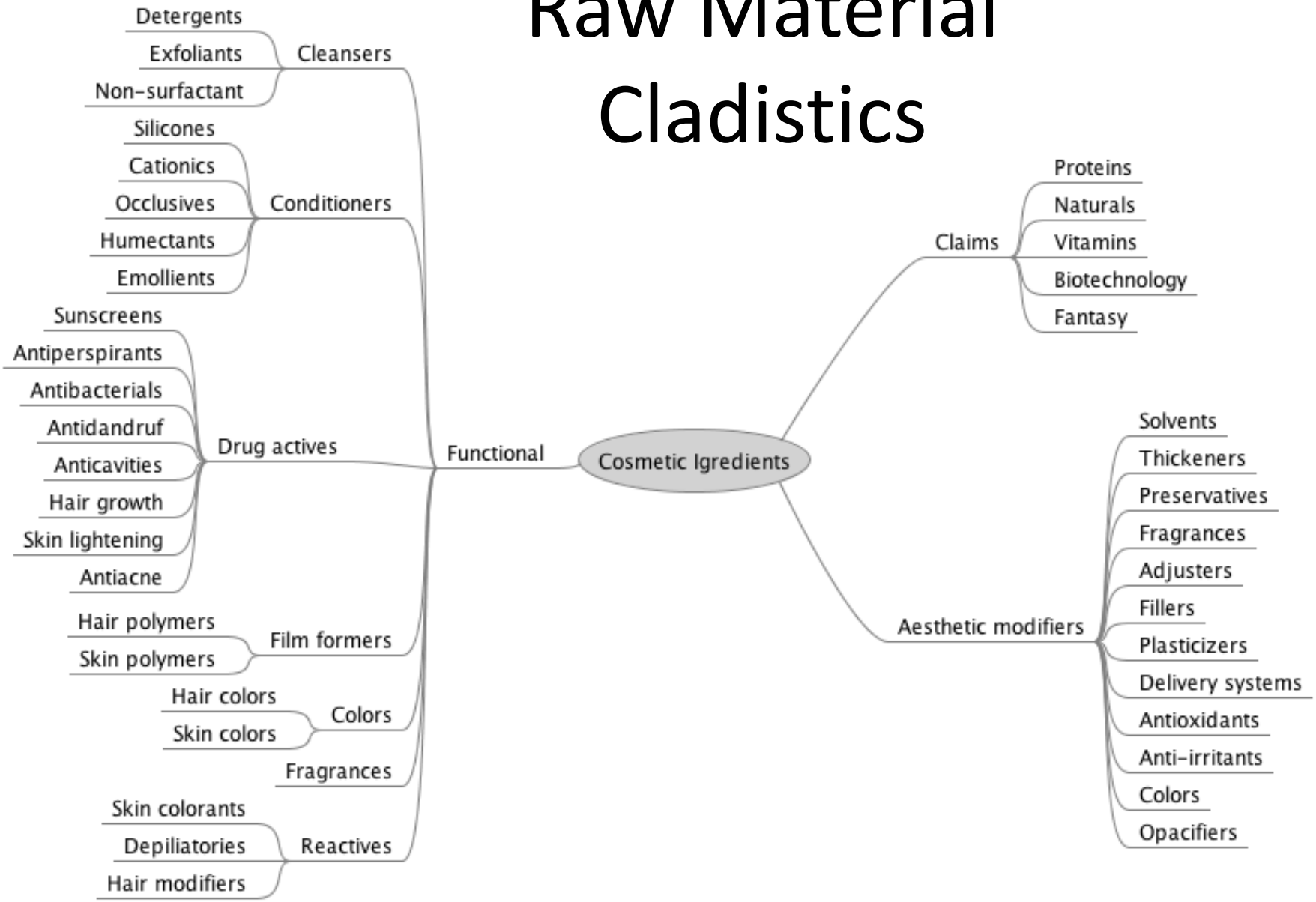
- Which ingredient is not in the top 10 most vilified cosmetic ingredients?
  - 1. Methyl Paraben
  - 2. Mineral Oil
  - 3. Titanium Dioxide
  - 4. Sodium Laureth Sulfate

Most Vilified Ingredients on the Internet

Sulfates – SLS / SLES
Parabens
Talc
Petrolatum
Mineral Oil
Propylene Glycol
DEA
Formaldehyde
Aluminum
Fragrance

Cosmetic Raw Materials

Raw Material Cladistics



Cosmetic Raw Materials

- Functional – Provide the product benefit
- Aesthetic – Improve the aesthetics of the functional ingredients
- Claims – Included to help sell the product

Functional Raw Materials

- Ingredients that make cosmetics work

- Cleansers
- Conditioners
- Film formers
- Drug actives
- Reactants
- Colorants
- Fragrances

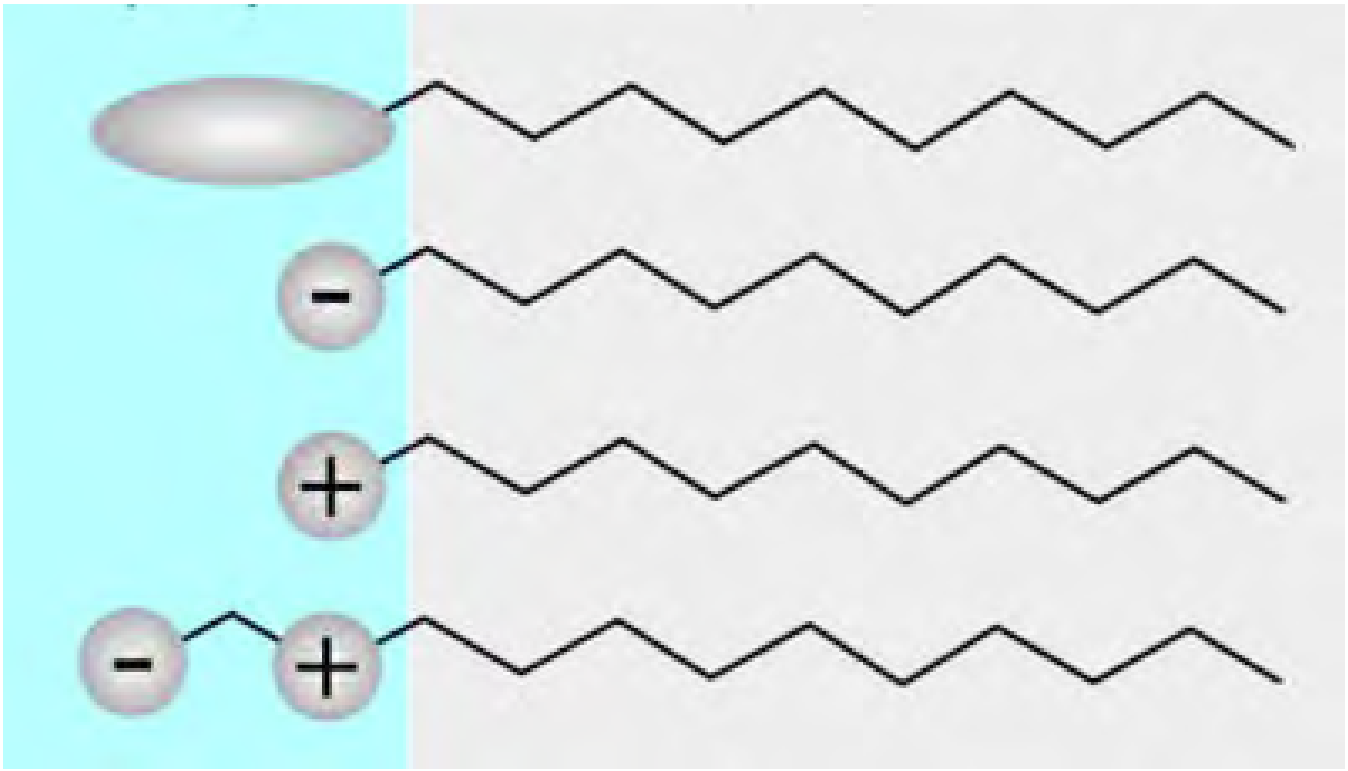
Cleansers

- Ingredients that remove surface dirt / oil
- Some oil based cleansers
- Surfactants

Surfactants

Hydrophillic

Lipophillic

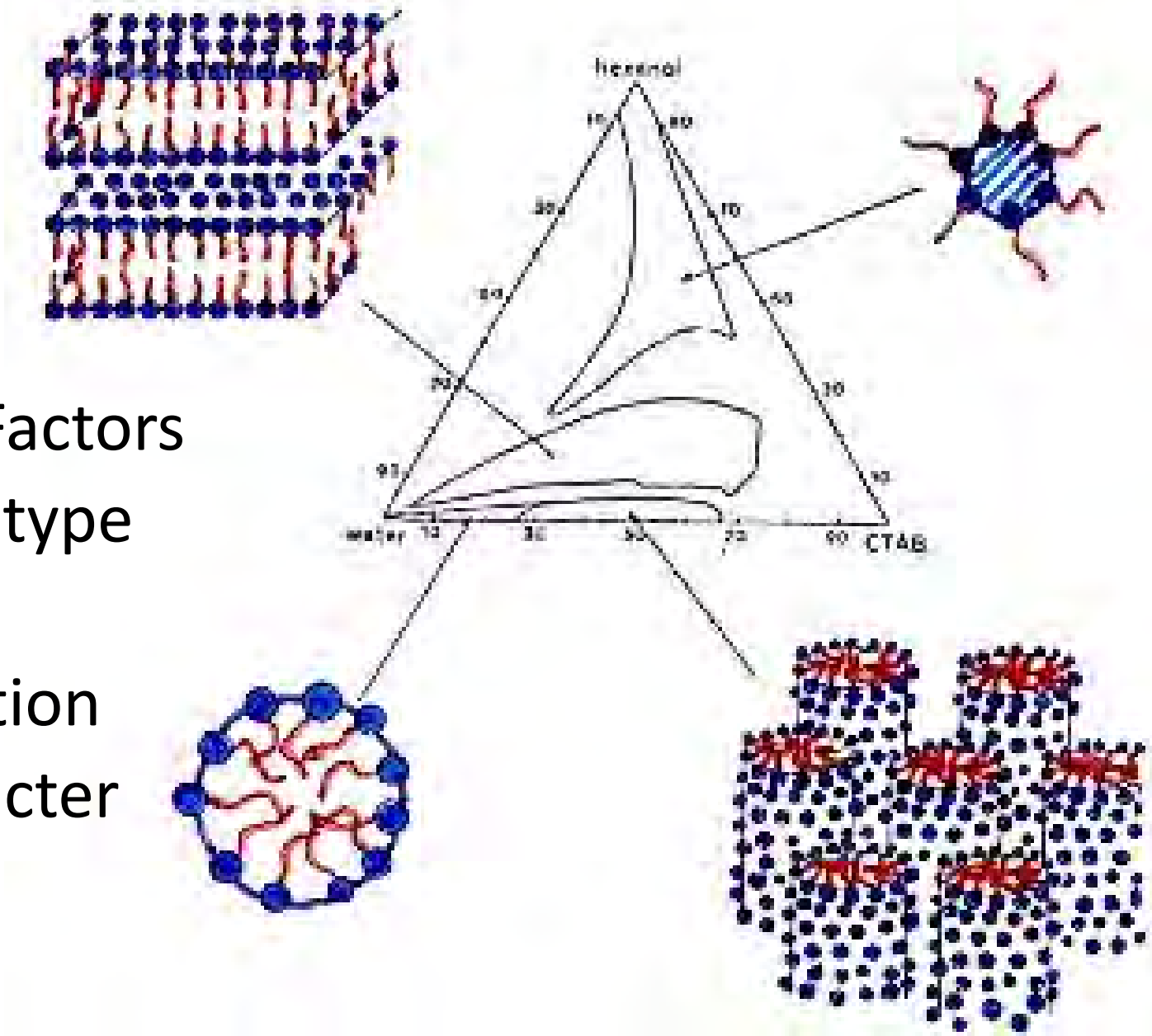


Compatible With Water

Compatible With Oil

Surfactant Structures

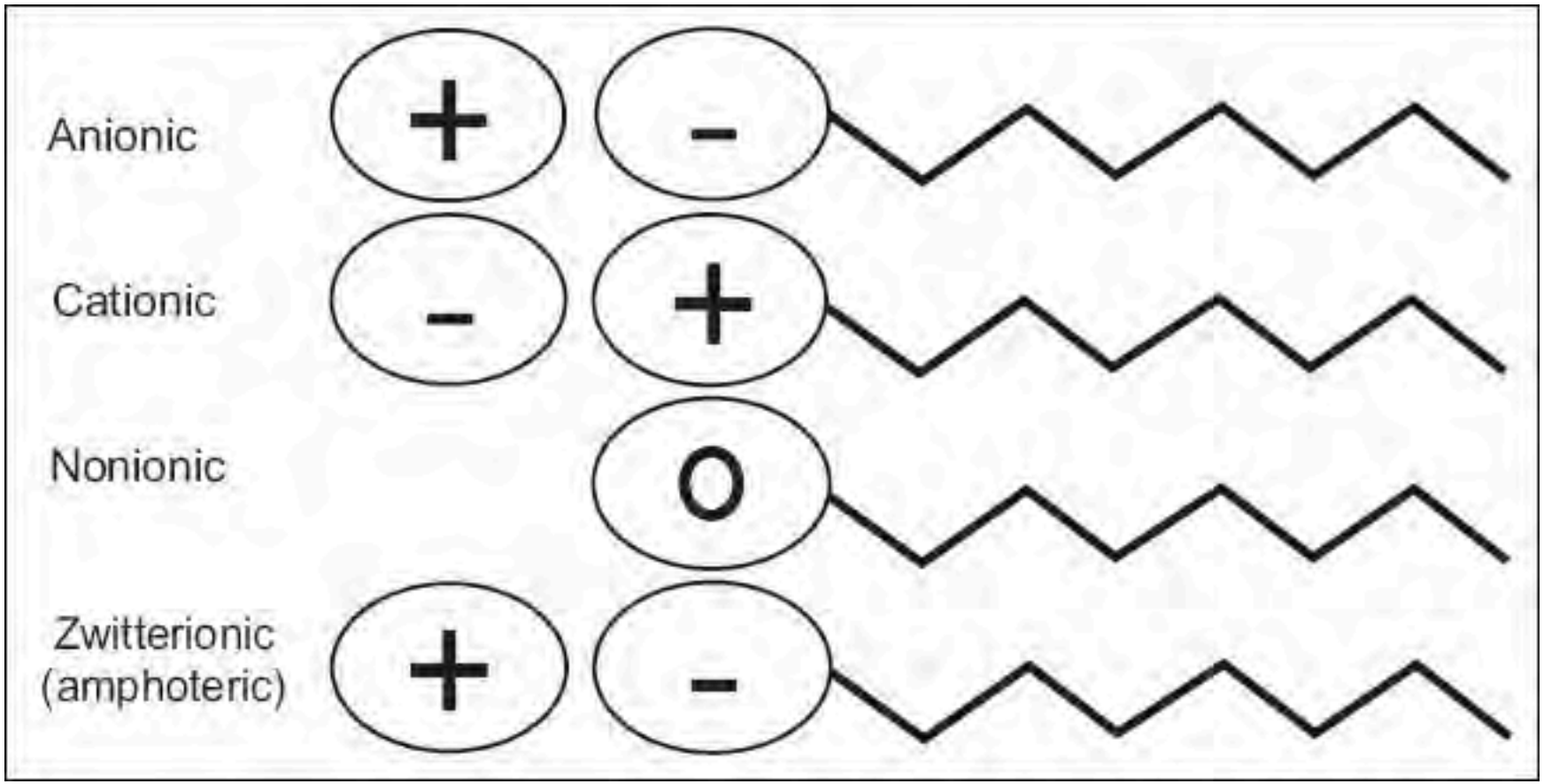
- Structure Factors
- Surfactant type
- Oil type
- Concentration
- Ionic character



Surfactant Functions

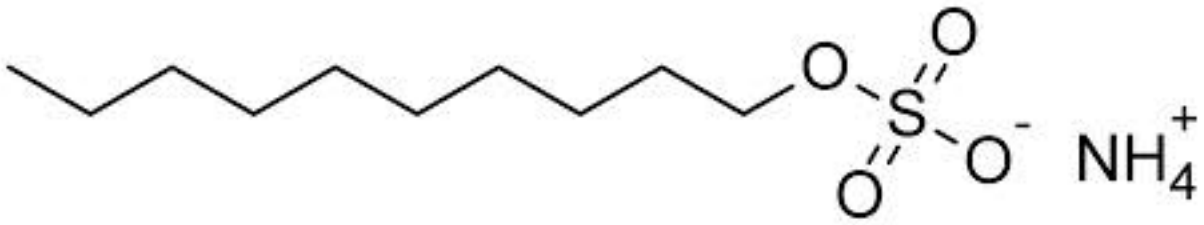
- Cosmetic Benefits
  - Cleaning / Detergency
  - Conditioning
  - Foaming
- Aesthetic benefits
  - Emulsification
  - Wetting / Dispersing
  - Thickening
  - Penetration enhancement
  - Antimicrobial activity
  - Opacification

Types of Surfactants



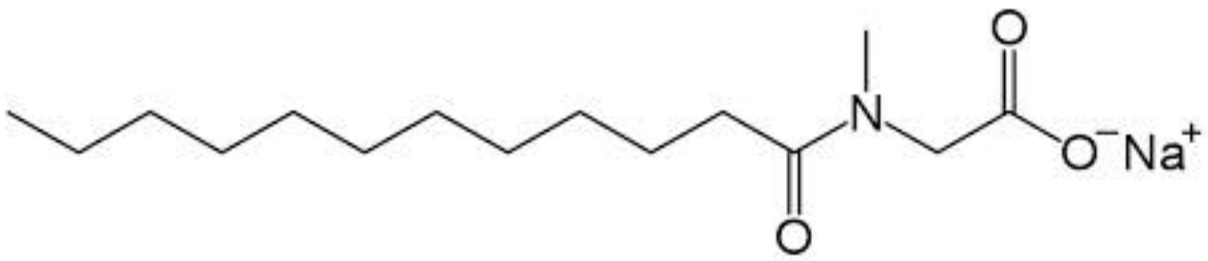
Anionic Surfactants

- These are the primary cleansing surfactants
- Alkyl Sulfates
  - Examples – SLS and ALS
- Alkyl Ether Sulfates - Ethoxylated
  - Example – SLES and ALES



Anionic Surfactants

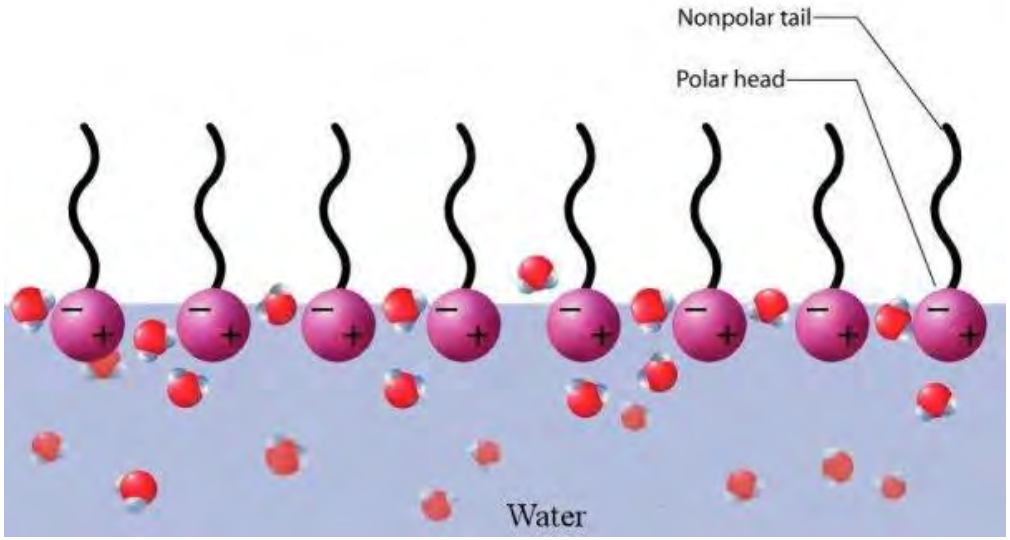
- Other types
  - Sulfosuccinates
  - Alkylbenzene Sulfonates
  - Acyl Methyltaurates
  - Acyl Sarcosinates
  - Acyl Isethionates
  - Acyl Polypeptide Condensates
  - Monoglyceride Sulfates
  - Fatty Glyceryl Ether Sulfonates



Sodium Lauryl Sarcosinate

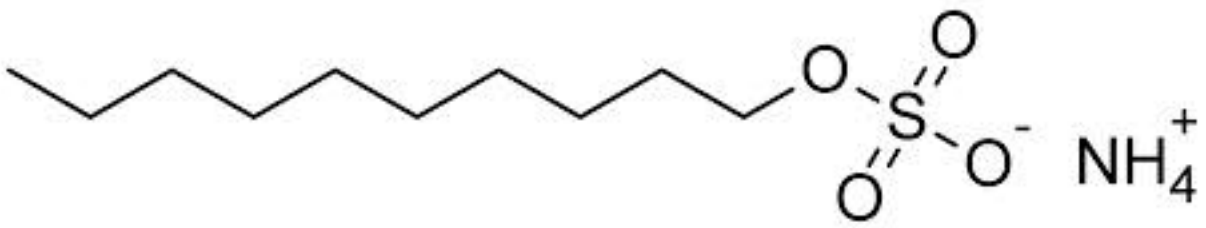
Anionics

- Why use them?
  - Excellent detergency
  - Relatively inexpensive
  - Good foaming
  - Highly stable
- Drawbacks
  - Can be irritating
  - Drying to hair



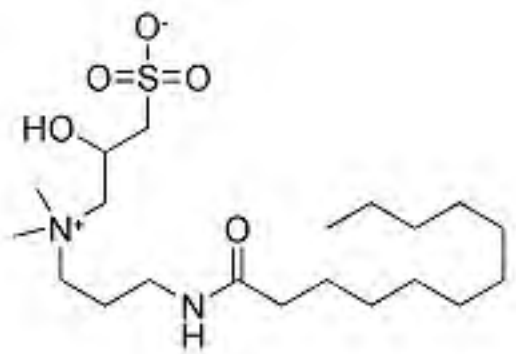
Sulfates and Naturals

- Unacceptable for cleansing surfactants for natural products
  - Sulfosuccinates
  - Sulfonates
  - Alkyl sulfates



What is used instead

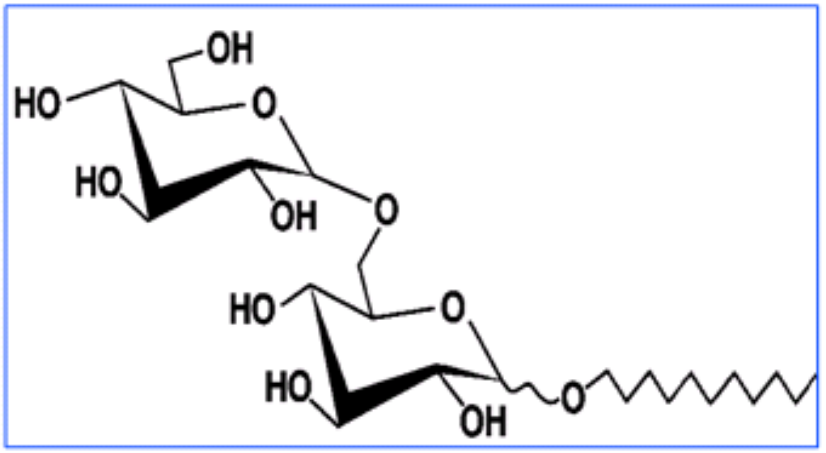
- Sultaines
  - Mild secondary surfactant, more stable and better viscosity builder
    - e.g. Cocamidopropyl Hydroxysultaine



- Acyl Sarcosinates
  - High foaming secondary surfactant
    - e.g. Sodium Lauryl Sarcosinate

Natural Surfactant Options

- Alkyl Polyglucoside
  - Natural primary surfactant derived from coconut and sugar
  - Does not build viscosity as well
  - Does not foam as well
  - Higher cost
  - e.g. Lauryl Glucoside



Saponin Glycosides

Parts of plants containing saponins are used as detergents.

For example;

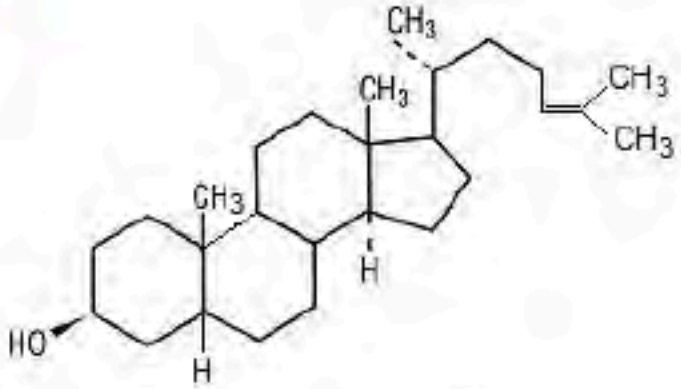
Root of Saponaria officinalis

Types:

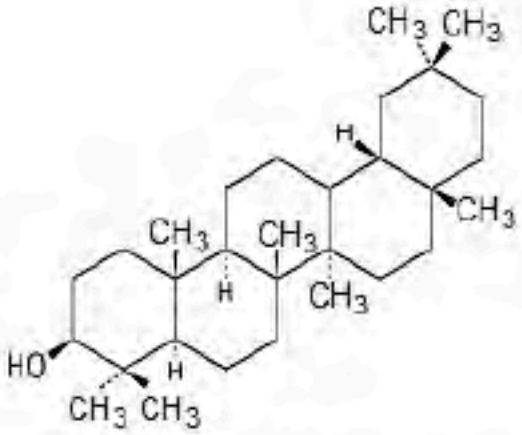
Aglycone may be of two types;

Steroidal

Tri terpenoidal



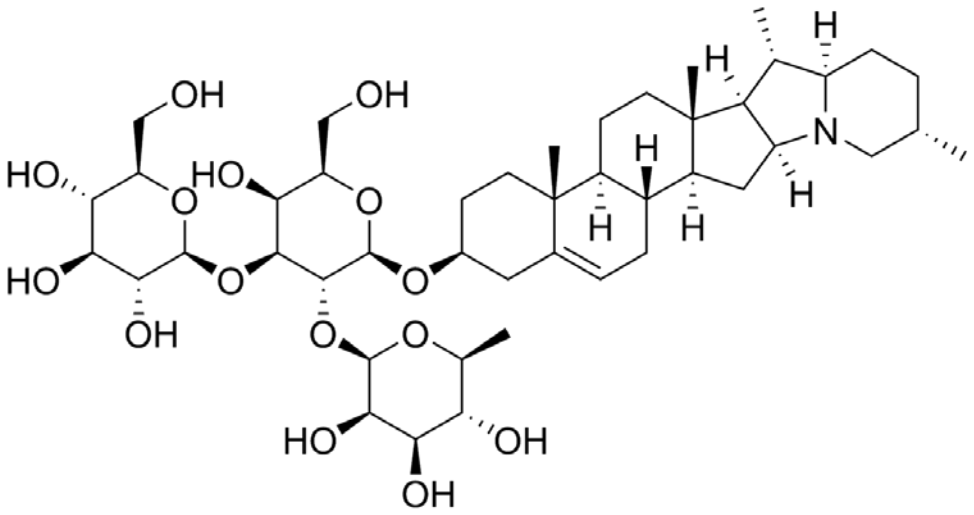
Steroidal skeleton



Tri-terpenoidal skeleton

Natural Cleansing Surfactants

- Saponins – Cleansing Surfactants
- Source: plants – marine derived
  - Quillaja saponaria Molina
- Difficult to purify
- Too expensive
- Not as effective
- ~40% less foam
- Highly colored

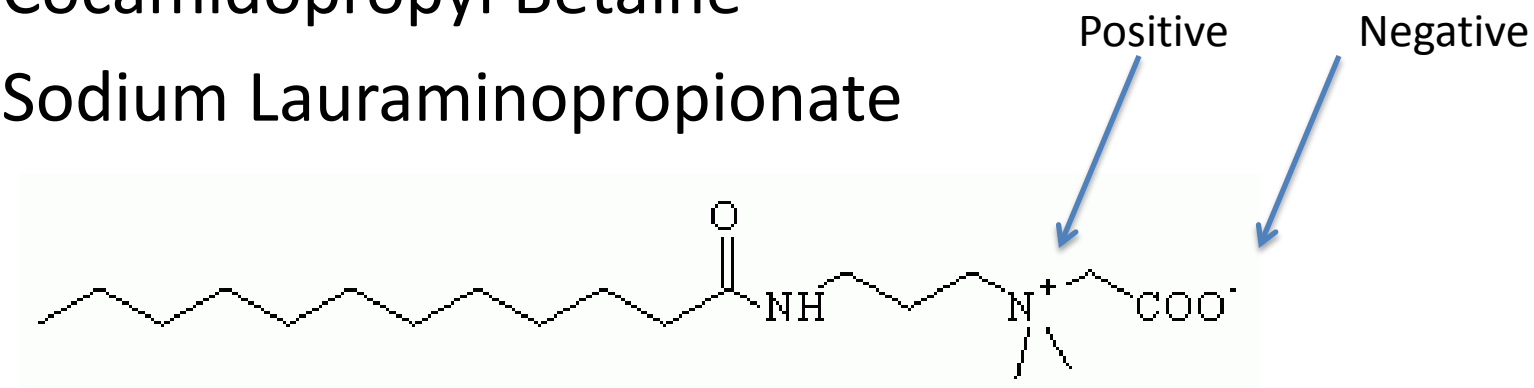


Commercially Available Saponins

- Bio-Saponins (Bio-Botanica)
  - mix of Sarsparilla, Wild Yam, Quillaja and Yucca extracts.
- Neo Actipone Soap Nutshell (Symrise)
  - Soap Nut tree (*Sapindus Mukurossi*) extract.
- Andean QD Ultra & Ultra Organic (Desert King)
  - Chilean soap bark tree (*Quillaja Saponaria Molina*) extract.

Amphoteric Surfactants

- Can have a positive or negative charge depending on the pH of the solution
    - Zwitterionic
- Types
  - Cocamidopropyl Betaine
  - Sodium Lauraminopropionate



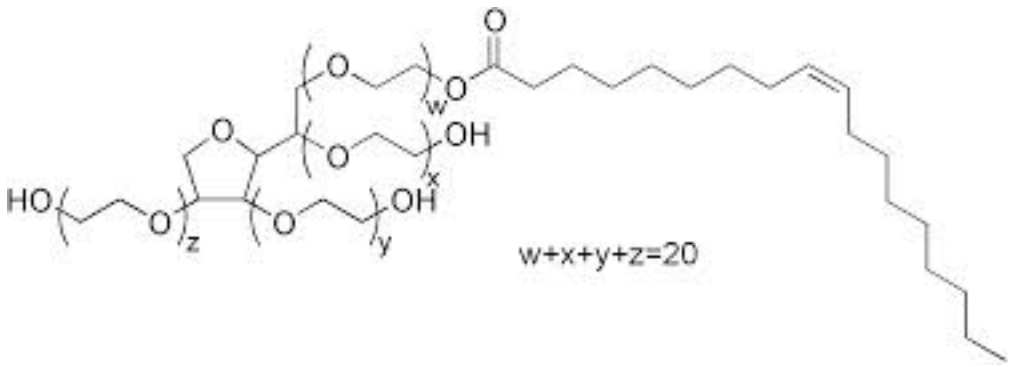
Amphoteric Surfactants

- Why use them?
  - Good Detergency
  - Less Irritating than anionics
  - Helps thicken system
  - Helps improve foam
- Drawbacks
  - More expensive
  - Do not foam well enough on their own

Non Ionic Surfactants

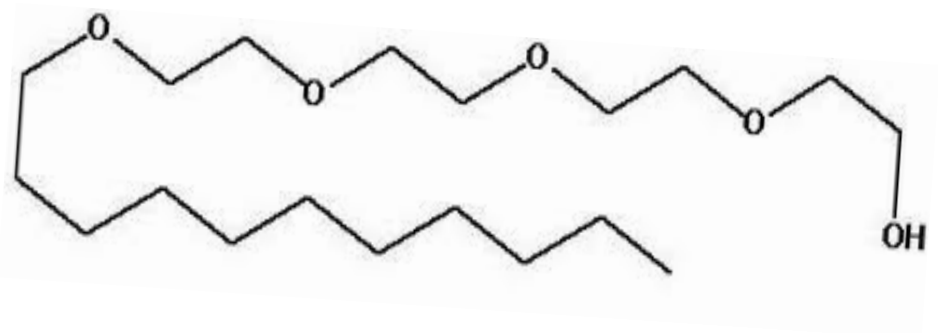
- Surfactant molecules with no charge

- Types
  - Fatty Alcohol
  - Fatty amines
    - Lauramide DEA
  - Amine Oxides
    - Lauramine Oxide
  - Polysorbates



Non Ionic Surfactants

- Why use them?
  - Foam enhancer
  - Reduce irritation
  - Conditioning effect
  - Solubilize fragrances
  - Emulsifiers



- Gentle Cleansers
  - PEG-80 Sorbitan Laurate

- Drawbacks
  - More expensive
  - Do not foam well on their own

Functional Raw Materials
Conditioners & Moisturizers

Functional Raw Materials
Conditioners & Moisturizers

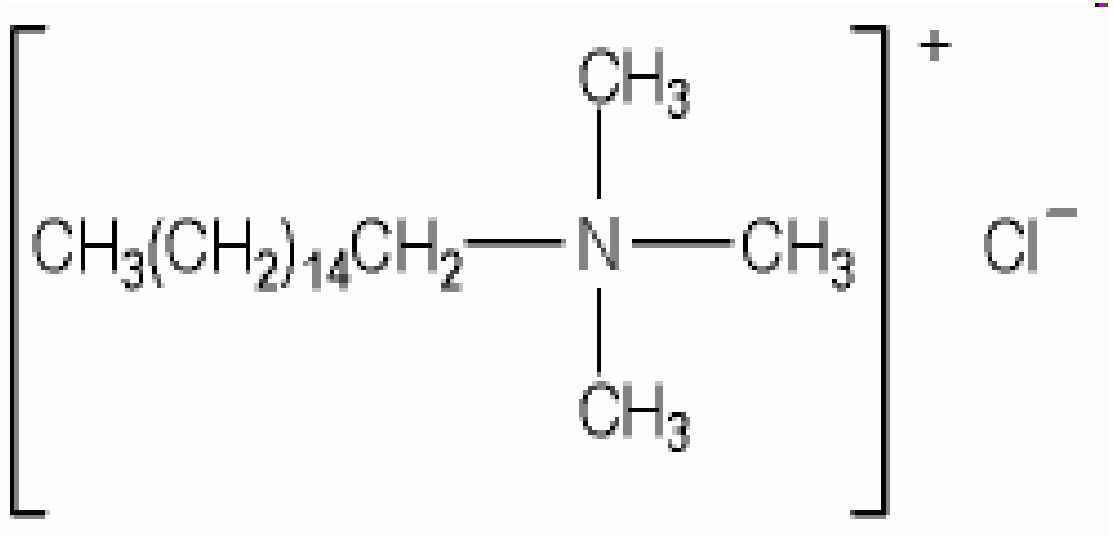
- Defined
  - Ingredients that improve condition of hair or skin
  - Must be substantive to work

Moisturizing Ingredients

- Quats
- Cationic Polymers
- Silicones
- Occlusives
- Humectants
- Emollients

Quats

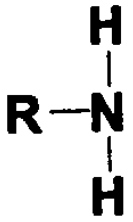
- Cationic Surfactants
  - Hydrophobic tail
  - Hydrophilic head



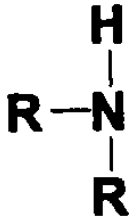
Cetrimonium Chloride

Quats

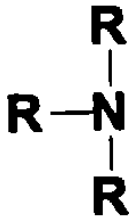
- Examples
  - Cetrimonium Chloride
  - Stearalkonium Chloride
  - Dicetyldimonium Chloride
  - Behentrimonium Chloride



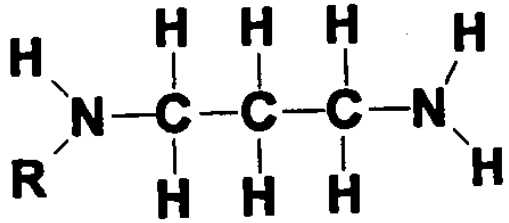
Primary Amine



Secondary Amine



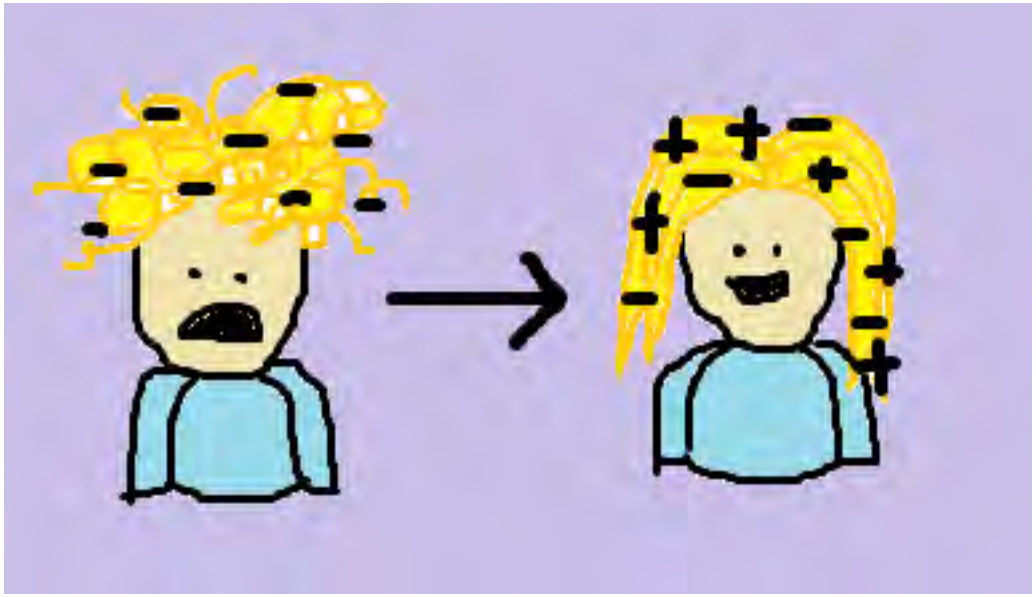
Tertiary Amine



Diamine

Quats

- How do they work?
  - Electrostatic Attraction
  - More damage = more substantivity
  - Longer chain length = more conditioning

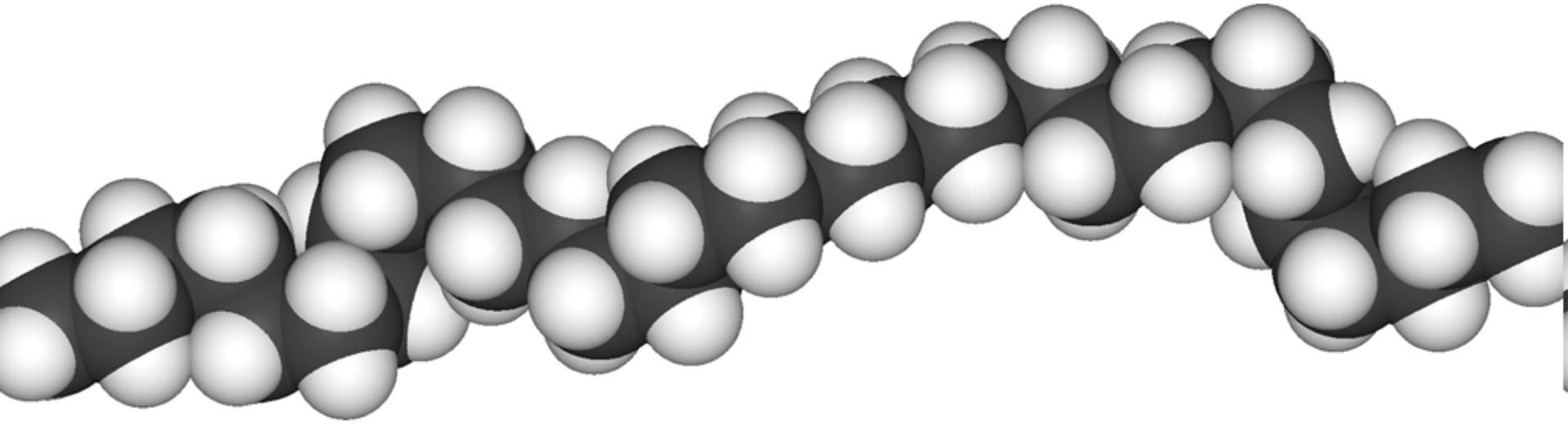


Quats

- Benefits
  - Effective
  - Easy to work with
  - Less expensive
- Drawbacks
  - Can be irritating
  - Not compatible with anionics
- % Used if formula
  - Up to 5%

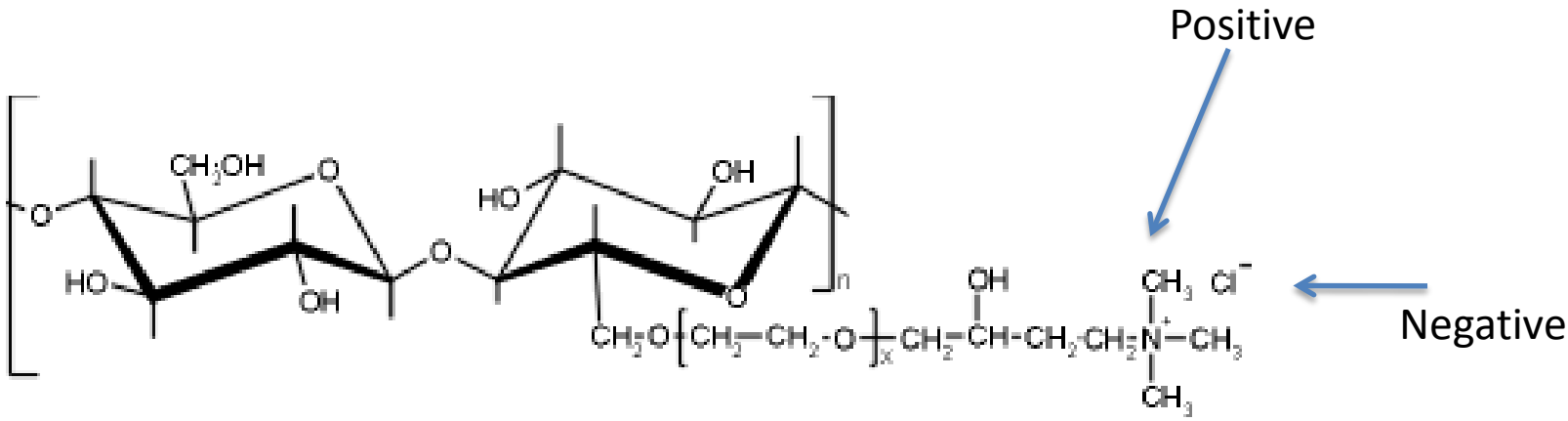
Cationic Polymers

- Large molecules with multiple, positively charged sites



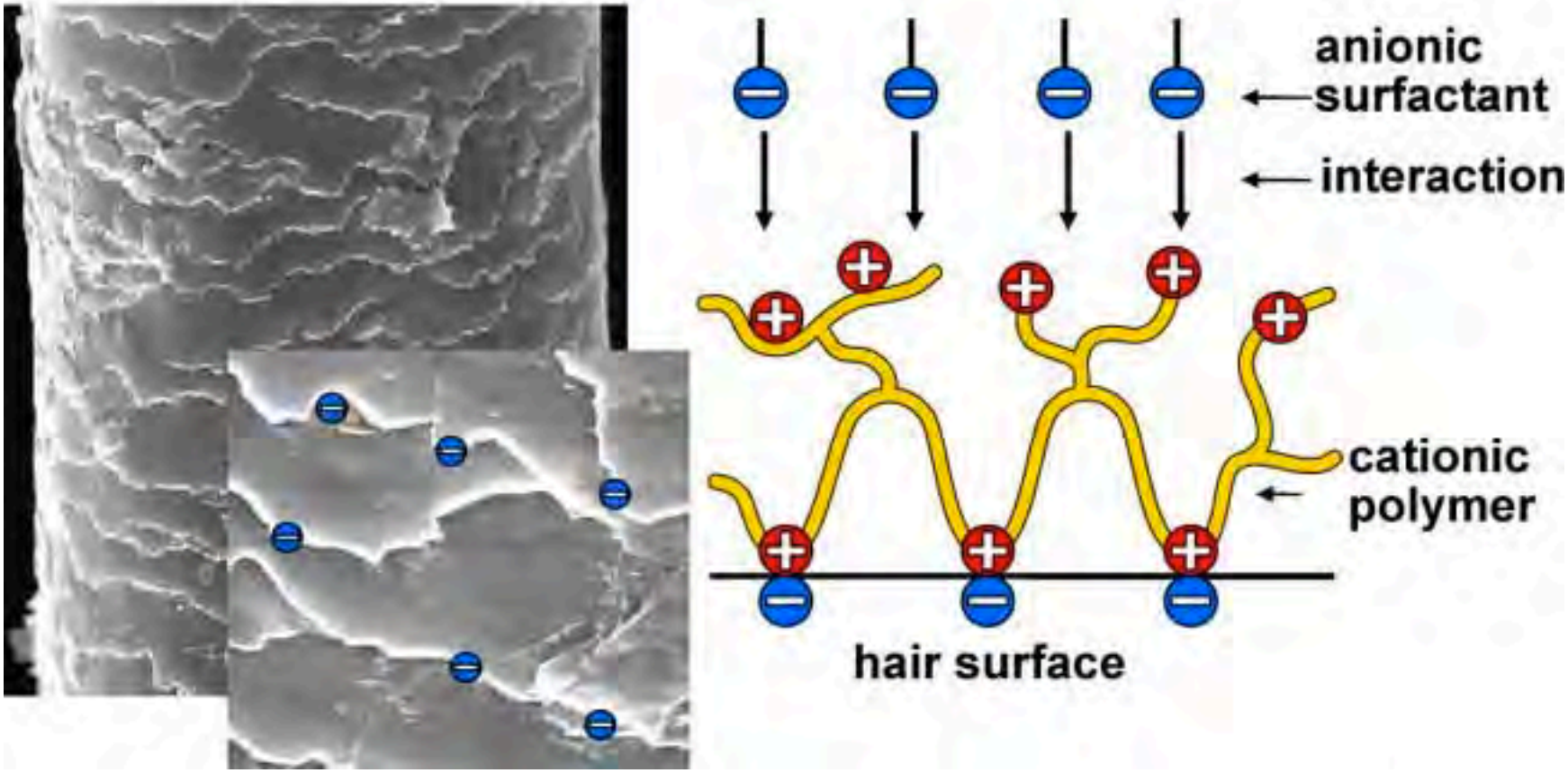
Cationic Polymers

- Common Examples
  - Polyquaternium 4
  - Polyquaternium 7
  - Polyquaternium 10
  - Guar Hydroxypropyltrimonium Chloride



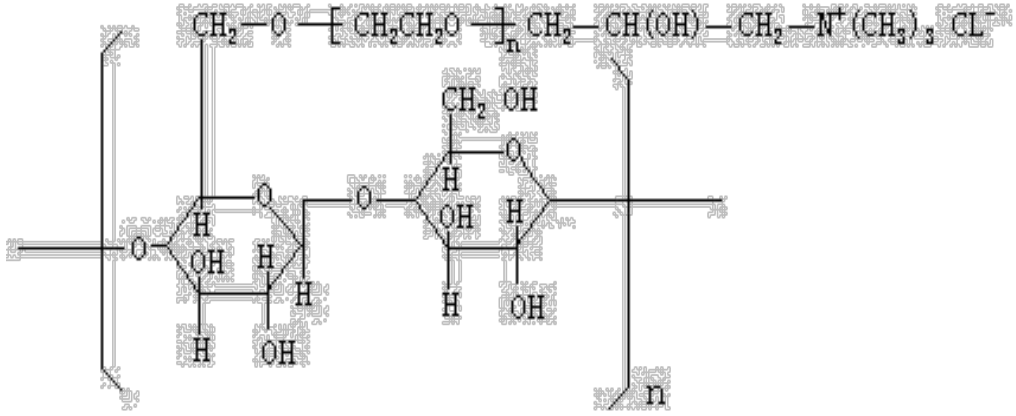
Cationic Polymers

Figure 1: Hair structure with cuticula
Polymer - Distribution of charge



Cationic Polymers

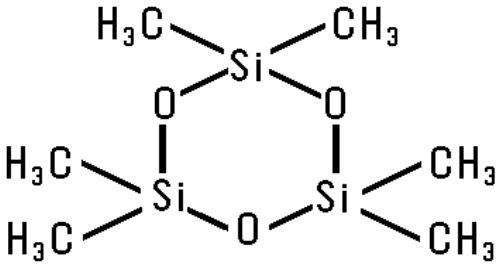
- Benefits
  - Effective at low levels
  - Compatible with anionics
- Drawbacks
  - Can build-up
- % Used if formula
  - Up to 5%
  - Usually 1% or less



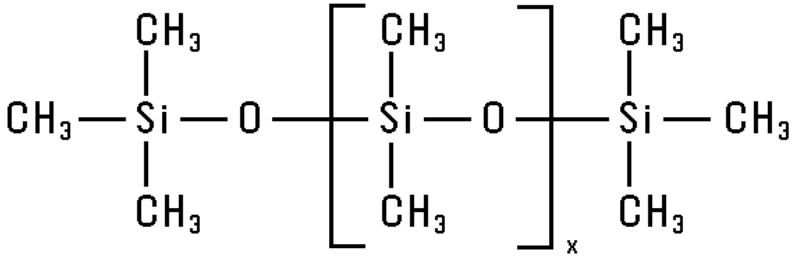
Silicones

- Compounds containing silicone

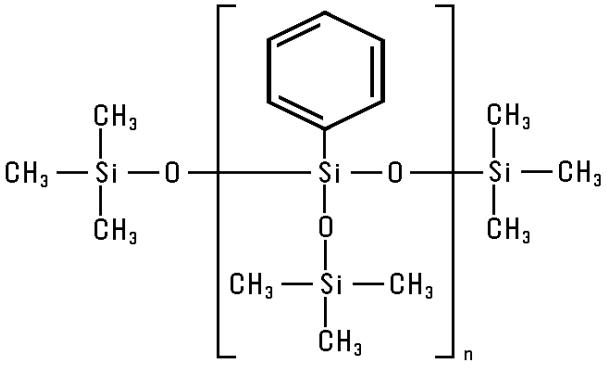
Varieties of Silicones



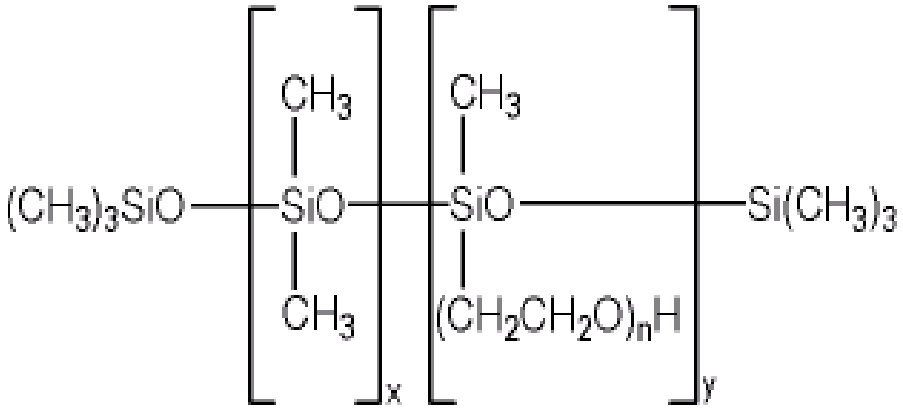
Cyclomethicone
(Hexamethyltrisiloxane)



Dimethicone



Phenyl Trimethicone



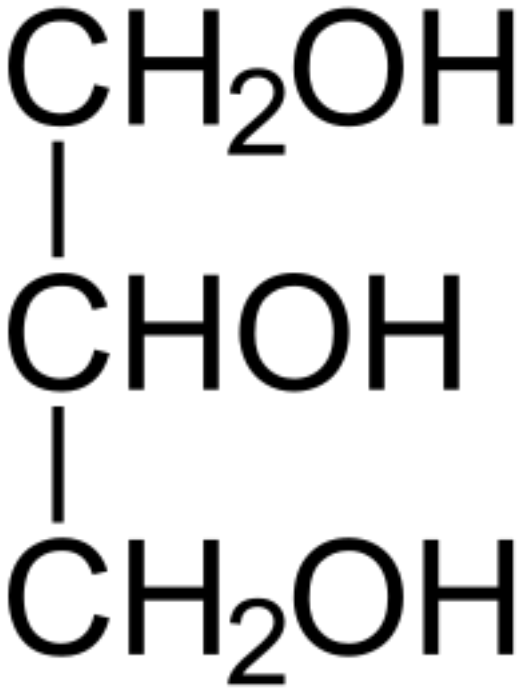
Dimethicone Copolyol

Silicones

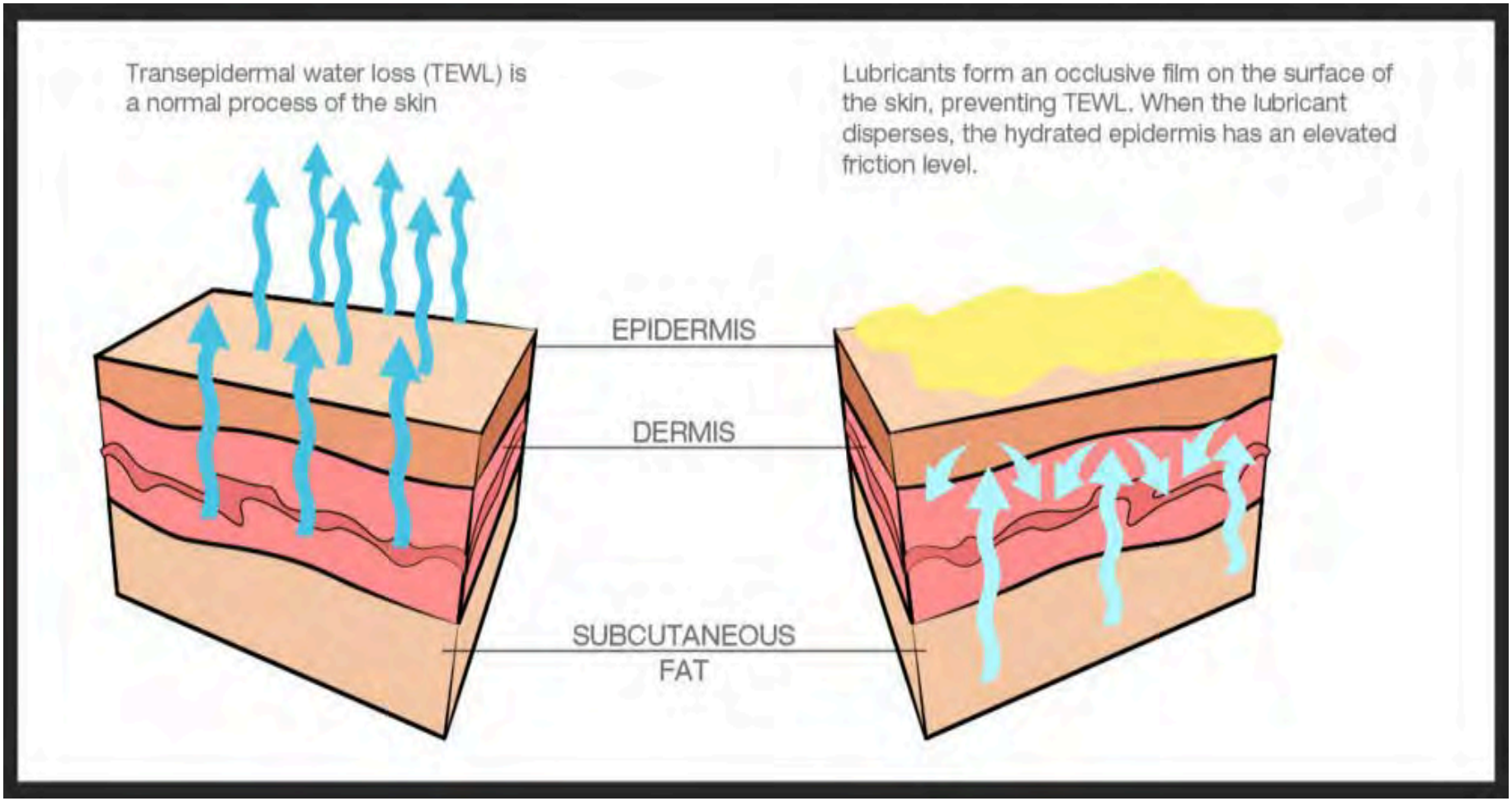
- Benefits
  - Increased shine
  - Increased lubricity
  - Works on undamaged hair
  - Synergistic with cationics
- Drawbacks
  - Build-up
  - Weigh down hair
- % Used if formula
  - Up to 2%

Humectants

- Ingredients that attract water
- Usually water soluble
  - Glycerin
  - Propylene Glycol
  - Sorbitol
  - Types of proteins
- Use level
  - 0.5% - 15.0%

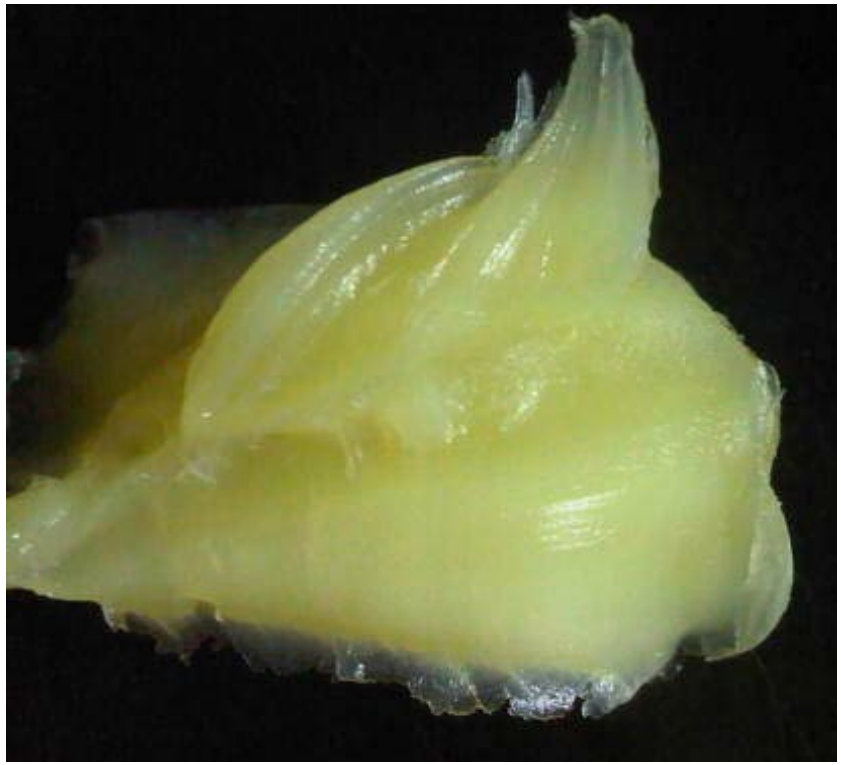


How Occlusives Work

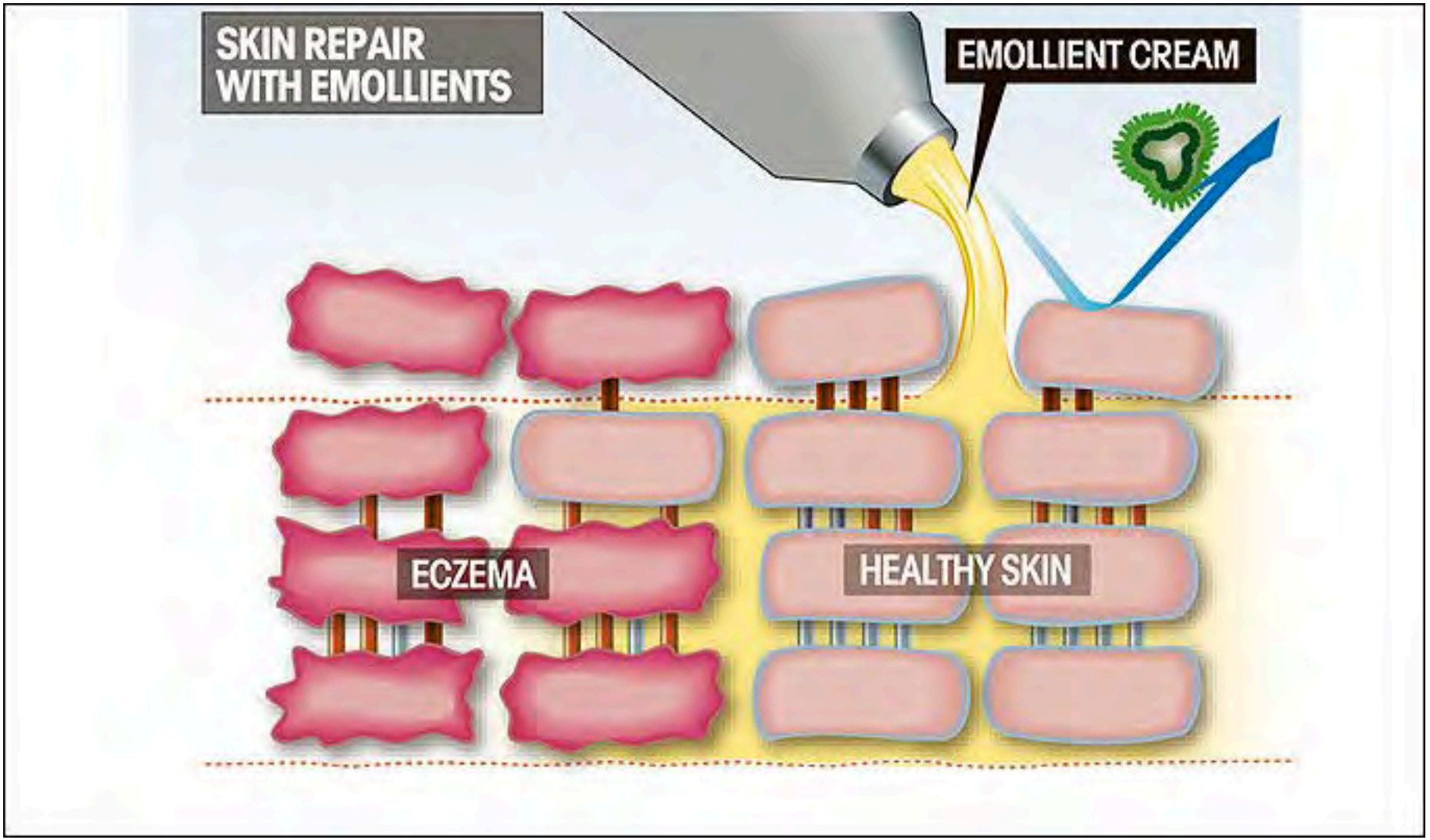


Occlusive Agents

- Water-insoluble materials
- Examples
  - Petrolatum
  - Mineral Oil
  - Dimethicone
- Use Level
  - 5% to 70%

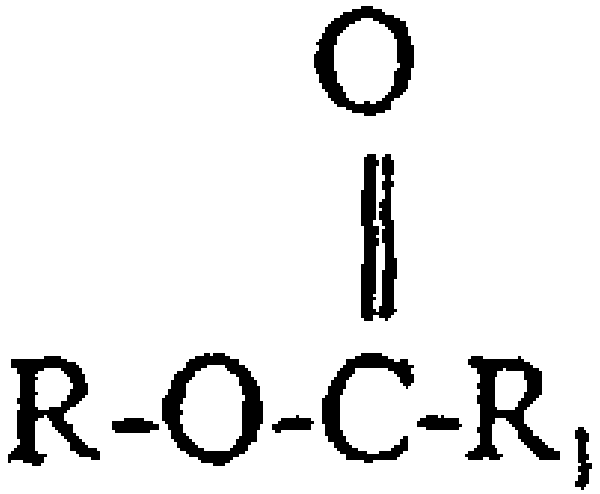


Emollients


SKIN REPAIR
WITH EMOLLIENTS
EMOLLIENT CREAM
ECZEMA
HEALTHY SKIN

Emollients

- Light coating on skin
- Used to improve feel
- Examples
  - Coconut oils
  - Almond oil
  - Esters
  - Silicones
- Use level
  - 5% - 25%



Functional Ingredients
Cosmetic Colorants

Cosmetic Colorants

- Pigments / Dyes
  - Provide color & shine
  - Color formulations
- Two main types
  - Mineral pigments
  - Organic pigments
- Limited by regulations
- Strictly controlled by FDA

Functional Raw Materials
Active Ingredients

- Proven to have an effect on cells or fight disease
- Classified as OTC Drugs
  - FDA Monograph
  - In US & elsewhere

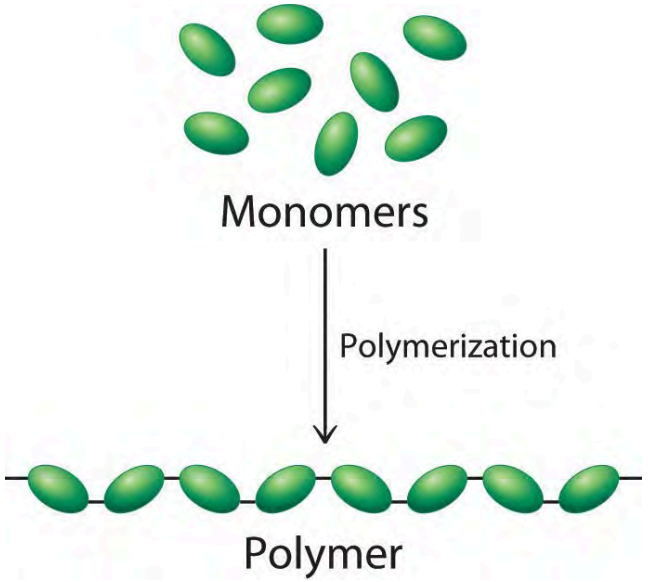
OTC “cosmetic” Active Ingredients

- Sunscreens
- Anti-acne
- Anti-perspirants
- Anti-dandruff
- Anti-cavity
- Anti-fungal
- Anti-microbial
- Hair growth
- Skin bleaching
- Wart Remover

Functional Raw Materials
Film Forming Polymers

- Polymers – Long chain molecules made up of repeating unit molecules (monomers)

- Wide range of uses
  - Thickeners
  - Conditioning / moisturizers
  - Hair colors
  - Styling polymers



Functional Raw Materials
Reactive Ingredients

- Ingredients that chemically react to produce an effect

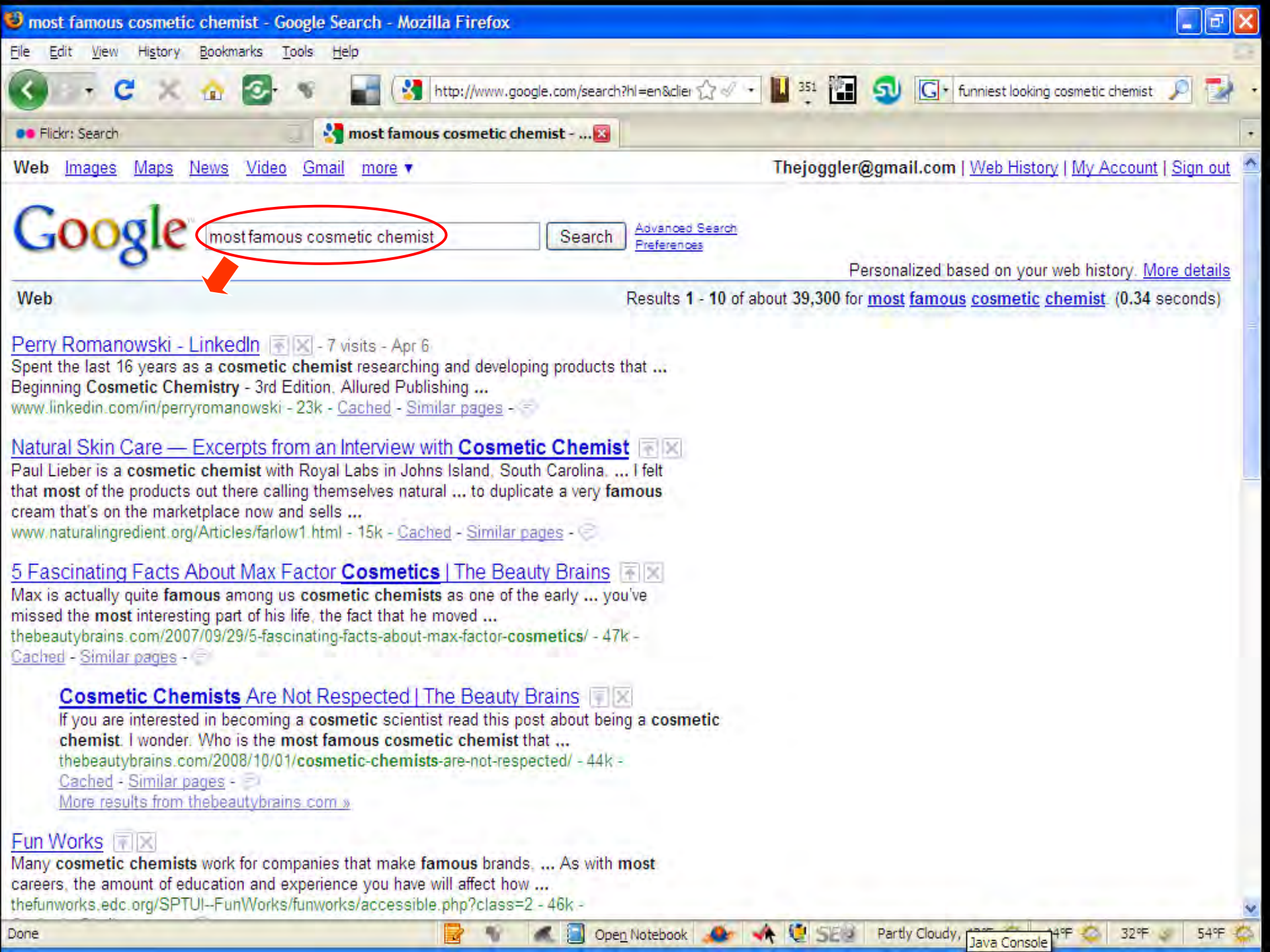
- Hair colorants
- Relaxers
- Perms
- Sunless Tanners
- Depilatories

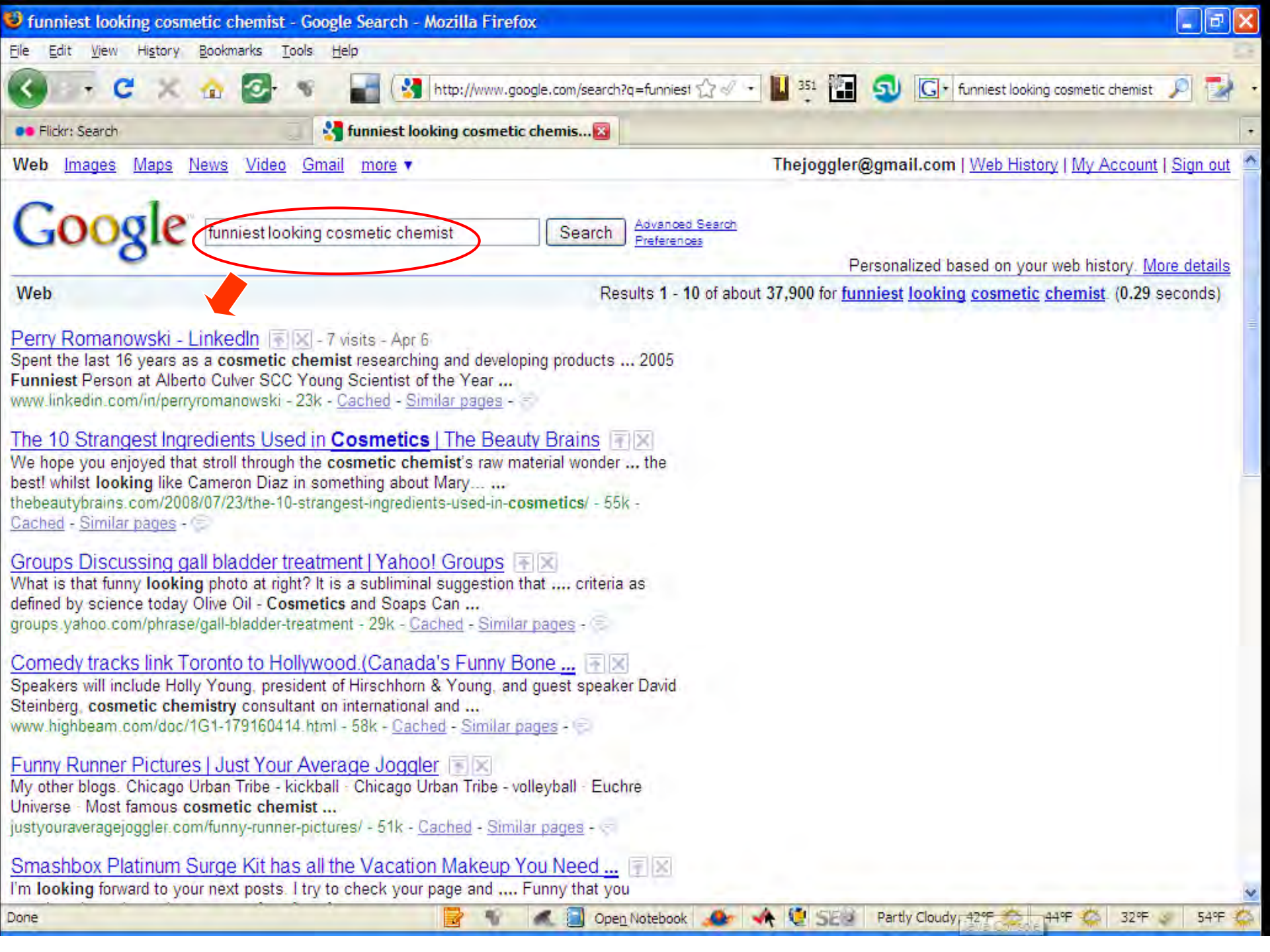
Cosmetic Chemistry Quiz

Which ingredient is NOT something you could possibly find in a cosmetic?

- Whale Vomit
- Sheep placenta
- Cow bone marrow
- Bull Semen

Break


most famous cosmetic chemist - Google Search - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www.google.com/search?hl=en&clie
funniest looking cosmetic chemist
Flickr: Search
most famous cosmetic chemist - ...
Web Images Maps News Video Gmail more ▼
Thejoggler@gmail.com | Web History | My Account | Sign out
Google
most famous cosmetic chemist
Search
Advanced Search
Preferences
Personalized based on your web history. More details
Web
Results 1 - 10 of about 39,300 for most famous cosmetic chemist. (0.34 seconds)
Perry Romanowski - LinkedIn - 7 visits - Apr 6
Spent the last 16 years as a cosmetic chemist researching and developing products that ...
Beginning Cosmetic Chemistry - 3rd Edition, Allured Publishing ...
www.linkedin.com/in/perryromanowski - 23k - Cached - Similar pages -
Natural Skin Care — Excerpts from an Interview with Cosmetic Chemist
Paul Lieber is a cosmetic chemist with Royal Labs in Johns Island, South Carolina. ... I felt that most of the products out there calling themselves natural ... to duplicate a very famous cream that's on the marketplace now and sells ...
www.naturalingredient.org/Articles/farlow1.html - 15k - Cached - Similar pages -
5 Fascinating Facts About Max Factor Cosmetics | The Beauty Brains
Max is actually quite famous among us cosmetic chemists as one of the early ... you've missed the most interesting part of his life, the fact that he moved ...
thebeautybrains.com/2007/09/29/5-fascinating-facts-about-max-factor-cosmetics/ - 47k - Cached - Similar pages -
Cosmetic Chemists Are Not Respected | The Beauty Brains
If you are interested in becoming a cosmetic scientist read this post about being a cosmetic chemist. I wonder: Who is the most famous cosmetic chemist that ...
thebeautybrains.com/2008/10/01/cosmetic-chemists-are-not-respected/ - 44k - Cached - Similar pages -
More results from thebeautybrains.com »
Fun Works
Many cosmetic chemists work for companies that make famous brands. ... As with most careers, the amount of education and experience you have will affect how ...
thefunworks.edc.org/SPTUI--FunWorks/funworks/accessible.php?class=2 - 46k -
Done
Open Notebook
Partly Cloudy,
Java Console
32°F
54°F

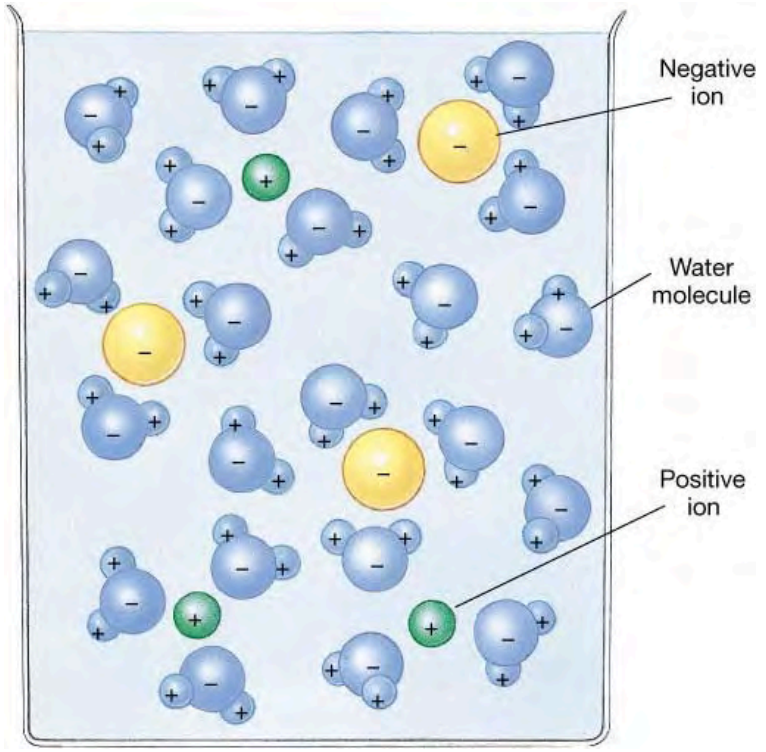

funniest looking cosmetic chemist - Google Search - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www.google.com/search?q=funniest
funniest looking cosmetic chemist
Flickr: Search
funniest looking cosmetic chemis...
Web Images Maps News Video Gmail more ▾
Thejoggler@gmail.com | Web History | My Account | Sign out
Google
funniest looking cosmetic chemist
Search
Advanced Search
Preferences
Personalized based on your web history. More details
Web
Results 1 - 10 of about 37,900 for funniest looking cosmetic chemist. (0.29 seconds)
Perry Romanowski - LinkedIn - 7 visits - Apr 6
Spent the last 16 years as a cosmetic chemist researching and developing products ... 2005 Funniest Person at Alberto Culver SCC Young Scientist of the Year ...
www.linkedin.com/in/perryromanowski - 23k - Cached - Similar pages -
The 10 Strangest Ingredients Used in Cosmetics | The Beauty Brains
We hope you enjoyed that stroll through the cosmetic chemist's raw material wonder ... the best! whilst looking like Cameron Diaz in something about Mary... ...
thebeautybrains.com/2008/07/23/the-10-strangest-ingredients-used-in-cosmetics/ - 55k - Cached - Similar pages -
Groups Discussing gall bladder treatment | Yahoo! Groups
What is that funny looking photo at right? It is a subliminal suggestion that .... criteria as defined by science today Olive Oil - Cosmetics and Soaps Can ...
groups.yahoo.com/phrase/gall-bladder-treatment - 29k - Cached - Similar pages -
Comedy tracks link Toronto to Hollywood.(Canada's Funny Bone ...
Speakers will include Holly Young, president of Hirschhorn & Young, and guest speaker David Steinberg, cosmetic chemistry consultant on international and ...
www.highbeam.com/doc/1G1-179160414.html - 58k - Cached - Similar pages -
Funny Runner Pictures | Just Your Average Joggler
My other blogs. Chicago Urban Tribe - kickball · Chicago Urban Tribe - volleyball · Euchre Universe · Most famous cosmetic chemist ...
justyouraveragejoggler.com/funny-runner-pictures/ - 51k - Cached - Similar pages -
Smashbox Platinum Surge Kit has all the Vacation Makeup You Need ...
I'm looking forward to your next posts. I try to check your page and .... Funny that you
Done
Open Notebook
Partly Cloudy 42°F 44°F 32°F 54°F

Aesthetic Raw Materials

- Solvents
- Emulsifiers
- Adjusters
- Preservatives
- Thickeners
- Fragrance
- Fillers
- Delivery Systems

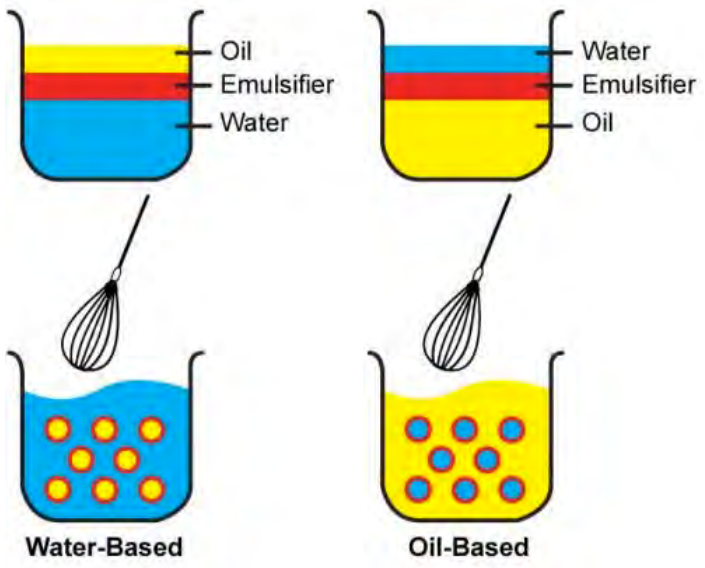
Solvents

- Ingredients that dilute functional ingredients
- Aid in delivery
- Low cost
- Non-reactive / Compatible
- Most common
  - Water
  - Alcohol
  - Mineral Oil
  - Propylene Glycol



Emulsifiers

- Ingredients that create oil & water mixtures
- Basis for all creams & lotions
- Emulsions consist of
  - Internal phase
  - External phase
  - Emulsifier
- Very few natural emulsifiers



Standard Emulsifiers to Avoid for Natural products

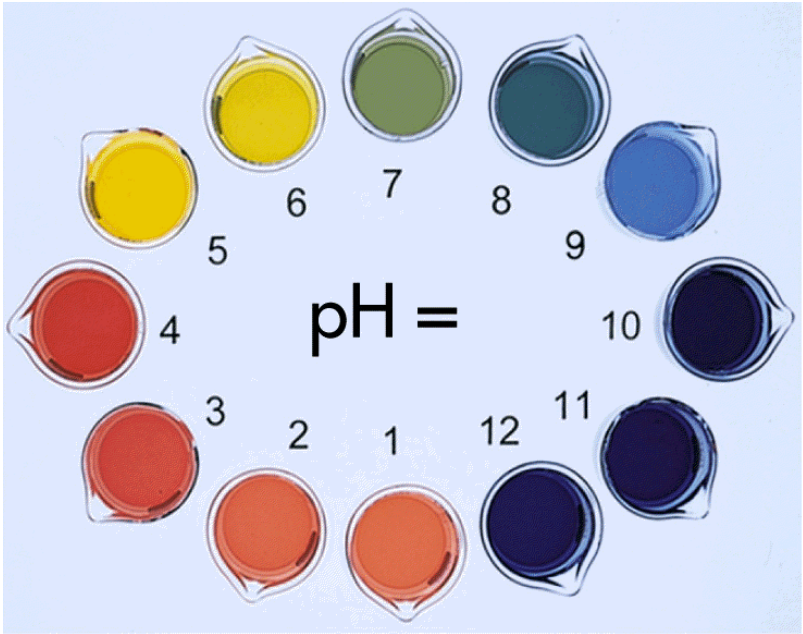
Type	INCI Name	Reason to exclude
Anionic	Triethanolamine Stearate (Also known as TEA Stearate)	TEA (stearic acid may be animal derived)
	Potassium Cetyl Phosphate	Phosphate content
Nonionic	PEG-100 Stearate	Ethoxylated
	Ceteareth-20	Ethoxylated
	Steareth-2	Ethoxylated
	Bis-PEG/PPG-14/14 Dimethicone	Silicone & PEG based
	Polyacrylate-13	Synthetic polymer
Cationic	Palmitamidopropyl-trimonium chloride	Quaternary

Natural Emulsifiers – What To Use

- Esters - glyceryl caprylate
- Lecithin
  - Challenging to formulate with
- Beeswax/Borate combination
  - Heavy/greasy/unstable
- Soaps
- Saponins
- Polysorbates

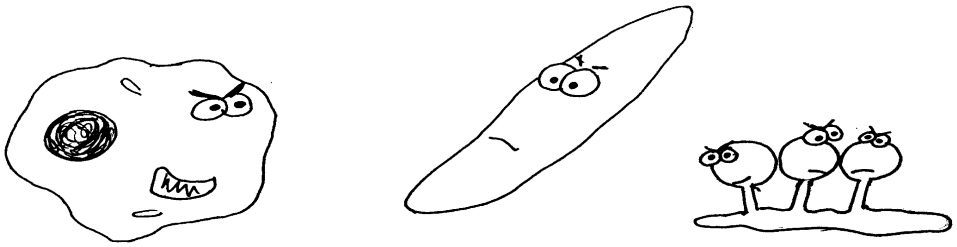
Formulation Aids

- Ingredients that adjust formulation properties
  - pH
  - Viscosity
  - Solubilizers
- Acids, bases or salts
- Chelating agents
- Nonionic surfactants



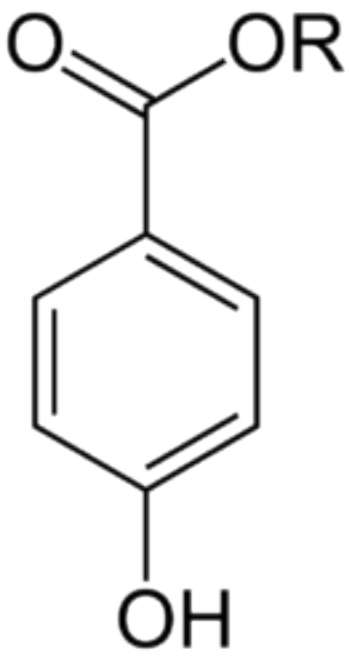
Preservatives

- Compounds that prevent contamination
  - Bacteria
  - Molds
  - Psuedomonas
- Sources of contamination
  - Equipment
  - Ingredients
  - Post-manufacture
  - Consumer



Cosmetic Preservatives

- Parabens
  - Propylparaben
  - Ethylparaben
  - Methylparaben
- Formaldehyde donors
- Phenol derivatives
  - Phenoxyethanol
- Quats
- Alcohol
- Organic compounds
  - Methylchloroisothiazolinone



“Natural” Preservatives

- Benzoic acid
- Boraxitrus seed extracts
- Copper salts
- Fragrance oils
- Glycerin
- Hinokitiol
- Honey
- Japanese Honeysuckle extracts
- Melaleucol (Tea Tree) oil
- Perillic acid
- Salicylic acid
- Salt
- Silver Chloride
- Sodium Gluconate
- Sorbic acid
- Sugar
- Usnic acid
- Wasabi extract
- Zinc Salts

Aesthetic Raw Materials

- Thickeners – Ingredients that increase the thickness of a formula

Lipid Thickeners

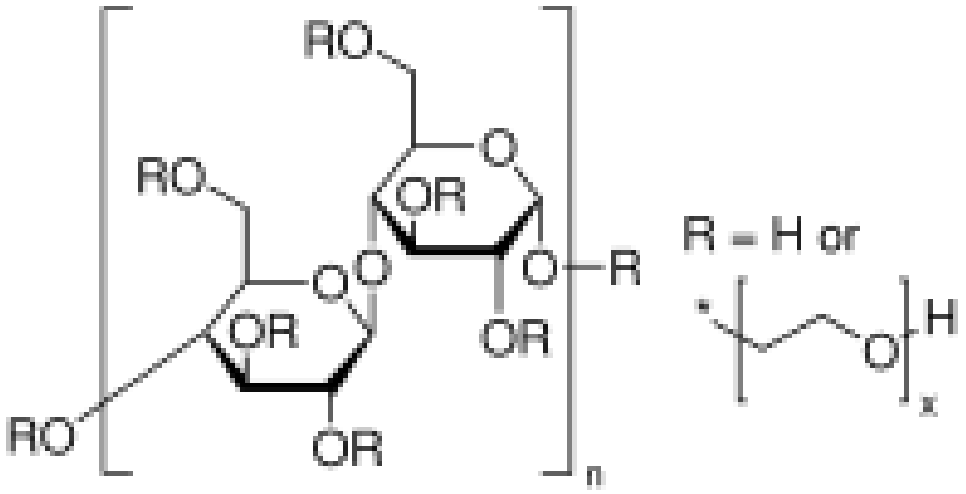
- Composed of lipophilic materials
- Solid at room temperature
- Liquid when heated, solid when cooled

- Examples
  - Carnauba wax
  - Cetyl Alcohol
  - Stearyl Alcohol

Thickening Technology

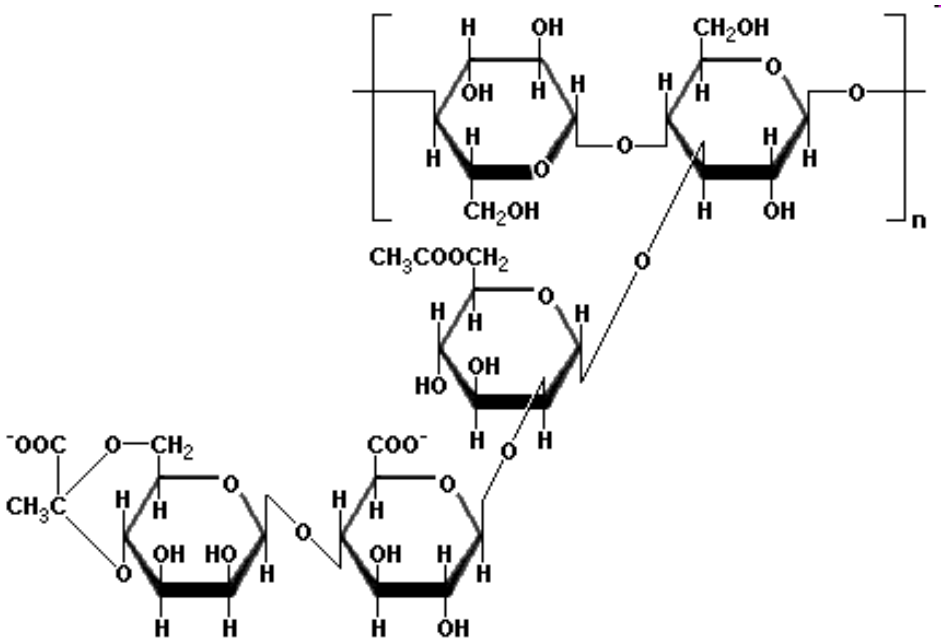
- Cellulose & Carbohydrate thickeners

- Examples
  - Carrageenan
  - Xanthan gum
  - Hydroxyethyl Cellulose



Cellulose & Carbohydrate thickeners

- How they work
  - Absorb water
  - Internal hydrogen bonding
- Benefits / drawbacks
  - High viscosity
  - Good spreadability
  - Sticky, stringy, cloudy
- Formula use %
  - Low levels to prevent stickiness
  - 1% or less



Xanthan Gum

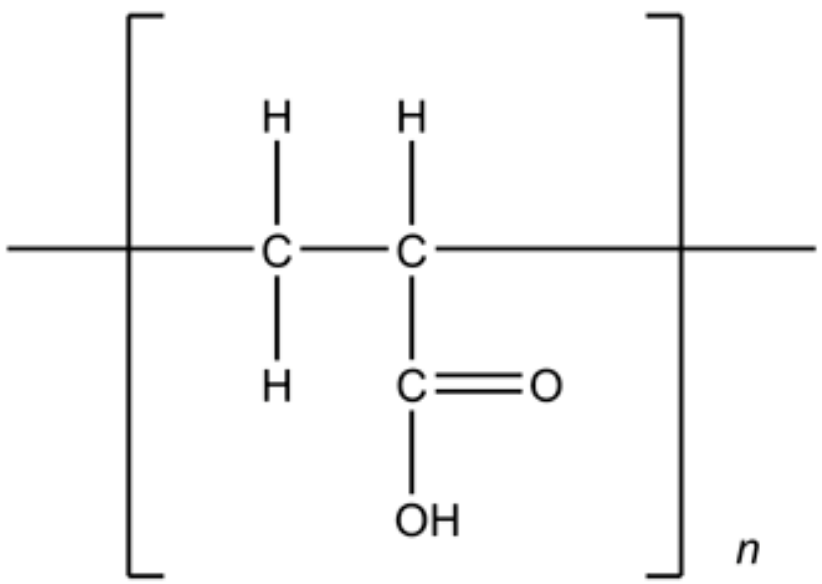
Mineral Thickeners

- Mined ingredients that hold water
- Different feeling formula
- Can be used to thicken non-aqueous formulas

- Examples
  - Silica
  - Bentonite
  - Magnesium Aluminum Silicate

Acrylic Thickeners

- Acrylate thickeners
- Examples
  - Carbomer



Acrylic acid monomer unit in carbomer polymers.

Carbomer Thickeners

- How they work
- Polymer freely moves in solution (Acidic)
- pH is neutralized
  - TEA or AMP
- Cross-linking bonds

Fragrances

- Used to improve the odor of formula / surface
- Blend of aromatic compounds.
  - Essential oils / naturals
  - Synthetics
- Creation requires art and science

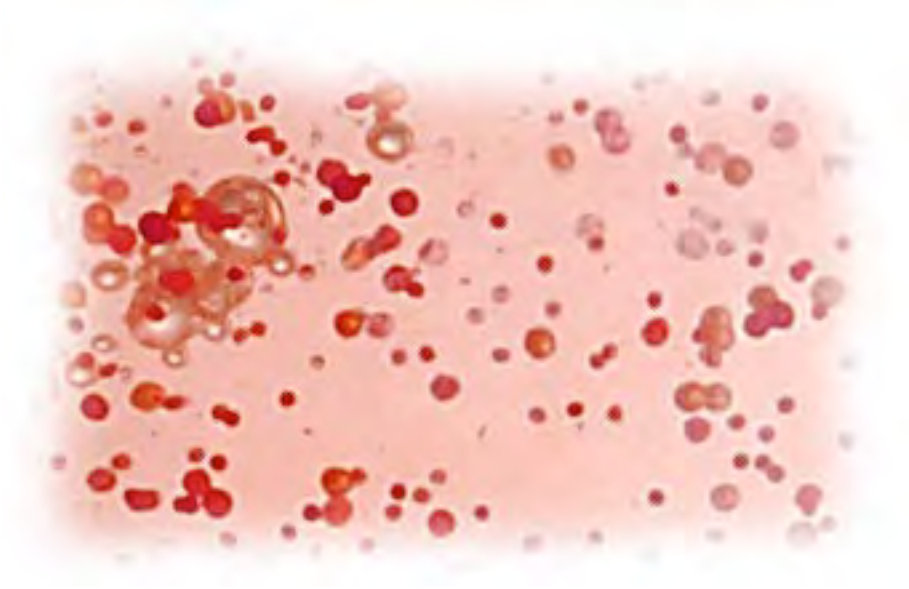
Fillers

- Used to extend colors
- Choice based on cost & formula needs

- Examples
  - Talc
  - Mica
  - Kaolin
  - Bismuth oxychloride
  - Calcium Carbonate

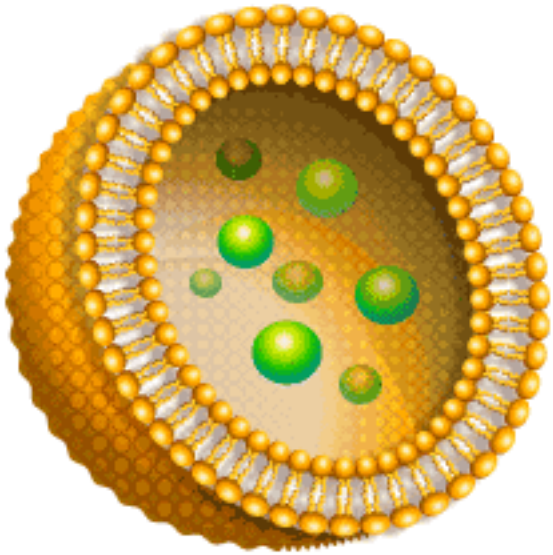
Appearance Modifiers

- Pearling Agents – Opacify formula
- Suspended beads
- Texture modifiers



Delivery Systems

- Ingredients used to better deliver functional ingredients to skin & hair
- Cyclodextrins
- Matrix Polymers
- Liposomes



Liposome

Marketing Ingredients

- Added to support a marketing story
- Generally have some functionality
- High concentrations are too expensive
- Give a measure of differentiation
- Recognizable by consumers
  - Positive reception
  - Seem like good ingredients

Marketing Raw Materials

- Vitamins
- Botanical Extracts
- Proteins
- Anti-Aging

- Used at low levels
- Minimal impact on performance

Natural Raw Materials

- Depends on Standards
- Don’t expect them to work as well
- They will cost more
- Consumers want products that work

Cosmetic Formulations

Cosmetic Formulation Types

- Solutions
- Emulsions
- Gels
- Sticks
- Powders
- Aerosols

Solutions

Simplest formulation

Mixture of compounds

Examples

- Shampoo
- Skin oils
- Aftershave

Solution Technology

- Ingredients in Shampoo formulation

- Functional Ingredients – 10-20%
  - Cleansing Surfactants
  - Conditioners
- Aesthetic ingredients – 80 – 90%
- Marketing ingredients – 0 – 5%

Example Solution - Shampoo formula

Shampoo

Water	75.60
Sodium Lauryl Sulfate	12.00
Sodium Laureth Sulfate	5.00
Cocamide DEA	3.00
Hydroxyethylcellulose	0.50
Hydrolyzed Keratin	0.50
Hydroxpropyl Guar Trimonium Chloride	0.20
Sodium Chloride	2.00
DMDM Hydantoin	0.20
Fragrance	1.00
Color	qs

Natural - Shampoo

Formula Name
Tier 3 Natural Standard Shampoo

Batch size: 500

	Purpose	INGREDIENT	%	Amt. In Batch
1	Aesthetic – Solvent	Water	42.40	212.00
2	Functional – Conditioning	Guar Hydroxypropyltrimonium Cl	0.300	1.50
3	Aesthetic – pH adjustment	Citric Acid	0.30	1.50
4	Functional – Secondary Surfactant	Cocamidopropyl Betaine	8.00	40.00
5	Functional – Surfactant	Coco Glucoside	15.00	75.00
6	Functional – Surfactant	Decyl Glucoside	20.00	100.00
7	Functional – Conditioning	Glycerin	5.00	25.00
8	Aesthetic – Thickener	Polyacrylate 33	5.00	25.00
9	Aesthetic – Opacifier	Glycol Distearate	1.00	5.00
10	Aesthetic – Fragrance	Lavender Oil	0.50	2.50
11	Aesthetic – Preservative	Caprylhydoxamic Acid & Glyceryl Caprylate & Methylpropanediol	1.00	5.00
12	Aesthetic – Thickening	Sodium Chloride	1.50	7.50
		TOTAL	100.000	500.00

Procedure:

1. Begin mixing item #1 in container. Begin heating to 70C
2. Add items #2 - #7
3. At 70C add item #9. Mix for 10 min & cool
4. At 40C add items #10, 11 and 12
5. At <30C mix 10 – 15 min
6. Check pH and viscosity. Adjust as required

Specifications

pH = 5.0 - 5.5
Viscosity = 4000 - 7000 cps

Natural Body Wash

Ingredient	Function	Wt, %
Sodium Coco Sulfate	Primary Surfactant	10.4
Coco Glucoside	Secondary surfactant	15.4
Lauryl Glucoside	Secondary surfactant	4
Xanthan Gum	Thickener	1.6
Apple Juice	Marketing ingredient	3
Sodium Benzoate	Preservative	0.5
Citric Acid	pH adjustment	QS
Sodium Chloride	Viscosity adjustment	QS
Fragrance	Fragrance	QS
Water	Carrier	QS to 100

* Meets NaTrue Standard

Emulsions

Mix of Oil & Water

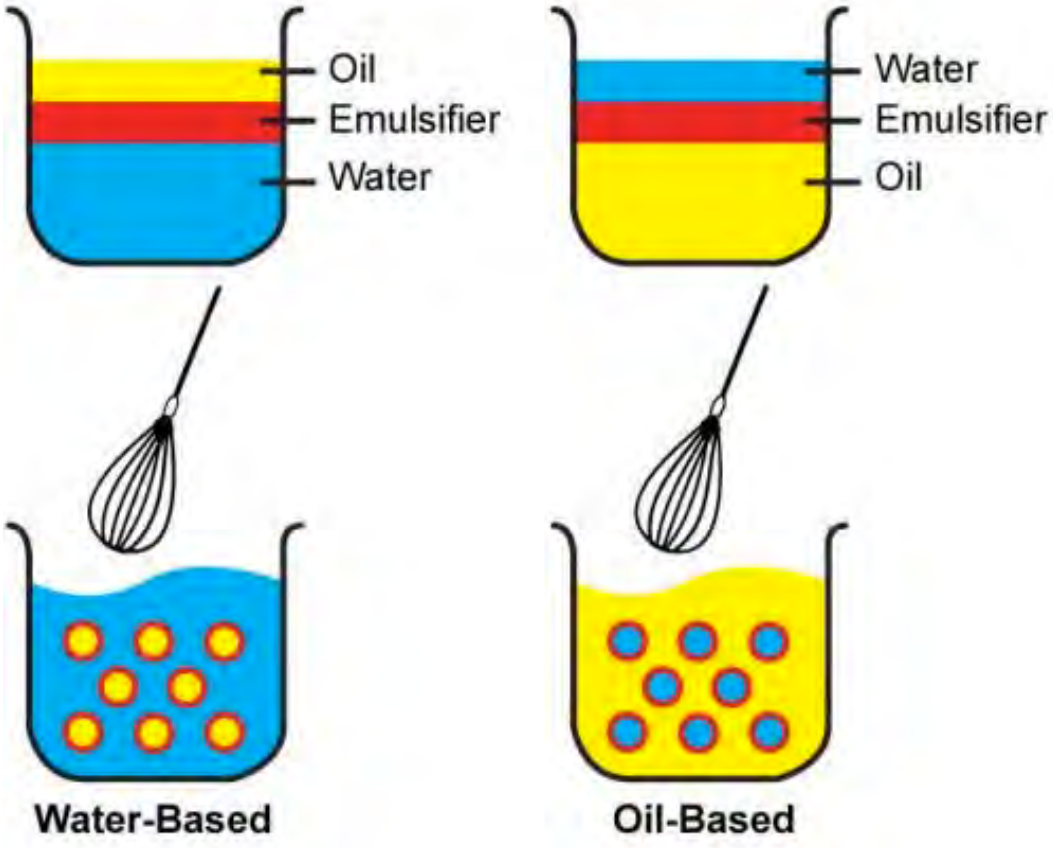
Held together with Emulsifier

Examples

- Lotions
- Conditioners
- Moisturizers

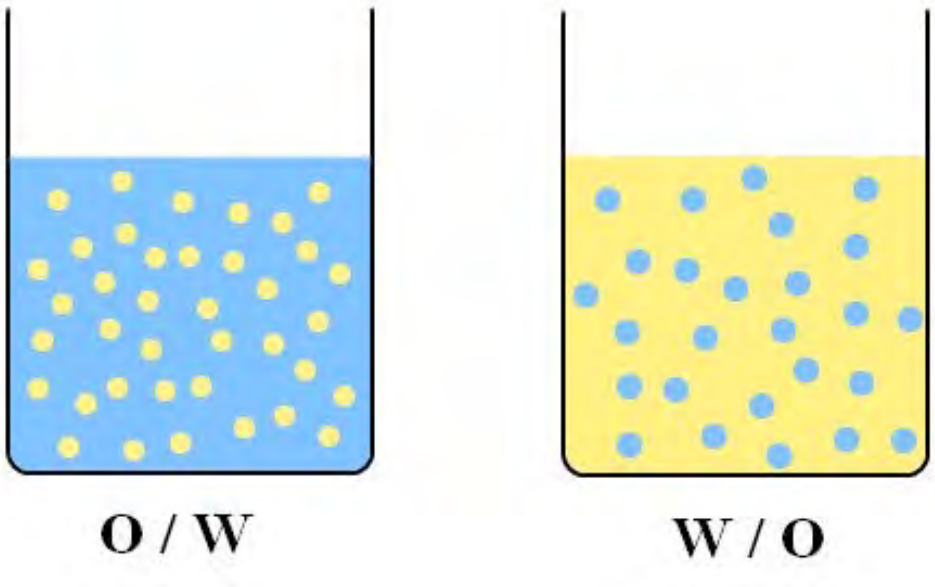
Emulsions Components

- Internal phase
  - Discontinuous phase
- External phase
  - Continuous phase
- Emulsifier

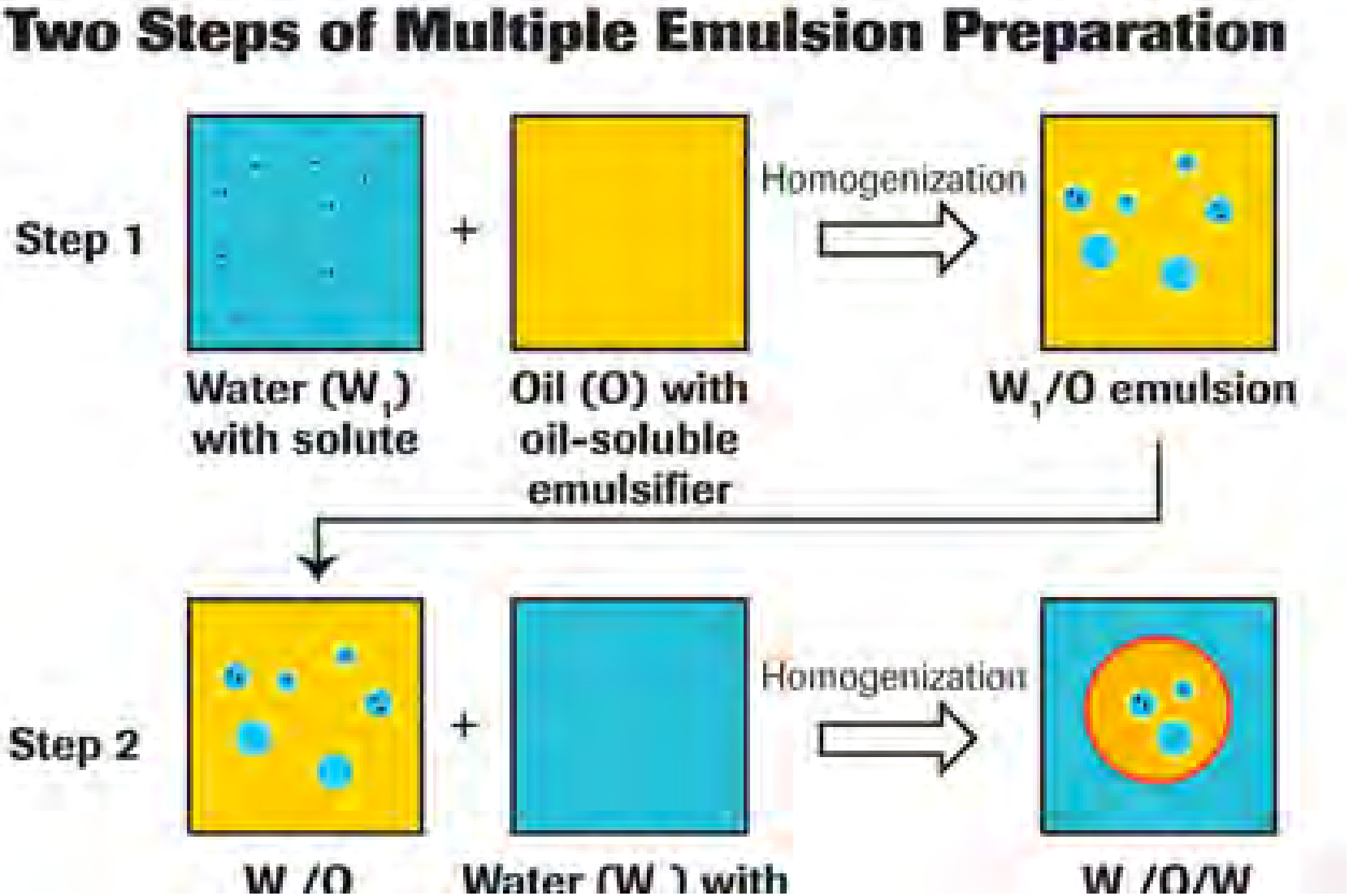


Emulsions Types

- Configuration
  - Oil in Water (O/W)
  - Water in Oil (W/O)
  - Multiple emulsions (W/O/W)



Multiple Emulsions



Emulsions Particles

- Classified by particle size
  - Solutions <5 nm
  - Micelles 5 – 10 nm
  - Microemulsions 10 – 100 nm
    - Clear
    - Stable
  - Macroemulsions >100nm
    - Opaque
    - Unstable

Emulsions Particles

- Particle size is determined by
  - Amount of agitation
  - Temperature
  - Component concentration
  - Type of emulsifier and oil
- Generally, smaller particles are more stable

General Moisturizing Cream

- Functional ingredients – 10 – 50%
- Aesthetic ingredients – 50 – 90%
- Marketing ingredients – 0 – 5%

- Oil in Water emulsion – O/W
- Water in oil emulsion – W/O

Creating a formula

- Pick oil phase
- Pick appropriate emulsifier
  - HLB method for choosing
- Decide on formula structure
  - O/W – less greasy but less effective
  - W/O – more effective, more expensive

Moisturizing Cream Formula

	Formula Name			Batch size	
	Moisturizing Cream	Oil in Water		500	grams

	Purpose	INGREDIENT	%	Amt. In Batch	Phase
1	Diluent	Water	79.650	398.25	w
2	Thickener	Carbomer (2%)	5.000	25.00	w
3	Humectant	Glycerin	3.000	15.00	w
4	Preservative	Methylparaben	0.100	0.50	w
5	Neutralizer	Triethanolamine	0.900	4.50	w
6	Coemulsifier	Cetyl Alcohol	2.000	10.00	o
7	Emulsifier	Stearic Acid	0.800	4.00	o
8	Emulsifier	Glyceryl Stearate SE	1.500	7.50	o
9	Preservative	Propylparaben	0.050	0.25	o
10	Occlusive	Isopropyl Myristate	1.500	7.50	o
11	Occlusive	Mineral oil	5.000	25.00	o
12	Fragrance	Fragrance	0.500	2.50	m
		TOTAL	100.000	500.00	

Procedure:

1. Begin mixing item #1 in container. Heat to 75C
2. Add items #2 thru #5
3. Separately mix items #6 - #11. Heat to 75C
4. Slowly mix oil phase with water phase
5. Mix for 30 min and begin cooling to 25C
6. At <40C add item #12
7. Check pH and viscosity.

Specifications

pH = 5.0 - 5.5

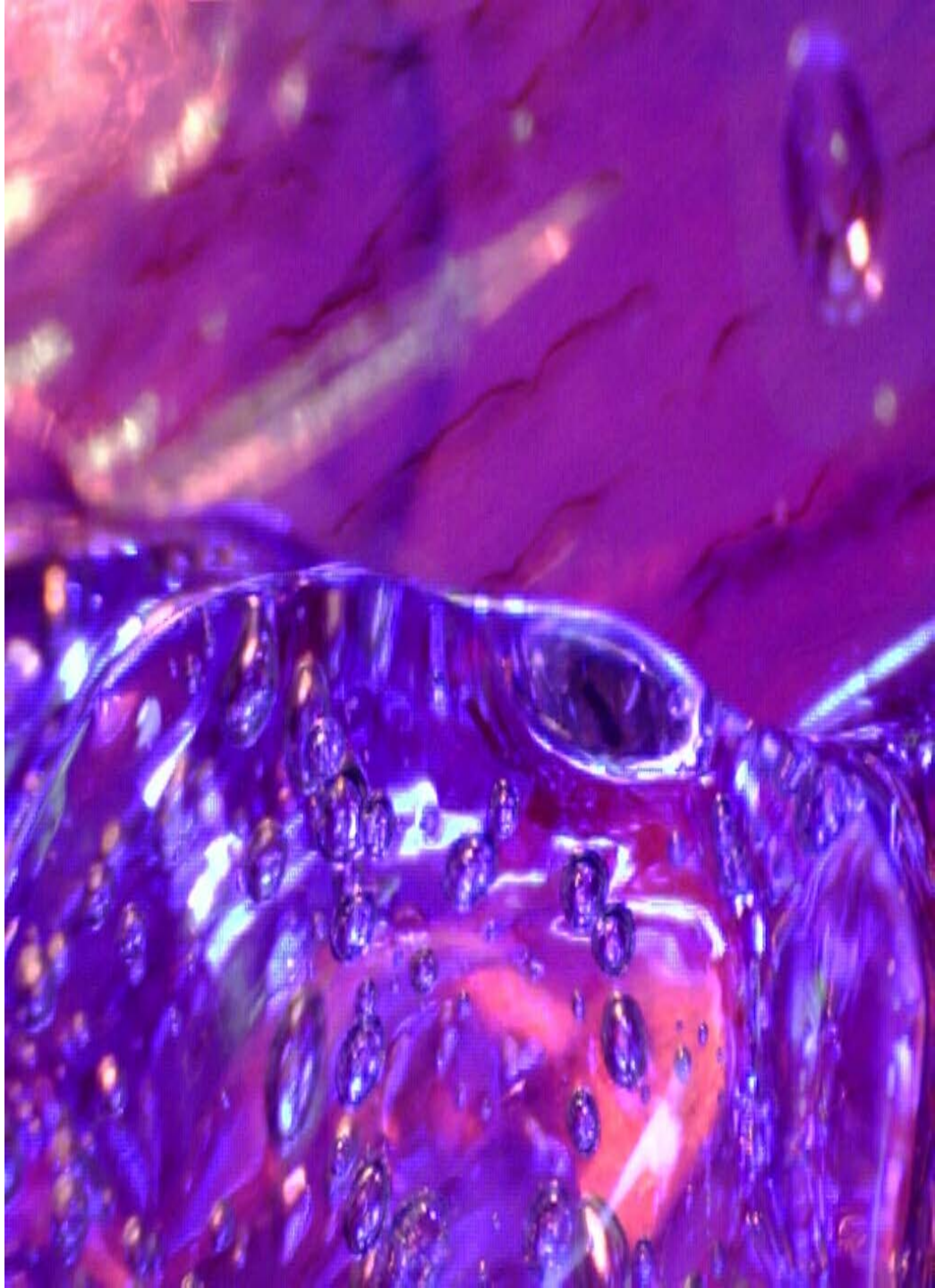
Viscosity = 15,000 - 20,000 cps

Natural Body Lotion

Ingredient	Function	%
Water	Diluent	QS to 100
Glycerin	Humectant	3
Sodium Stearoyl Glutamate	Emulsifier	0.5
Dehydroacetic Acid (and) Benzyl Alcohol	Preservative	0.8
Xanthan Gum	Thickener	1.0
Cetearyl Alcohol	Emulsifier	2
Polyglyceryl-2 Dipolyhydroxystearate	Secondary emulsifier	2
Glyceryl Stearate	Secondary emulsifier	1
Dicaprylyl Ether	Emollient	5
Oleyl Erucate	Emollient	2
Olive Oil (Organic certified)	Emollient	5

Gel formula

- Thickened solution or emulsion



Types of Gel

- Styling Gels
  - Normal Hold
  - Extra Hold
- Shaving gel
- Hand gels

Gel formulas

- Ingredients in gel formulas

- Functional Ingredients – 10-30%
  - Styling Polymers
  - Conditioning Ingredients
- Aesthetic ingredients – 70 – 90%
- Marketing ingredients – 0 – 5%

Example Styling Gel

	Formula Name			Batch size	
	Normal Gel			500	grams

	Purpose	INGREDIENT	%	Amt. In Batch	Phase
1	Solvent	Water	72.180	360.90	a
2	Thickener	Carbomer	0.500	2.50	a
3	Adjustment Agent	Disodium EDTA	0.200	1.00	a
4	Humectant	Glycerin	0.500	2.50	a
5	Stabilizer	Benzophenone-4	0.020	0.10	a
6	Preservative	Dazolidinyl urea & iodopropynyl butylcarbamate	0.100	0.50	a
7	Solvent	Water	20.000	100.00	b
8	Styling polymer	PVP K-90	2.000	10.00	b
9	Styling polymer	PVP/dimethylaminoethylmethacrylate copolymer	3.000	15.00	b
10	Solubilizer	Oleth-20	0.800	4.00	b
11	Fragrance	Fragrance	0.200	1.00	b
12	Neutralizer	Aminomethylpropanol	0.500	2.50	b
		TOTAL	100.000	500.00	

Procedure:

1. Begin mixing item #1 in container.
2. Add item #2 slowly to prevent clumping
3. Add items #3 - #6
4. In a separate container mix item #7
5. Add items #8 & #9
6. Premix #10 & #11. Add to polymer mixture
7. Add item #12 and mix until clear.
8. Mix polymers with Carbomer solution. Mix 30 minutes until clear.
9. Take pH and viscosity readings

Specifications

pH =	6.0 – 6.2
Viscosity =	25,000 – 35,000

Natural Styling Gel

Formula Name

Tier 3 Natural Standard Gel

Batch size
500

	Purpose	INGREDIENT	%	Amt. In Batch
1	Aesthetic – Solvent	Water	90.400	452.00
2	Functional – Conditioning	Sorbitol	2.500	12.50
3	Functional – Conditioning	Glycerin	3.500	17.50
4	Functional – Hold / Thickening	Dehydoxanthan Gum	2.000	10.00
5	Aesthetic – Preservative	Benzyl Alcohol	1.000	5.00
6	Aesthetic – Fragrance	Fragrance	0.200	1.00
7	Functional – Hold	Acacia Gum	0.400	2.00
		TOTAL	100.000	500.00

Procedure:

1. Begin mixing item #1 in container. Begin heating to 45C
2. Add items 2,3, &4
3. Premix item 5&6. Add to formula
4. Cool to 30C. Add item #7

Specifications

pH = 5.5 – 6.0

Viscosity = 15,000 – 20,000 cps

Cosmetic Chemistry Quiz

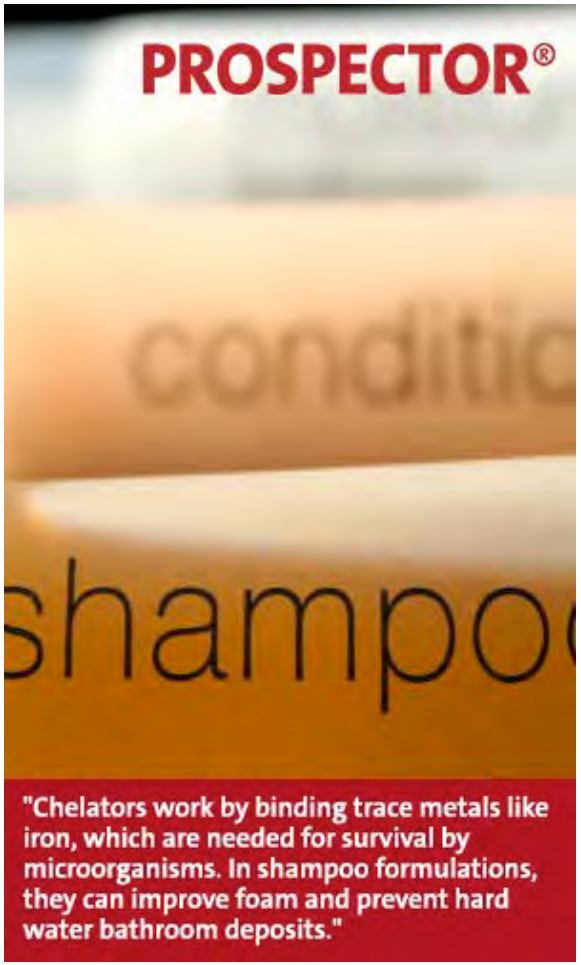
Which one is the FAKE beauty gadget?

- Ceramic unipolar magnet that controls acne
- Wand that shoots oxygen into your skin to smooth, tone & stimulate
- Hand held laser that makes your hair grow
- Electronic headband that relaxes muscles to remove wrinkles

Creating Cosmetic Formulas

Sources for Starting Formulas

- Patents
- Books
  - Harry's Cosmeticology
- Chemical suppliers
  - Prospector.com
- Trade journals
  - Happi.com
- Colleagues
- Ingredient lists – LOIs



Getting information from patents

- Google patents
- Sections of patent
- Finding formulas
- Finding testing ideas
- Working around patents

Relevant Parts of a patent

- Title / Abstract
- Background – good historical info here
- Summary / Description – Good background
- Claims – Most important
  - Gives details %, ingredients, etc.
- Examples – The formulas, tests

Using Ingredient Lists as Starting Formulas

- Look at the LOI of competitive products
- Sources of LOI and claims information
  - http://drugstore.com
  - http://ulta.com
- Use the 1% line exercise to guess at formula

CeraVe Moisturizing Cream 16 oz (453 g)

★★★★★ (577) read reviews | write a review

Like 190 people like this. Be the first of your friends.

+1 4

suggested: ~~$15.79~~ in stock

our price: $14.99

save 5%

select quantity: 1

add to bag

save to your list™ »

view larger image

see more from CeraVe

product details | **ingredients** | reviews | directions

Water (Purified), Glycerin, Ceteareth 20, Capric/Caprylic Stearic Triglyceride, Behentrimonium Methylsulfate/Cetearyl Alcohol, Cetearyl Alcohol, Ceramide 3, Ceramide 6 11, Ceramide 1, Hyaluronic Acid, Cholesterol, Petrolatum, Dimethicone, Potassium Phosphate, Dipotassium Phosphate, Sodium Lauroyl Lactylate, Disodium EDTA, Phenoxyethanol, Methylparaben, Propylparaben, Phytosphingosine, Carbomer, Xanthan Gum

How to read cosmetic ingredient lists

- Ingredient Labeling
- Legal requirement
- Use standardized names (INCI)
- Proper order
  - In order above 1%
  - Below 1% is mostly arbitrary (colors at the end)

Ingredient listing tips

- Fragrance is rarely over 1%
- Adjustment ingredients are low
- Natural sounding ingredients are usually below 1%
- Ingredients over 1% are most important in the formula

Ingredient list example

- Identify formula type
- Guess the 1% line
- Identify key ingredients, guess at % levels
- Ignore below 1% ingredients in first formula efforts

Ingredient list example
Skin lotion

Water, Safflower Seed Oil, Glyceryl Stearate, Glycerin, Jojoba Seed Oil, Borage Seed Oil, Cetyl Alcohol, Vitamin E Acetate, Dimethicone, Aloe Vera Gel, Shea Butter, Sodium Ascorbyl Phosphate (Vitamin C), Phenoxyethanol, L Ergothioneine, Ethylhexyl Glycerin

Possible Starting Formula

• Water	86.0
• Safflower Seed Oil	5.0
• Glyceryl Stearate	3.0
• Glycerin	3.0
• Jojoba Seed Oil	1.0
• Borage Seed Oil	1.0
• Cetyl Alcohol	1.0
• Preservative	qs

Where is the 1% line?

- Hair Shampoo formula
  - Water, Ammonium Lauryl Sulfate, Ammonium Laureth Sulfate, Sodium Chloride, Cocoamide MEA, Glycol Distearate, Dimethicone, Ammonium Xylenesulfonate, Vanilla Planifolia Fruit Extract, Cocos Nucifera Milk Coconut, Fragrance, Cetyl Alcohol, Polyquaternium-10, Sodium Citrate, Sodium Benzoate, Disodium EDTA, PEG-7M, Citric Acid, Propylene Glycol, Methylchloroisothiazolinone, Methylisothiazolinone, Blue No. 1

Possible Starting Formula

• Water	77.9
• Ammonium Lauryl Sulfate	8.0
• Ammonium Laureth Sulfate	7.0
• Sodium Chloride	1.8
• Cocoamide MEA	1.8
• Glycol Distearate	1.5
• Dimethicone	1.0
• Ammonium Xylenesulfonate	1.0
• Preservative	qs

Where is the 1% line?

- Hair Conditioner formula
  - Water (aqua), Cetearyl Alcohol, Glycerin, Cyclomethicone, Behentrimonium Methosulfate, Behentrimonium Chloride, Cetyl Alcohol, Wheat Germ Oil (triticum vulgare), Hydrolyzed Silk, Panthenol, Tocopheryl Acetate, Jojoba Oil (buxus chinensis), Aloe Barbadensis Leaf Juice, Fragrance, Propylene Glycol, Methylparaben, Propylparaben, Diazolidinyl Urea, Citric Acid, Red 33, Blue 1

Possible Starting Formula

• Water	87.0
• Cetearyl Alcohol	5.0
• Glycerin	3.0
• Cyclomethicone	2.0
• Behentrimonium Methosulfate	1.0
• Behentrimonium Chloride	1.0
• Cetyl Alcohol	1.0

Use Knock-out Experiments

- Objective: To figure out the function & effect of ingredients in a formulation

- Procedure:
  - Create a series of formulas substituting main solvent for one ingredient
  - Evaluate effect on specification tests, stability, performance

Knock-out Example

Formula Name: **Bubble Bath**

	Ingredient	%	Control Amount	Test A	Test B	Test C	Test D	Test E	Test F	Test G	Test H	Test I	Test J
1	Water	64.50	322.50	324.50	337.5	323.00	387.50	397.5	325.00	332.50	325.00	325.00	325.00
2	Polyquaternium 10	0.40	2.00	-	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
3	Glycerin	3.00	15.00	15.00	-	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
4	Tetrasodium EDTA	0.10	0.50	0.50	0.50	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50
5	Ammonium Lauryl Sulfate (28%)	13.00	65.00	65.00	65.00	65.00	-	65.00	65.00	65.00	65.00	65.00	65.00
6	Ammonium Laureth Sulfate (25%)	15.00	75.00	75.00	75.00	75.00	75.00	-	75.00	75.00	75.00	75.00	75.00
7	PEG 5 Cocamide	0.50	2.50	2.50	2.50	2.50	2.50	2.50	-	2.50	2.50	2.50	2.50
8	Cocamidopropyl Betaine	2.00	10.00	10.00	10.00	10.00	10.00	10.00	10	-	10	10	10.00
9	Citric Acid	0.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	-	2.50	2.50
10	DMDM Hydantoin	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	2.50
11	Fragrance (Parfum)	0.80	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	-
	TOTAL	100.000											

Knock-out Experiment shortcuts

- Ingredients you don’t have to knockout
- Dyes
- Feature ingredients
- Preservatives

Knock-out Experiment Example 2

	Formula Name			Batch size	
	Intensive Cream	Oil in Water		500	grams

	Purpose	INGREDIENT	%	Amt. In Batch	Phase
1	Diluent	Water	70.470	352.35	w
2	Dye	Blue No 2	0.044	0.22	w
3	Thickener	Carbomer (2%)	5.000	25.00	w
4	Humectant	Glycerin	5.000	25.00	w
5	Preservative	Methylparaben	0.100	0.50	w
6	Neutralizer	Triethanolamine	0.900	4.50	w
7	Coemulsifier	Cetyl Alcohol	2.000	10.00	o
8	Emulsifier	Stearic Acid	0.800	4.00	o
9	Emulsifier	Glyceryl Stearate SE	2.000	10.00	o
10	Preservative	Propylparaben	0.050	0.25	o
11	Occlusive	Petrolatum	3.000	15.00	o
12	Occlusive	Mineral oil	10.000	50.00	o
13	Feature	Silk Protein	0.100	0.50	m
14	Feature	Aloe Vera gel	0.080	0.40	m
15	Fragrance	Fragrance	0.500	2.50	m
		TOTAL	100.044	500.22	

Knock-out Experiment Example 2

Formula Name	
Intensive Cream	Oil in Water

	Purpose	INGREDIENT	Control	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Diluent	Water	70.426	70.47	75.43	75.43	70.53	71.33	72.43	71.23	72.43	70.48	73.43	80.43	70.53	70.51	70.93
2	Dye	Blue No 2	0.044	-	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
3	Thickener	Carbomer (2%)	5.000	5.00	-	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
4	Humectant	Glycerin	5.000	5.00	5.00	-	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5	Preservative	Methylparaben	0.100	0.10	0.10	0.10	-	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
6	Neutralizer	Triethanolamine	0.900	0.90	0.90	0.90	0.90	-	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
7	Coemulsifier	Cetyl Alcohol	2.000	2.00	2.00	2.00	2.00	2.00	-	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
8	Emulsifier	Stearic Acid	0.800	0.80	0.80	0.80	0.80	0.80	0.80	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
9	Emulsifier	Glyceryl Stearate SE	2.000	2.00	2.00	2.00	2.00	2.00	2.00	2.00	-	2.00	2.00	2.00	2.00	2.00	2.00
10	Preservative	Propylparaben	0.050	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	-	0.05	0.05	0.05	0.05	0.05
11	Occlusive	Petrolatum	3.000	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	-	3.00	3.00	3.00	3.00
12	Occlusive	Mineral oil	10.000	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	-	10.00	10.00	10.00
13	Feature	Silk Protein	0.100	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-	0.10	0.10
14	Feature	Aloe Vera gel	0.080	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	-	0.08
15	Fragrance	Fragrance	0.500	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-
		TOTAL	100.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

15 batches total

Knock-out Experiment Simplified

	Formula Name										
	Intensive Cream	Oil in Water									
	Purpose	INGREDIENT	Control	B	C	E	F	G	H	J	K	N
1	Diluent	Water	70.426	75.43	75.43	71.33	72.43	71.23	72.43	73.43	80.43	70.93
2	Dye	Blue No 2	0.044	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
3	Thickener	Carbomer (2%)	5.000	-	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
4	Humectant	Glycerin	5.000	5.00	-	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5	Preservative	Methylparaben	0.100	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
6	Neutralizer	Triethanolamine	0.900	0.90	0.90	-	0.90	0.90	0.90	0.90	0.90	0.90
7	Coemulsifier	Cetyl Alcohol	2.000	2.00	2.00	2.00	-	2.00	2.00	2.00	2.00	2.00
8	Emulsifier	Stearic Acid	0.800	0.80	0.80	0.80	0.80	-	0.80	0.80	0.80	0.80
9	Emulsifier	Glyceryl Stearate SE	2.000	2.00	2.00	2.00	2.00	2.00	-	2.00	2.00	2.00
10	Preservative	Propylparaben	0.050	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
11	Occlusive	Petrolatum	3.000	3.00	3.00	3.00	3.00	3.00	3.00	-	3.00	3.00
12	Occlusive	Mineral oil	10.000	10.00	10.00	10.00	10.00	10.00	10.00	10.00	-	10.00
13	Feature	Silk Protein	0.100	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
14	Feature	Aloe Vera gel	0.080	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
15	Fragrance	Fragrance	0.500	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-
		TOTAL	100.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

10 batches total

Knockout experiment Case Study

- Test a shampoo formula
- See what you can learn from the study
- Things to test
- Specification
  - pH
  - Viscosity
- Performance
  - Foam
  - Conditioning

Knockout experiment Case Study

	Formula Name		Batch size						
	Basic Clear Cleansing Shampoo		500	grams					
	INGREDIENT	%	Control	A	B	C	D	E	F
1	Water	38.800	194.00	394.00	244.00	209.00	219.00	204.00	199.00
2	Sodium Laureth Sulfate	40.000	200.00	-	200.00	200.00	200.00	200.00	200.00
3	Sodium Lauroylmethyltaurate	10.000	50.00	50.00	-	50.00	50.00	50.00	50.00
4	Cocamide DEA	3.000	15.00	15.00	15.00	-	15.00	15.00	15.00
5	Glycerin	5.000	25.00	25.00	25.00	25.00	-	25.00	25.00
6	Sodium Chloride	2.000	10.00	10.00	10.00	10.00	10.00	-	10.00
7	Fragrance	1.000	5.00	5.00	5.00	5.00	5.00	5.00	-
8	DMDM Hydantoin	0.200	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	Water	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL	100.000	500.00	500.00	500.00	500.00	500.00	500.00	500.00

Knockout Results

	pH	Viscosity	Foam
Control Formula	5.5	9000	8
Sodium Lauryl Sulfate	6.0	4000	3
Sodium Laurylmethosulfate	5.7	6000	4
Sodium Chloride	5.5	500	8
Cocoamide DEA	4.8	2000	5
Glycerin	5.4	9000	8
Fragrance	5.5	12000	10

Using Knockout Results

- pH is off…
  - Too high add SLS or SLMS
  - Too low add Cocamide DEA
- Viscosity is off…
  - Too high add fragrance
  - Too low can try SLS, SLMS, Salt, Cocamide DEA
- Foam is off…
  - Too low can try SLS, SLMS, Cocamide DEA

Knockout Limitations & DOE

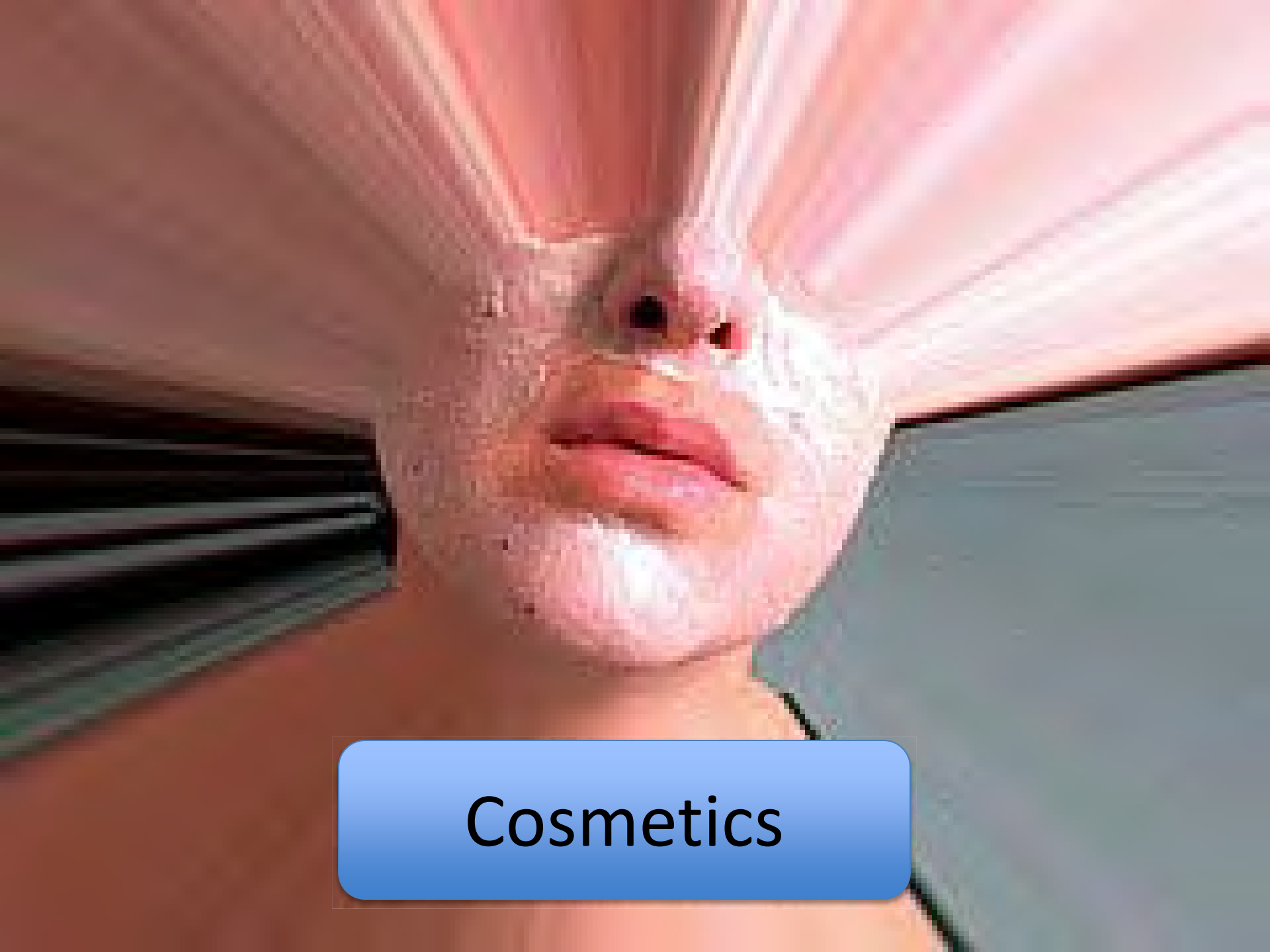
- Limitations
  - Too many batches to make
  - Miss synergistic effects
  - Results in unrealistic results
- DOE – Design of Experiment
  - More thorough study
  - Understand synergies between ingredients
  - Not as useful for cosmetics

Morning Session Summary

- Introduction to cosmetics
- Review of cosmetic ingredients
- Review of cosmetic formulation types
- Beginning steps in creating new formulas

- This afternoon will focus on creating more optimal formulations


Questions?

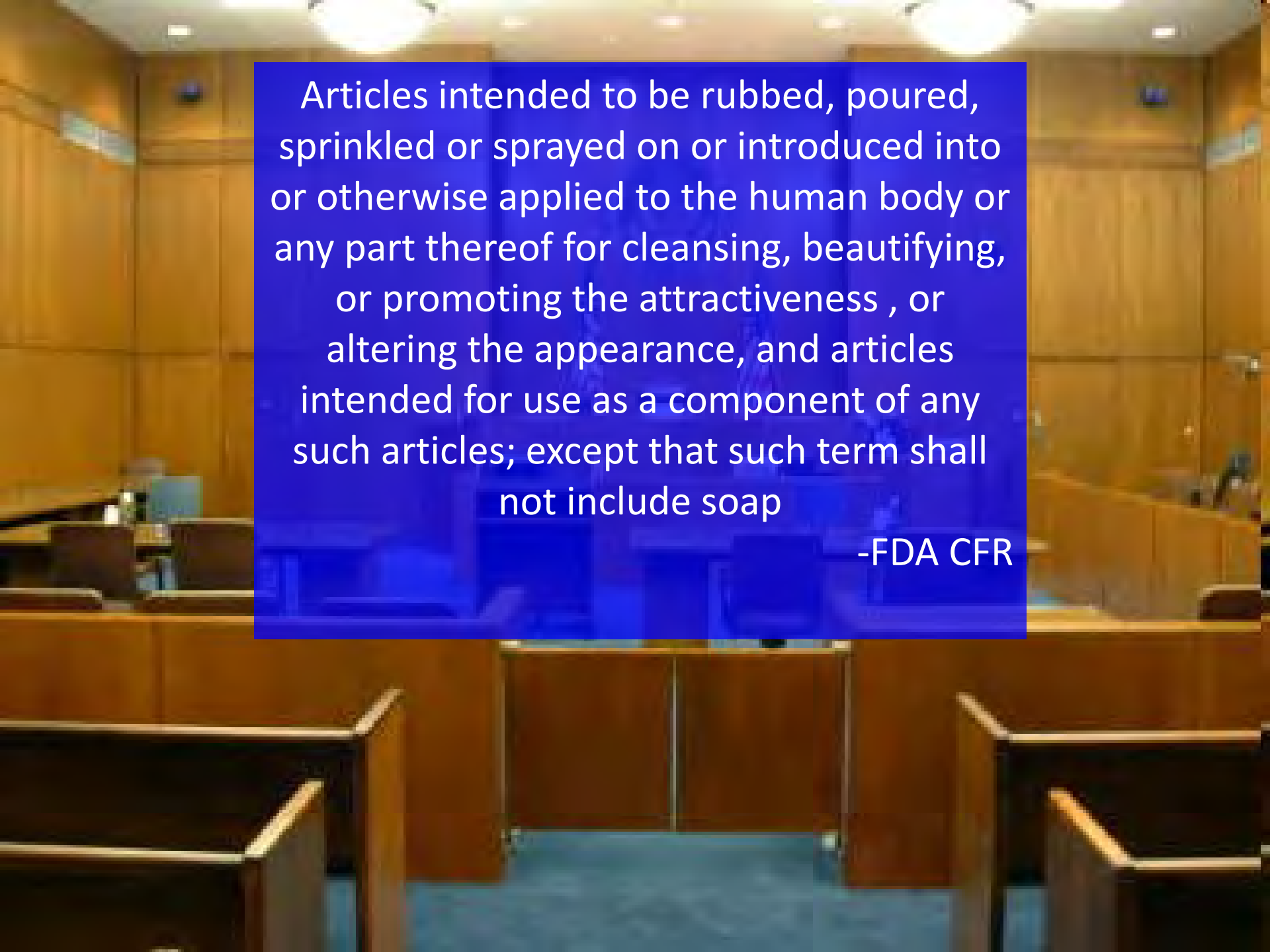

Cosmetics

Purposes of Cosmetics

- Improve your…

- Appearence
- Skin Feel
- Odor


What are
Cosmetics?


Articles intended to be rubbed, poured, sprinkled or sprayed on or introduced into or otherwise applied to the human body or any part thereof for cleansing, beautifying, or promoting the attractiveness , or altering the appearance, and articles intended for use as a component of any such articles; except that such term shall not include soap
-FDA CFR


Skin
Products

Perfume & Fragrances

Oral care Products

Cosmetics aren’t drugs

- Drugs = Treat disease

- Cosmetics = Improve appearance

  Can't interfere with metabolism

International Regulatory bodies

- European Commission
- Health Canada
- Ministry of Health (Japan)
- Department of Health & Ageing (Australia)
- CFDA - China

General Problems addressed by cosmetics

- Appearance
- Feel
- Smell

Top 10 skin problems

1. Dry itchy skin
2. Wrinkles
3. Acne
4. Sagging Skin
5. Age spots
6. Skin lightening
7. Tattoo removal
8. Eczema / Dermatitis
9. Psoriasis
10. Cellulite

Strategies for Improving Appearance

- Remove dirt from surface
  - Cleansing products
- Change the surface
  - Exfoliating products
- Leave color behind
  - Make-up
- Change color of surface
  - Self tanning products

Strategies for Improving Feel

- Materials that make skin & hair feel better
  - Oils and emollients
- Water attracting compounds
  - Moisturizers
- Conditioning products
  - Film forming material

Strategies for Improving Odor

- Clean odor materials off body
- Cover odors with fragrance
- Kill microbes that cause odor


Greenwashing

Natural has no legal definition

Major US Natural Standards Groups

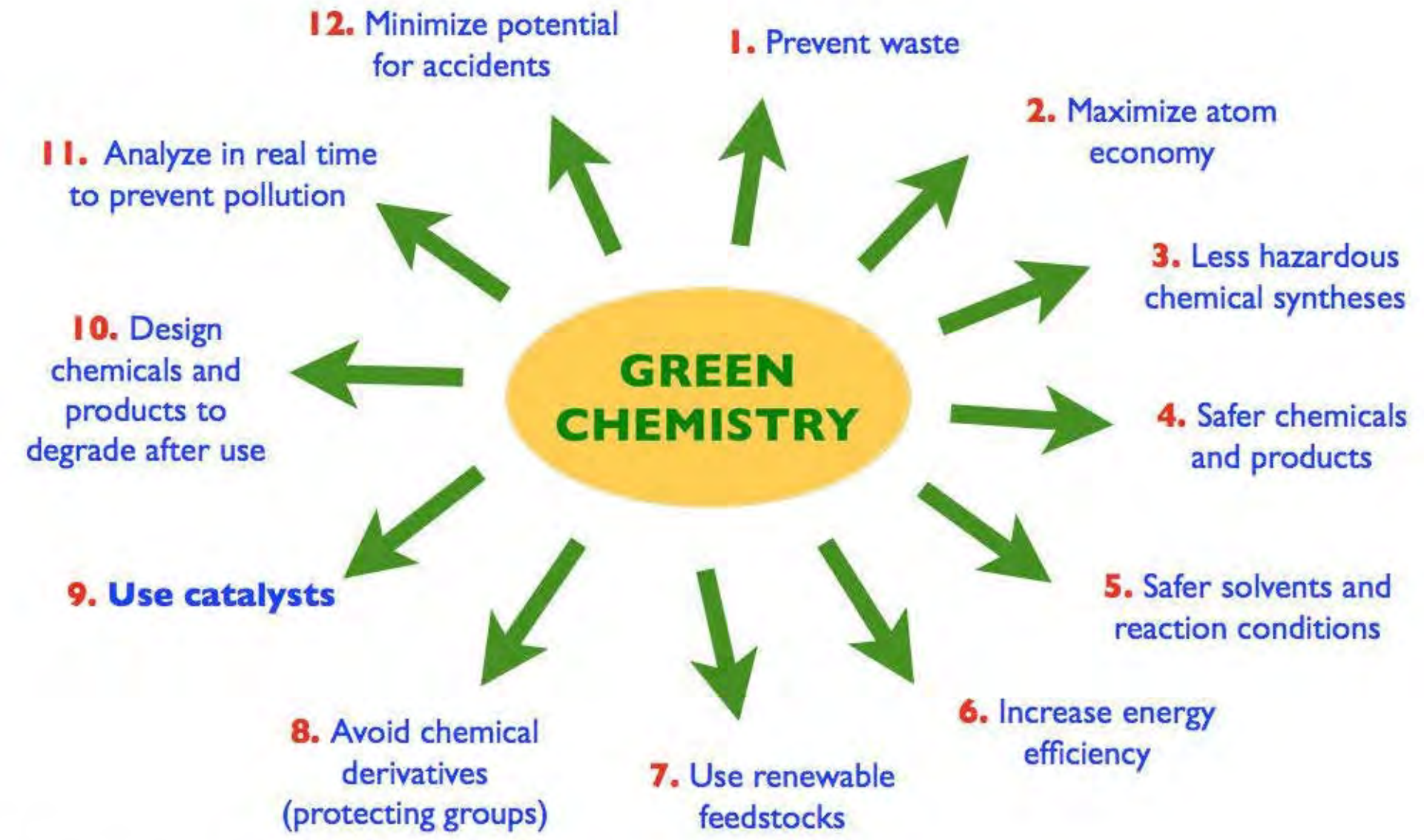
- USDA
- National Sanitation Foundation
- National Product Association
- OASIS

International Natural Standards

COSMOS Standards

- Promote organic agriculture
- Use natural resources
- Clean processing and manufacture
- “Precautionary Principle”
- Integrate Green Chemistry principles

Principles of Green Chemistry



Anastas and Warner (1998)

Common Standards

- Water is natural
- Mineral ingredients are natural
- Physically processed agro-materials are natural
- Some chemical processing of agro materials
- Some synthetics allowed

Some Prohibited Ingredients

- Parabens
- Formaldehyde Donors
- Petrolatum & petroleum derived
- Propylene glycols
- Sodium Lauryl Sulfate
- Ethanolamines
- Synthetic Silicones
- Synthetic Fragrances
- Synthetic Polymers
- EDTA

Some Chemistry Allowed

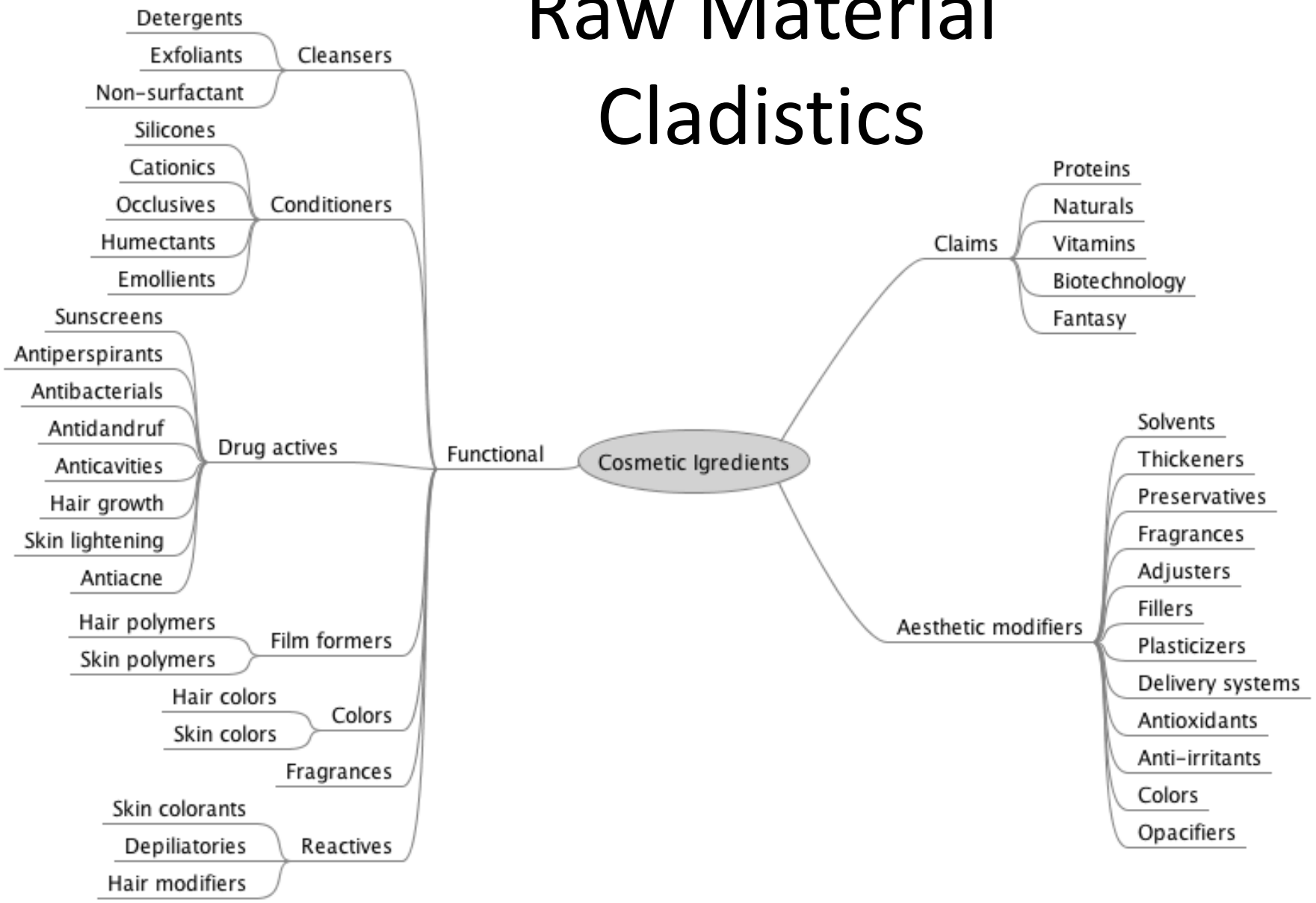
- Distillation
- Esterification & Etherification
- Expression
- Extraction
- Fat Splitting
- Fermentation
- Hydrogenation
- Protein Hydrolysis
- Saponification
- Sulfation – (no SLS)

Cosmetic Science Quiz

- Which ingredient is not in the top 10 most vilified cosmetic ingredients?
  - 1. Methyl Paraben
  - 2. Mineral Oil
  - 3. Titanium Dioxide
  - 4. Sodium Laureth Sulfate

Cosmetic Raw Materials

Raw Material Cladistics



Cosmetic Raw Materials

- Functional – Provide the product benefit
- Aesthetic – Improve the aesthetics of the functional ingredients
- Claims – Included to help sell the product

Functional Raw Materials

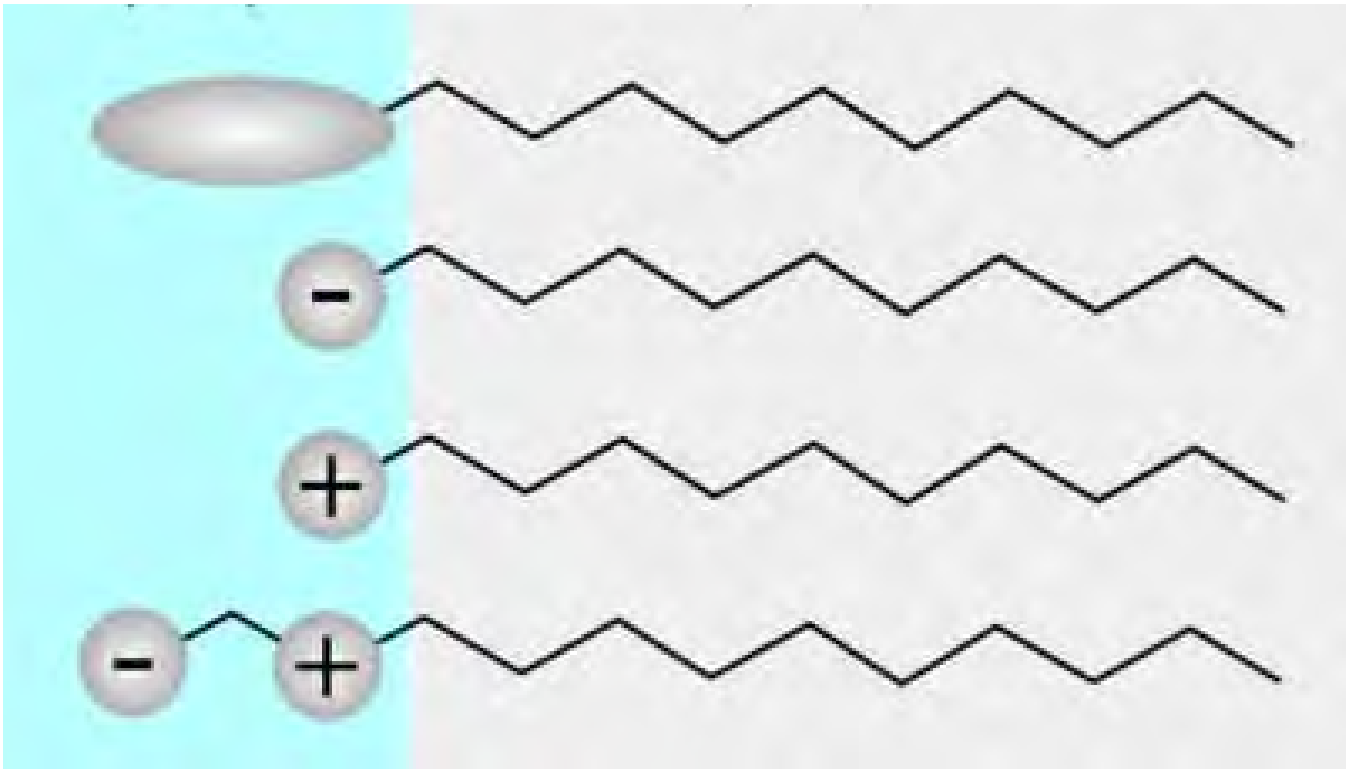
- Ingredients that make cosmetics work

- Cleansers
- Conditioners
- Film formers
- Drug actives
- Reactants
- Colorants
- Fragrances

Surfactants

Hydrophillic

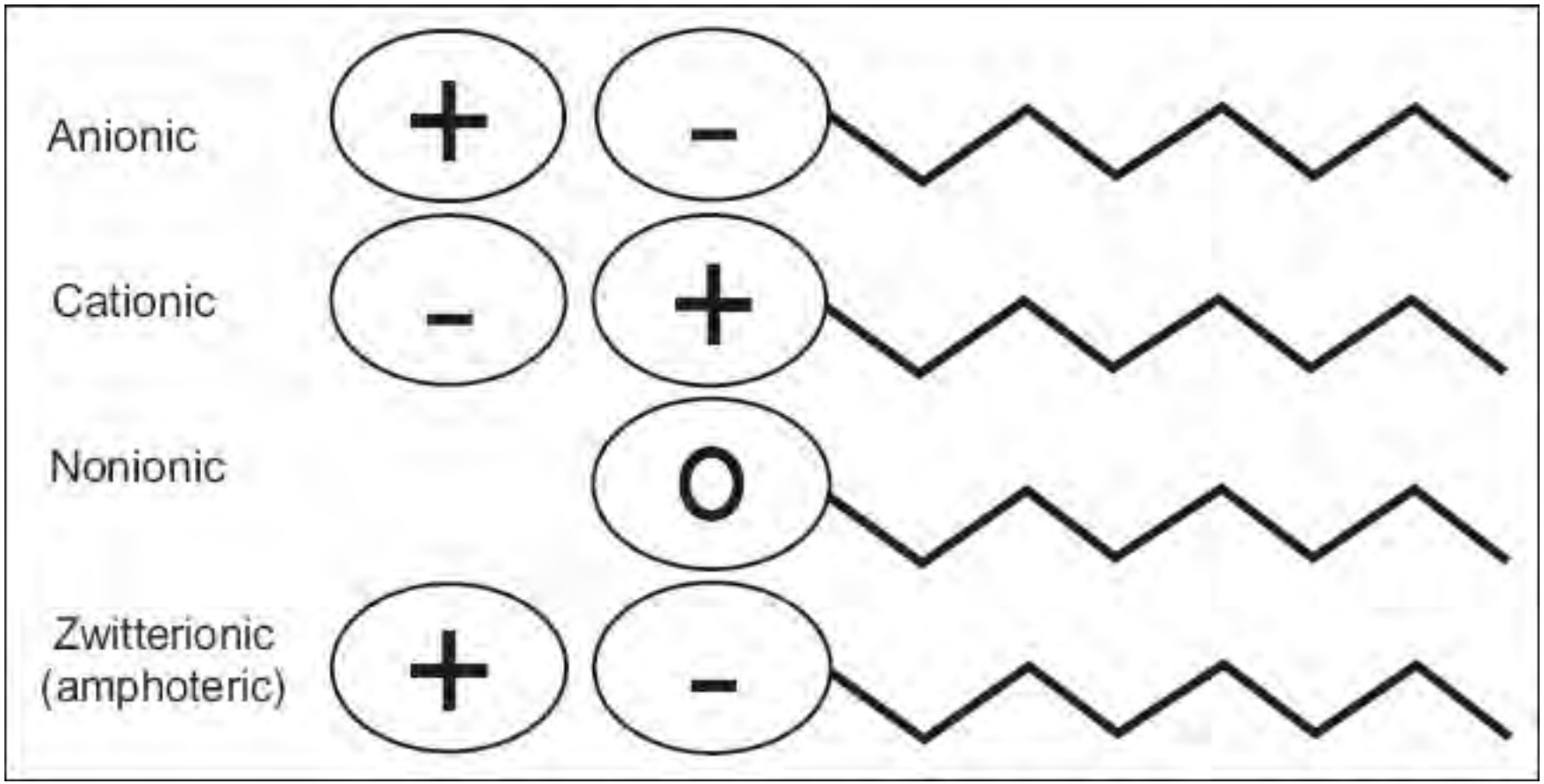
Lipophillic



Compatible With Water

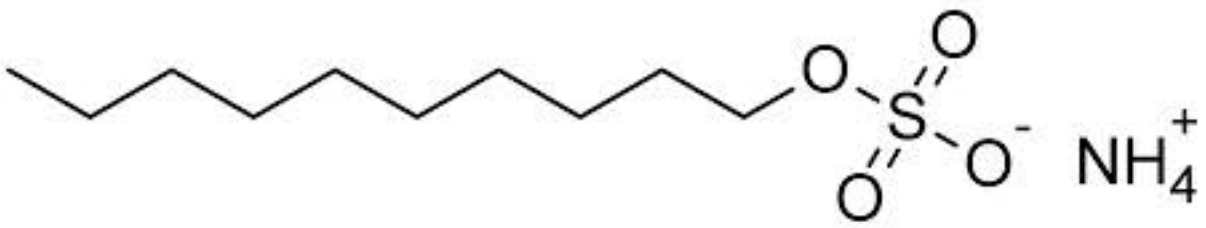
Compatible With Oil

Types of Surfactants



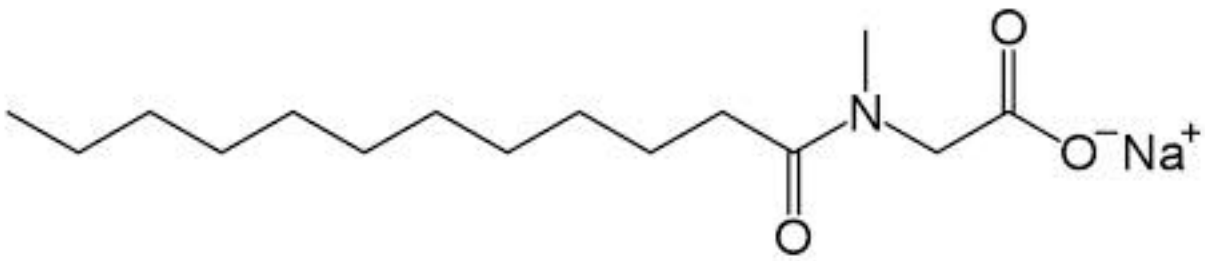
Anionic Surfactants

- These are the primary cleansing surfactants
- Alkyl Sulfates
  - Examples – SLS and ALS
- Alkyl Ether Sulfates - Ethoxylated
  - Example – SLES and ALES



Anionic Surfactants

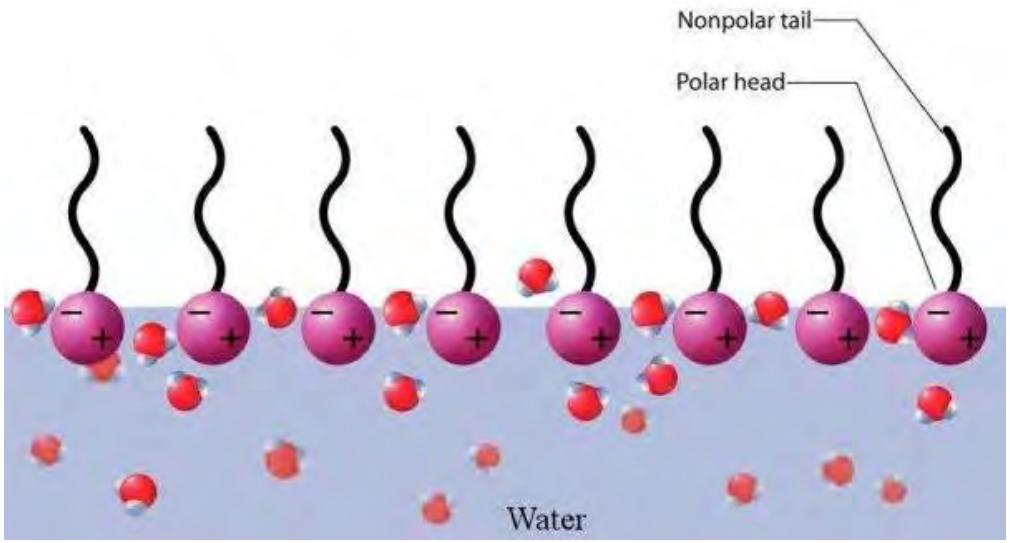
- Other types
  - Sulfosuccinates
  - Alkylbenzene Sulfonates
  - Acyl Methyltaurates
  - Acyl Sarcosinates
  - Acyl Isethionates
  - Acyl Polypeptide Condensates
  - Monoglyceride Sulfates
  - Fatty Glyceryl Ether Sulfonates



Sodium Lauryl Sarcosinate

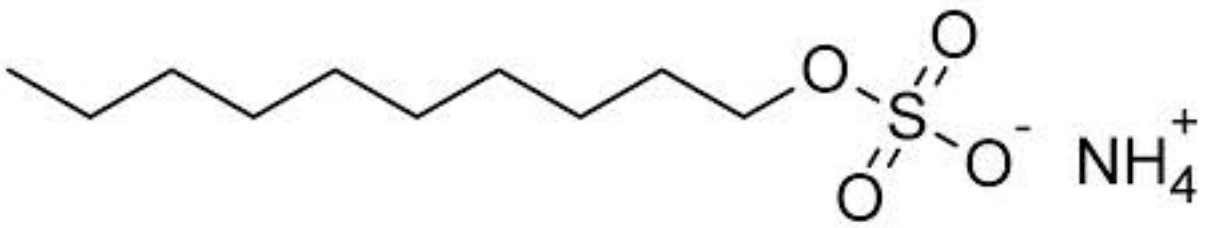
Anionics

- Why use them?
  - Excellent detergency
  - Relatively inexpensive
  - Good foaming
  - Highly stable
- Drawbacks
  - Can be irritating
  - Drying to hair



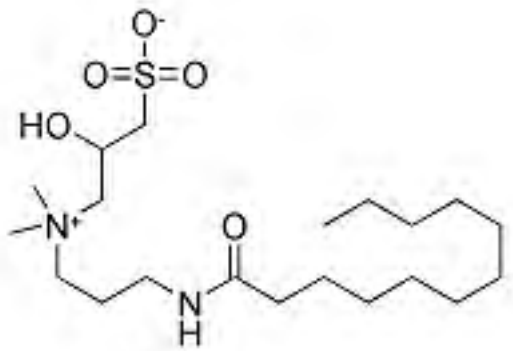
Sulfates and Naturals

- Unacceptable for cleansing surfactants for natural products
  - Sulfosuccinates
  - Sulfonates
  - Alkyl sulfates



What is used instead

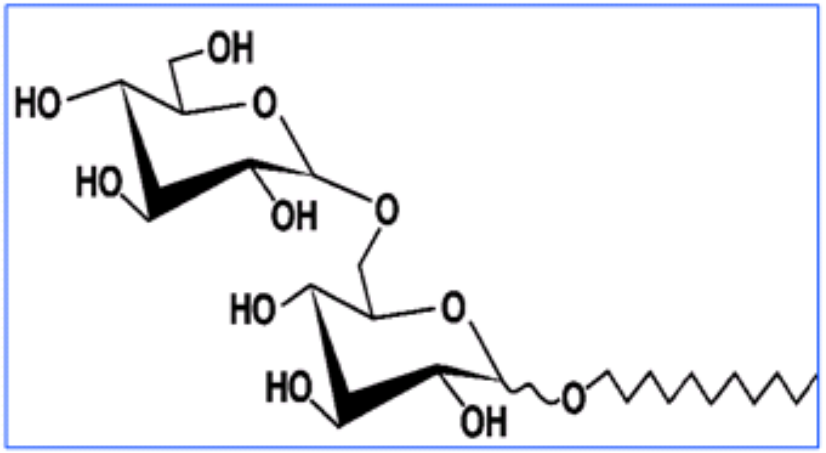
- Sultaines
  - Mild secondary surfactant, more stable and better viscosity builder
    - e.g. Cocamidopropyl Hydroxysultaine



- Acyl Sarcosinates
  - High foaming secondary surfactant
    - e.g. Sodium Lauryl Sarcosinate

Natural Surfactant Options

- Alkyl Polyglucoside
  - Natural primary surfactant derived from coconut and sugar
  - Does not build viscosity as well
  - Does not foam as well
  - Higher cost
  - e.g. Lauryl Glucoside



Saponin Glycosides

Parts of plants containing saponins are used as detergents.

For example;

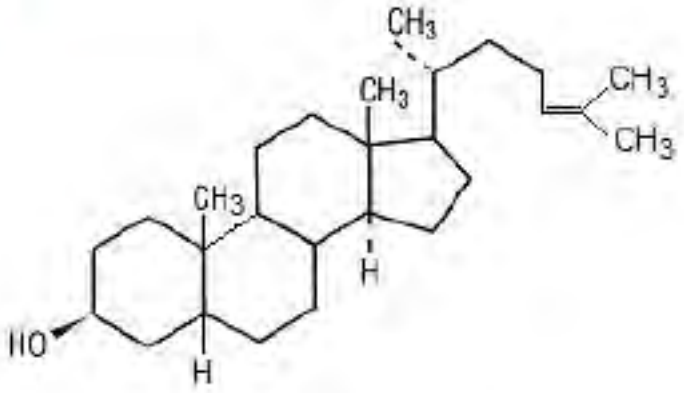
Root of Saponaria officinalis

Types:

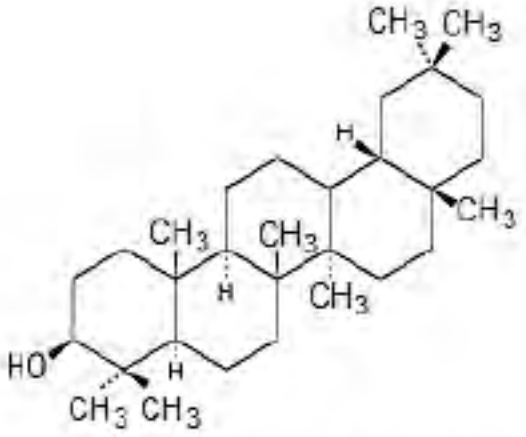
Aglycone may be of two types;

Steroidal

Tri terpenoidal



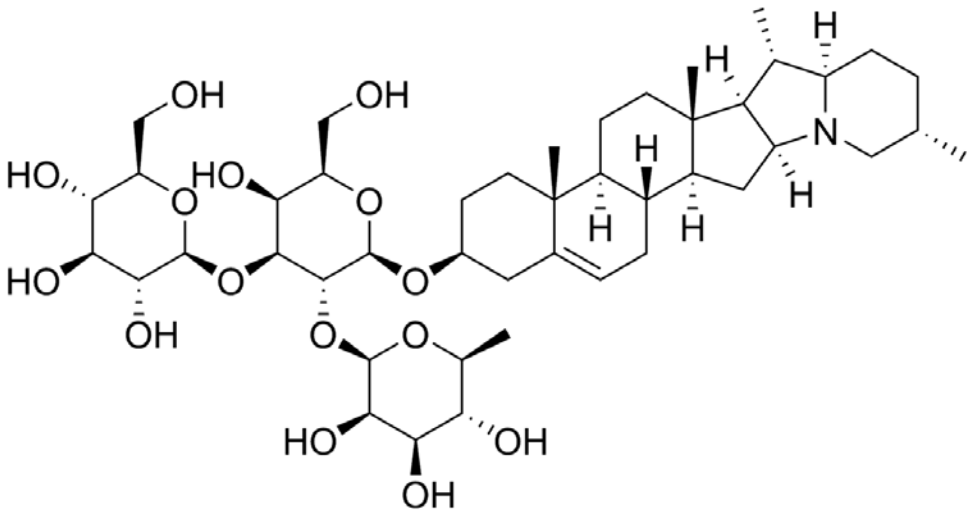
Steroidal skeleton



Tri-terpenoidal skeleton

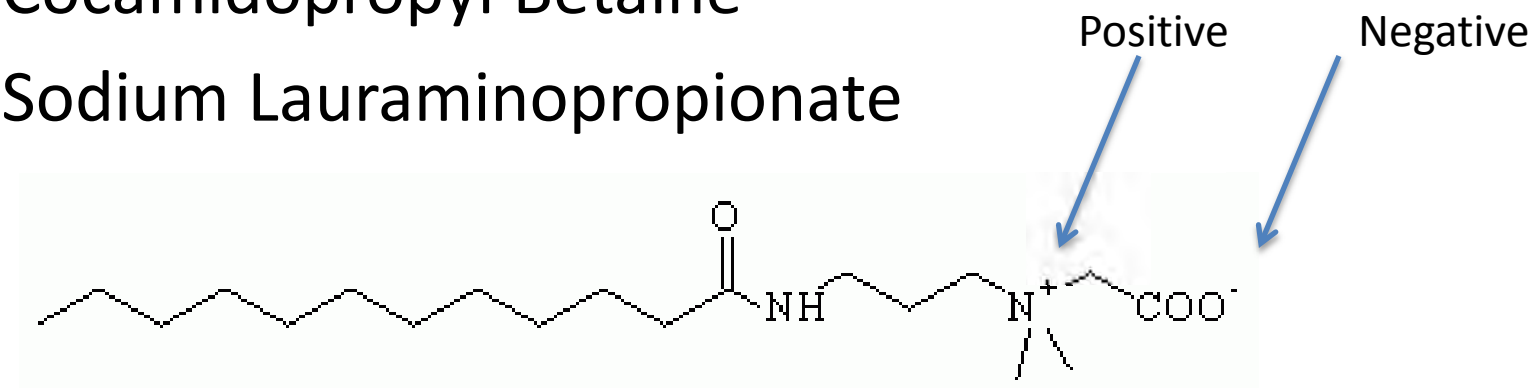
Natural Cleansing Surfactants

- Saponins – Cleansing Surfactants
- Source: plants – marine derived
  - Quillaja saponaria Molina
- Difficult to purify
- Too expensive
- Not as effective
- ~40% less foam
- Highly colored



Amphoteric Surfactants

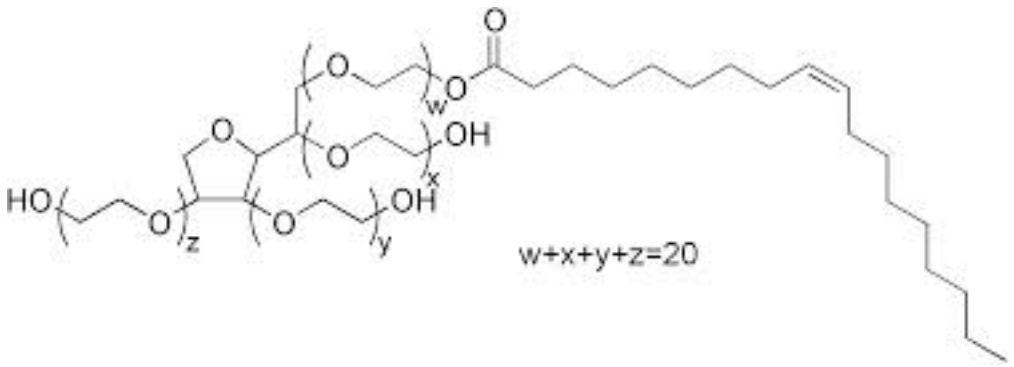
- Can have a positive or negative charge depending on the pH of the solution
  - Zwitterionic
- Types
  - Cocamidopropyl Betaine
  - Sodium Lauraminopropionate



Non Ionic Surfactants

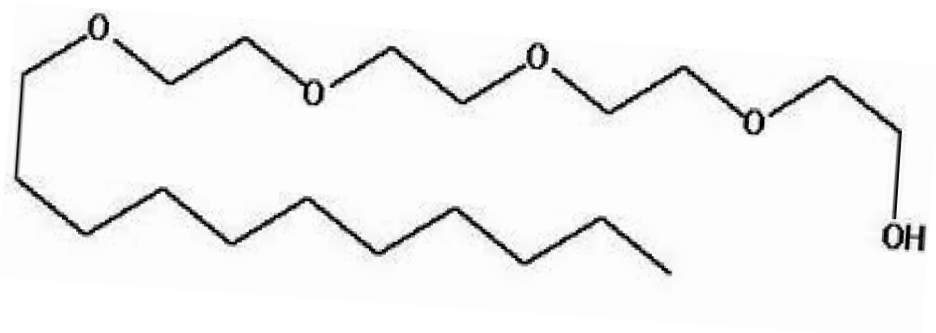
- Surfactant molecules with no charge

- Types
  - Fatty Alcohol
  - Fatty amines
    - Lauramide DEA
  - Amine Oxides
    - Lauramine Oxide
  - Polysorbates



Non Ionic Surfactants

- Why use them?
  - Foam enhancer
  - Reduce irritation
  - Conditioning effect
  - Solubilize fragrances
  - Emulsifiers



- Gentle Cleansers
  - PEG-80 Sorbitan Laurate

- Drawbacks
  - More expensive
  - Do not foam well on their own

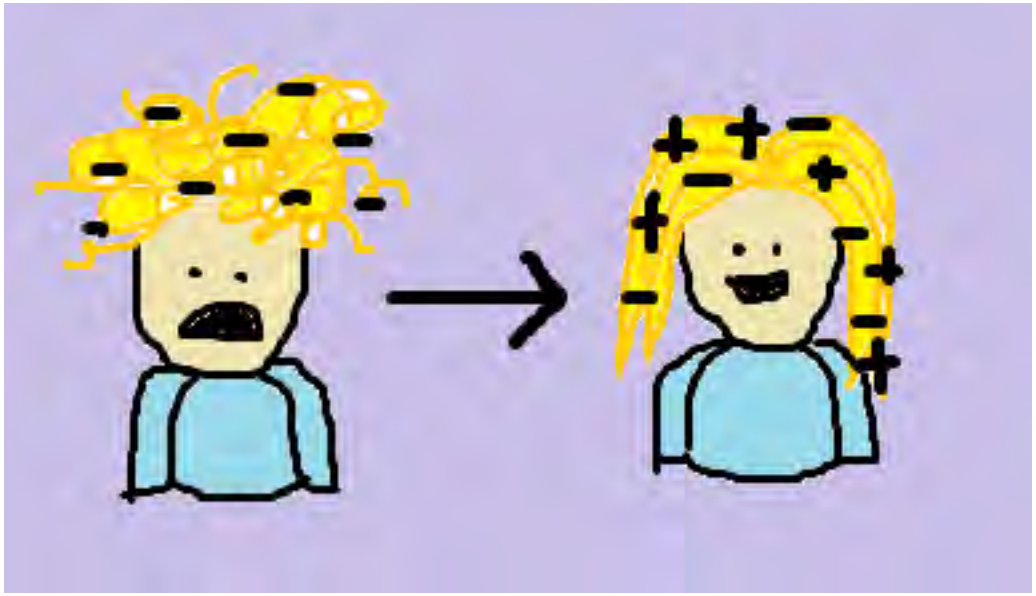
Functional Raw Materials
Conditioners & Moisturizers

Moisturizing Ingredients

- Quats
- Cationic Polymers
- Silicones
- Occlusives
- Humectants
- Emollients

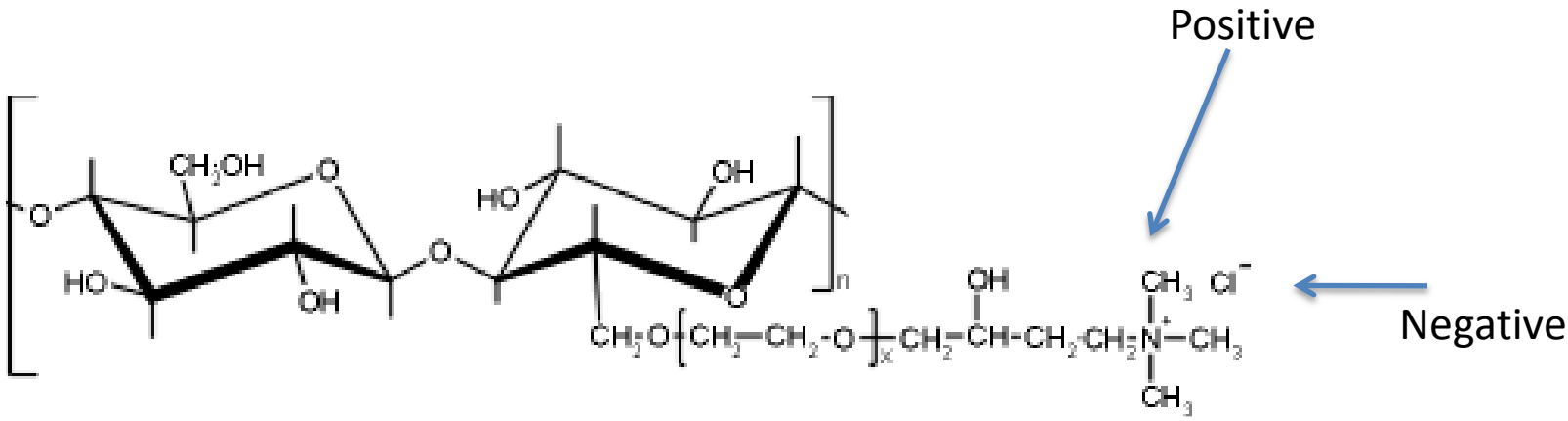
Quats

- How do they work?
  - Electrostatic Attraction
  - More damage = more substantivity
  - Longer chain length = more conditioning



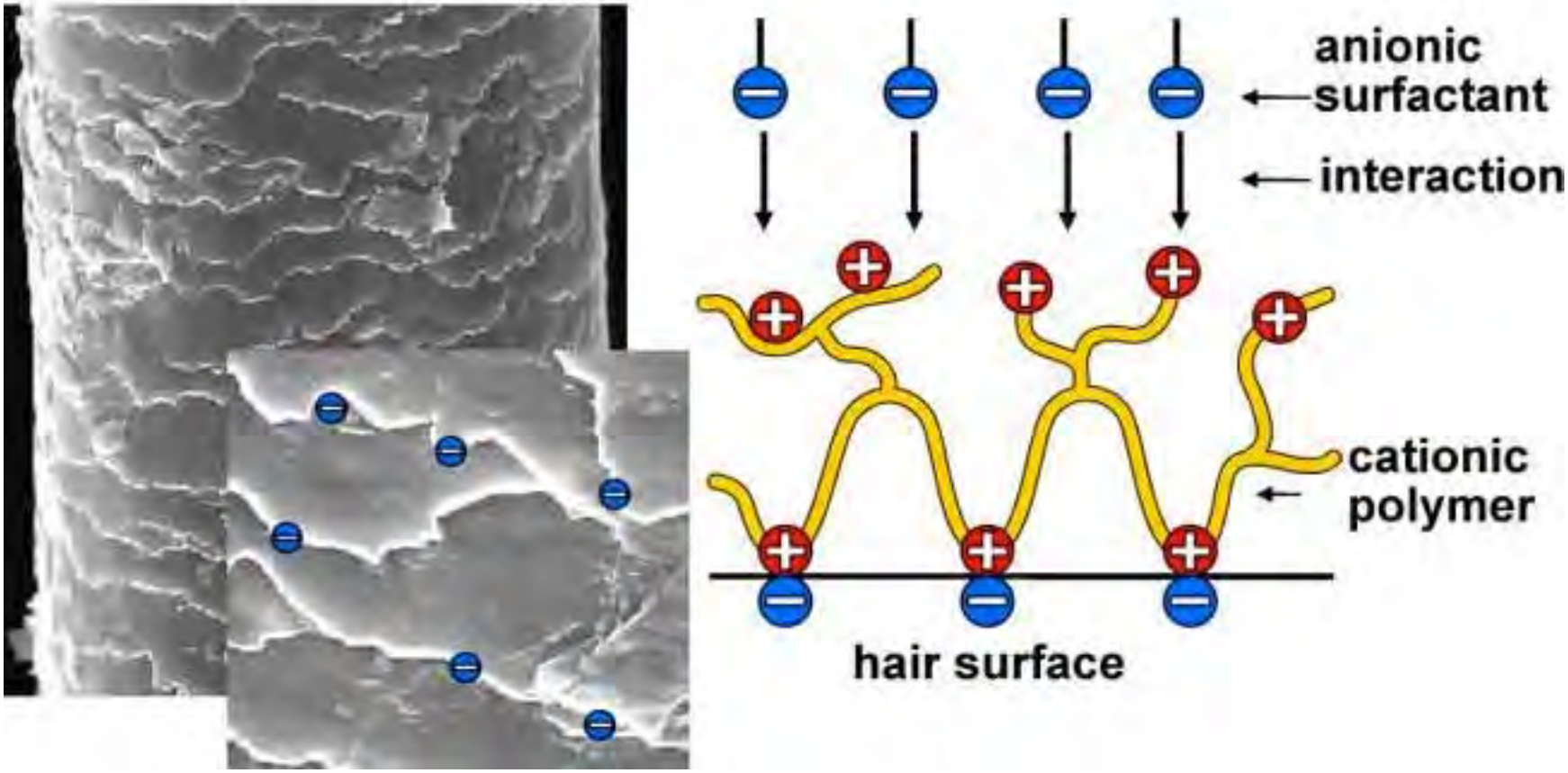
Cationic Polymers

- Common Examples
  - Polyquaternium 4
  - Polyquaternium 7
  - Polyquaternium 10
  - Guar Hydroxypropyltrimonium Chloride



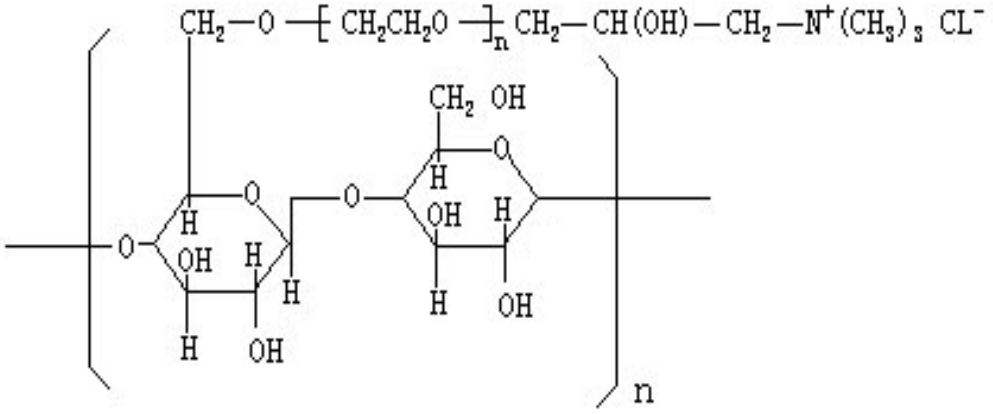
Cationic Polymers

Figure 1: Hair structure with cuticula
Polymer - Distribution of charge



Cationic Polymers

- Benefits
  - Effective at low levels
  - Compatible with anionics
- Drawbacks
  - Can build-up
- % Used if formula
  - Up to 5%
  - Usually 1% or less

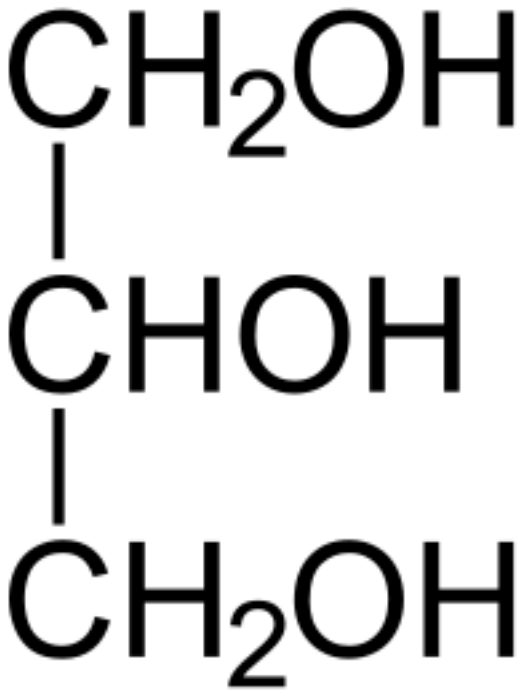


Silicones

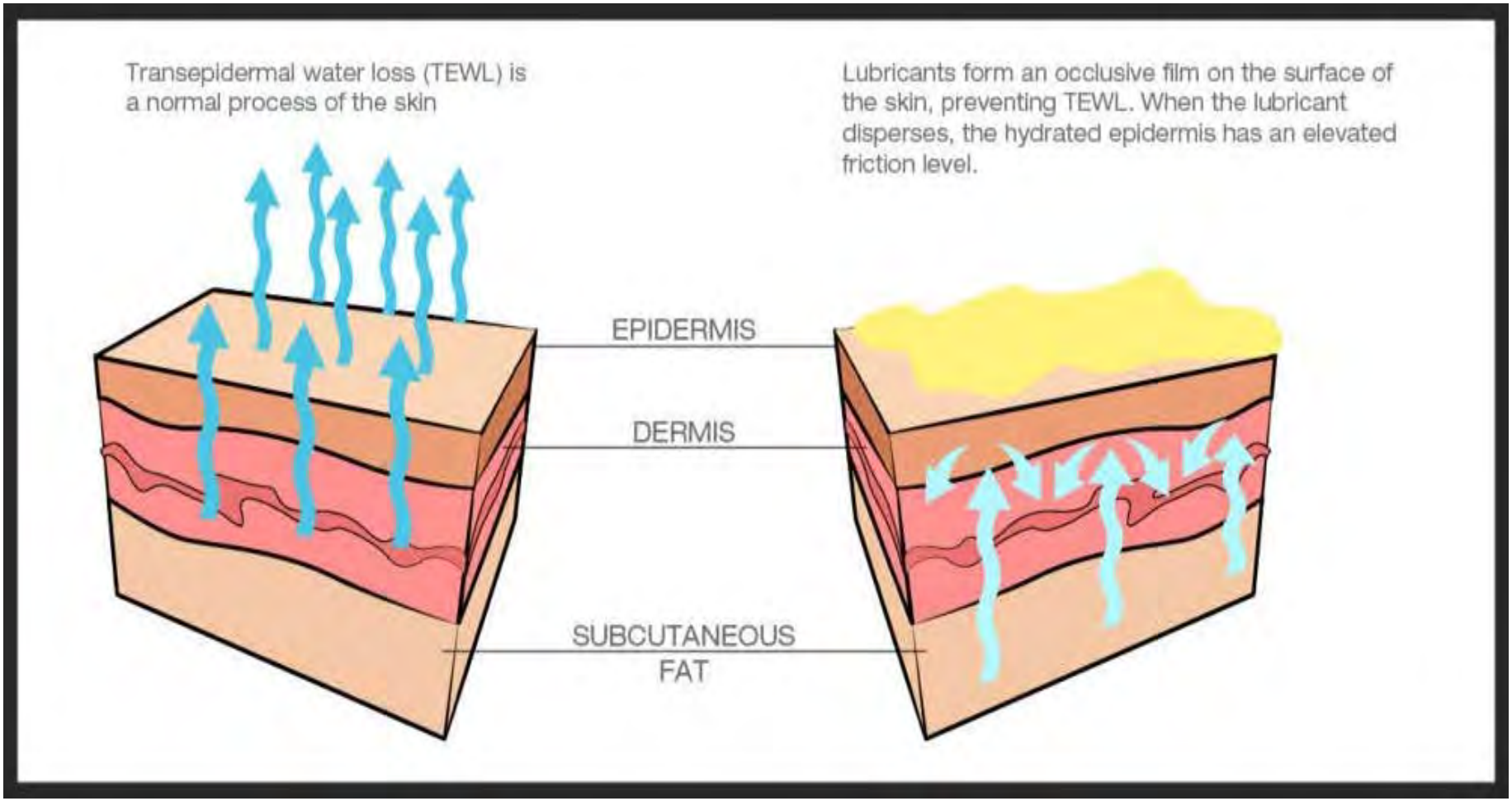
- Benefits
  - Increased shine
  - Increased lubricity
  - Works on undamaged hair
  - Synergistic with cationics
- Drawbacks
  - Build-up
  - Weigh down hair
- % Used if formula
  - Up to 2%

Humectants

- Ingredients that attract water
- Usually water soluble
  - Glycerin
  - Propylene Glycol
  - Sorbitol
  - Types of proteins
- Use level
  - 0.5% - 15.0%

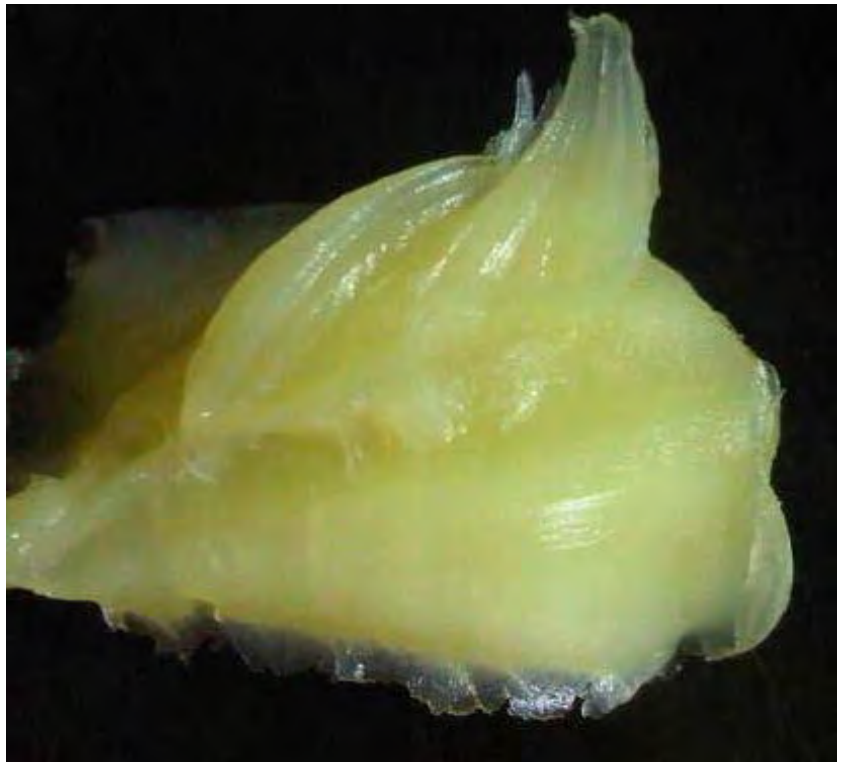


How Occlusives Work

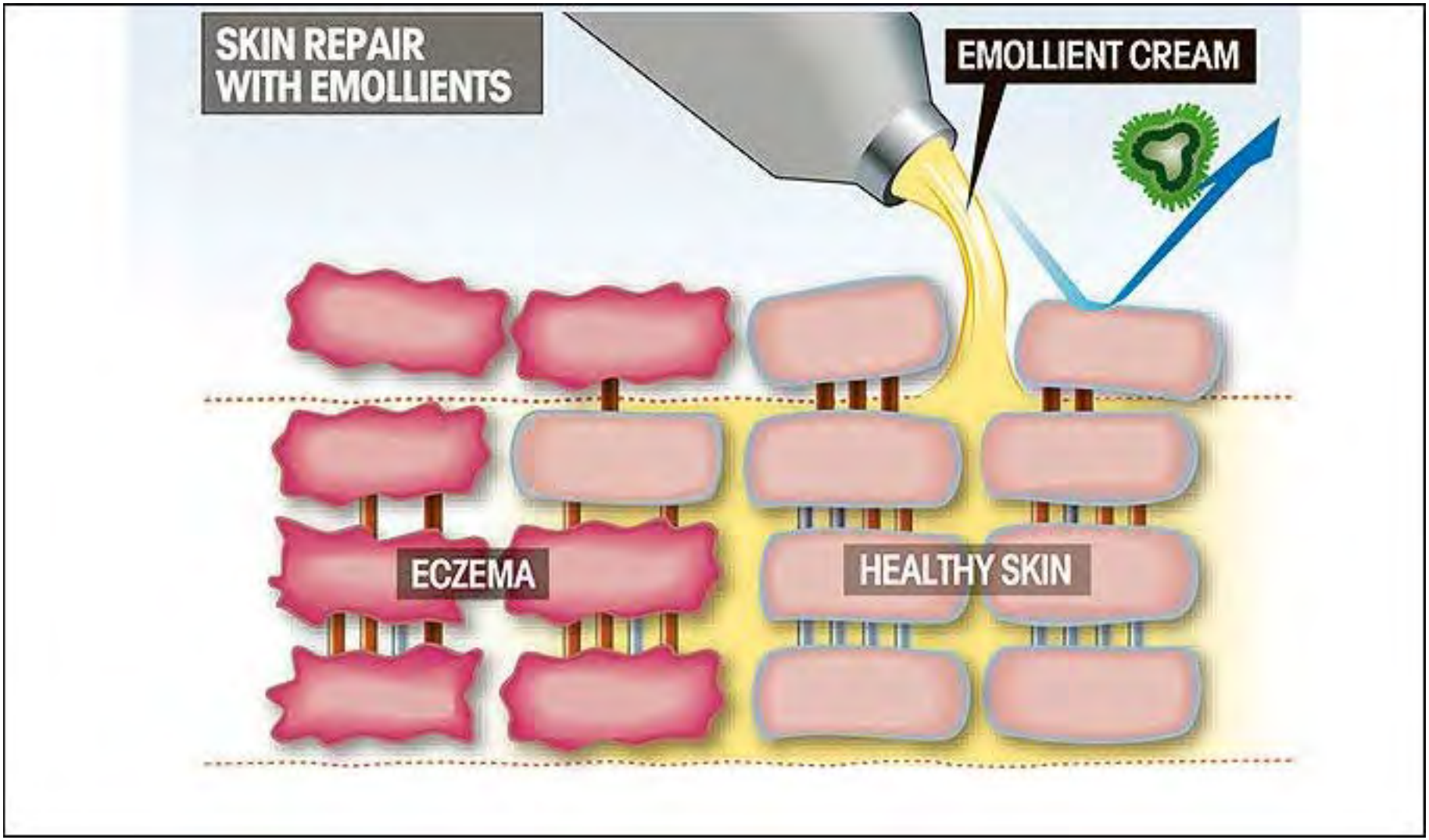


Occlusive Agents

- Water-insoluble materials
- Examples
  - Petrolatum
  - Mineral Oil
  - Dimethicone
- Use Level
  - 5% to 70%

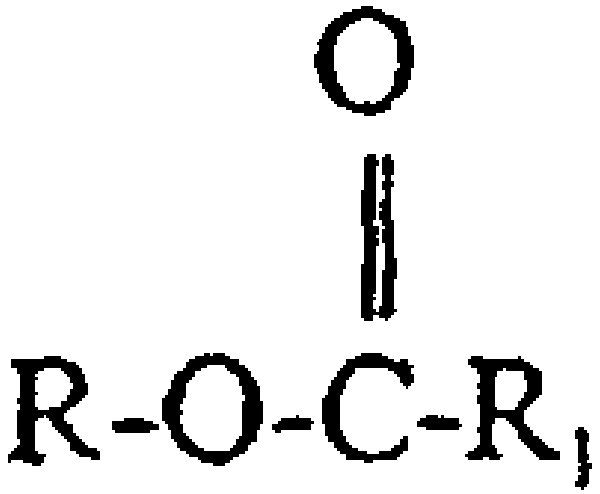


Emollients


SKIN REPAIR
WITH EMOLLIENTS
EMOLLIENT CREAM
ECZEMA
HEALTHY SKIN

Emollients

- Light coating on skin
- Used to improve feel
- Examples
  - Coconut oils
  - Almond oil
  - Esters
  - Silicones
- Use level
  - 5% - 25%



Functional Raw Materials
Active Ingredients

- Proven to have an effect on cells or fight disease
- Classified as OTC Drugs
  - FDA Monograph
  - In US & elsewhere

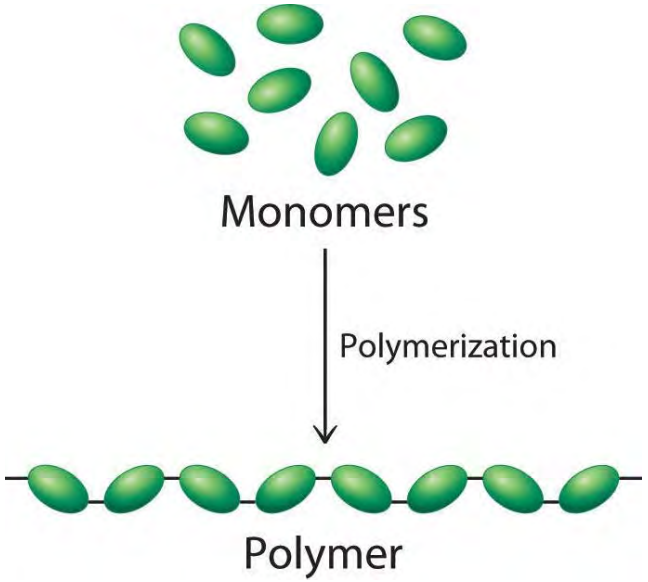
OTC “cosmetic” Active Ingredients

- Sunscreens
- Anti-acne
- Anti-perspirants
- Anti-dandruff
- Anti-cavity
- Anti-fungal
- Anti-microbial
- Hair growth
- Skin bleaching
- Wart Remover

Functional Raw Materials
Film Forming Polymers

- Polymers – Long chain molecules made up of repeating unit molecules (monomers)

- Wide range of uses
  - Thickeners
  - Conditioning / moisturizers
  - Hair colors
  - Styling polymers



Functional Raw Materials
Reactive Ingredients

- Ingredients that chemically react to produce an effect

- Hair colorants
- Relaxers
- Perms
- Sunless Tanners
- Depilatories

Cosmetic Chemistry Quiz

Which ingredient is NOT something you could possibly find in a cosmetic?

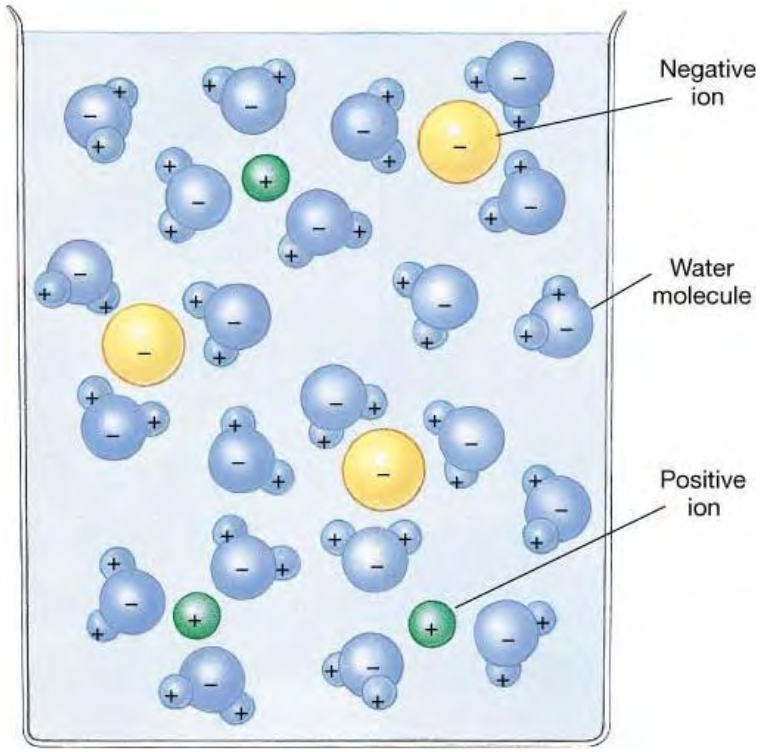
- Whale Vomit
- Sheep placenta
- Cow bone marrow
- Bull Semen

Aesthetic Raw Materials

- Solvents
- Emulsifiers
- Adjusters
- Preservatives
- Thickeners
- Fragrance
- Fillers
- Delivery Systems

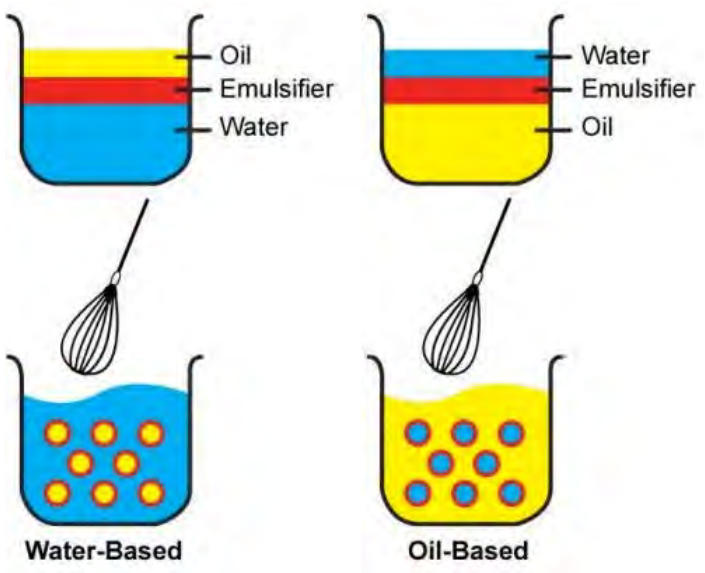
Solvents

- Ingredients that dilute functional ingredients
- Aid in delivery
- Low cost
- Non-reactive / Compatible
- Most common
  - Water
  - Alcohol
  - Mineral Oil
  - Propylene Glycol



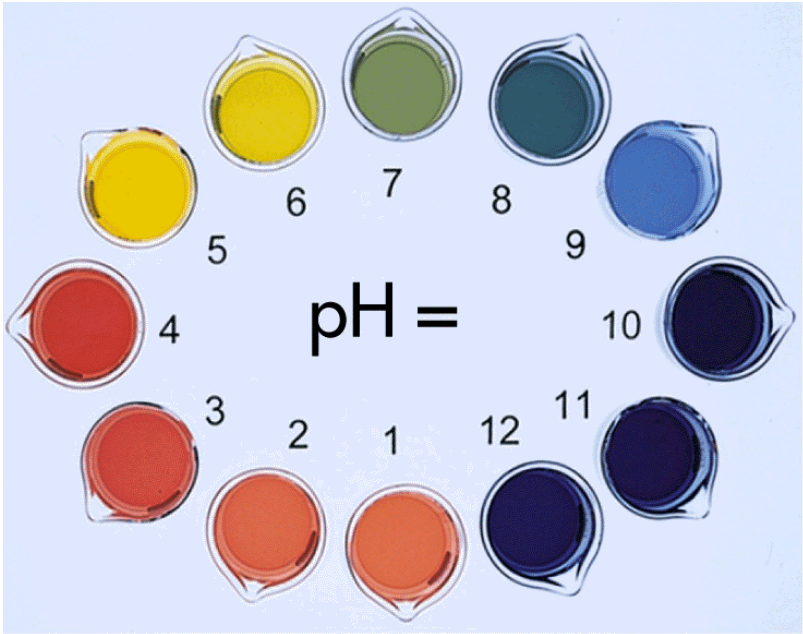
Emulsifiers

- Ingredients that create oil & water mixtures
- Basis for all creams & lotions
- Emulsions consist of
  - Internal phase
  - External phase
  - Emulsifier
- Very few natural emulsifiers



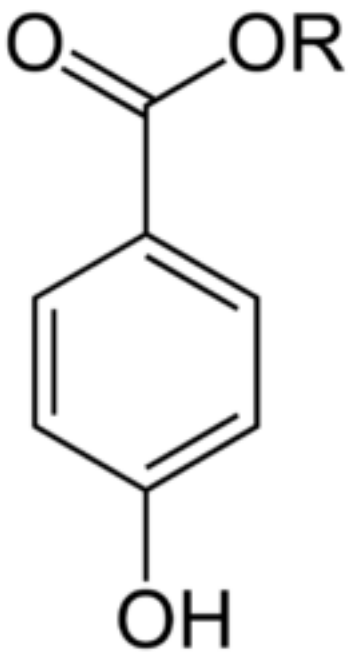
Formulation Aids

- Ingredients that adjust formulation properties
  - pH
  - Viscosity
  - Solubilizers
- Acids, bases or salts
- Chelating agents
- Nonionic surfactants



Cosmetic Preservatives

- Parabens
  - Propylparaben
  - Ethylparaben
  - Methylparaben
- Formaldehyde donors
- Phenol derivatives
  - Phenoxyethanol
- Quats
- Alcohol
- Organic compounds
  - Methylchloroisothiazolinone



Aesthetic Raw Materials

- Thickeners – Ingredients that increase the thickness of a formula

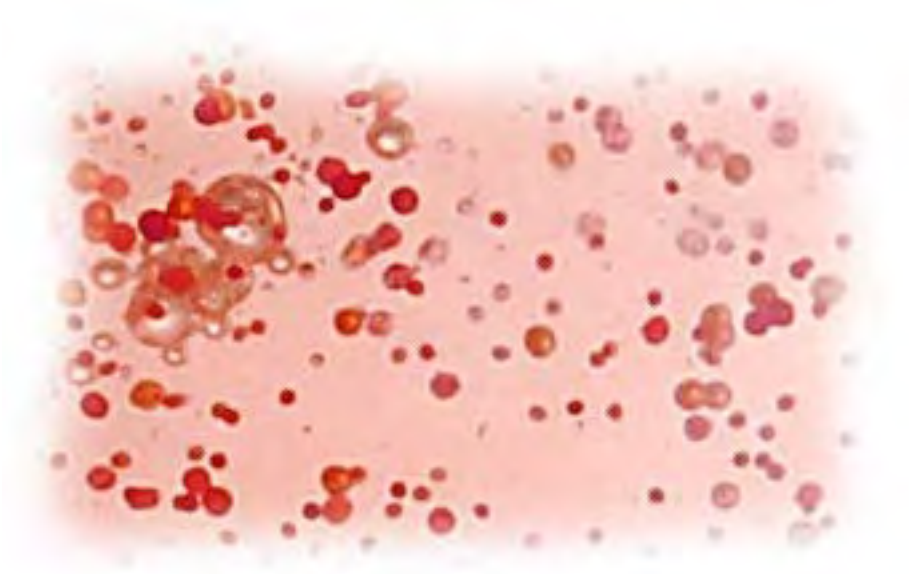
Lipid Thickeners

- Composed of lipophilic materials
- Solid at room temperature
- Liquid when heated, solid when cooled

- Examples
  - Carnauba wax
  - Cetyl Alcohol
  - Stearyl Alcohol

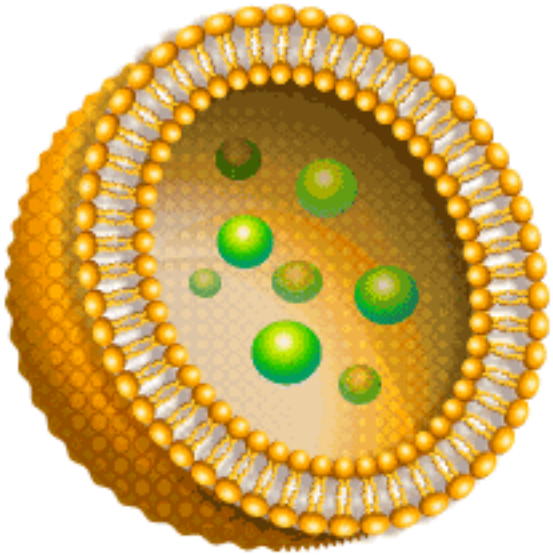
Appearance Modifiers

- Pearling Agents – Opacify formula
- Suspended beads
- Texture modifiers



Delivery Systems

- Ingredients used to better deliver functional ingredients to skin & hair
- Cyclodextrins
- Matrix Polymers
- Liposomes



Liposome

Marketing Raw Materials

- Vitamins
- Botanical Extracts
- Proteins
- Anti-Aging

- Used at low levels
- Minimal impact on performance

Natural Raw Materials

- Depends on Standards
- Don’t expect them to work as well
- They will cost more
- Consumers want products that work

Solutions

Simplest formulation

Mixture of compounds

Examples

- Shampoo
- Skin oils
- Aftershave

Natural - Shampoo

Formula Name
Tier 3 Natural Standard Shampoo

Batch size: 500

	Purpose	INGREDIENT	%	Amt. In Batch
1	Aesthetic – Solvent	Water	42.40	212.00
2	Functional – Conditioning	Guar Hydroxypropyltrimonium Cl	0.300	1.50
3	Aesthetic – pH adjustment	Citric Acid	0.30	1.50
4	Functional – Secondary Surfactant	Cocamidopropyl Betaine	8.00	40.00
5	Functional – Surfactant	Coco Glucoside	15.00	75.00
6	Functional – Surfactant	Decyl Glucoside	20.00	100.00
7	Functional – Conditioning	Glycerin	5.00	25.00
8	Aesthetic – Thickener	Polyacrylate 33	5.00	25.00
9	Aesthetic – Opacifier	Glycol Distearate	1.00	5.00
10	Aesthetic – Fragrance	Lavender Oil	0.50	2.50
11	Aesthetic – Preservative	Caprylhydoxamic Acid & Glyceryl Caprylate & Methylpropanediol	1.00	5.00
12	Aesthetic – Thickening	Sodium Chloride	1.50	7.50
		TOTAL	100.000	500.00

Procedure:

1. Begin mixing item #1 in container. Begin heating to 70C
2. Add items #2 - #7
3. At 70C add item #9. Mix for 10 min & cool
4. At 40C add items #10, 11 and 12
5. At <30C mix 10 – 15 min
6. Check pH and viscosity. Adjust as required

Specifications

pH = 5.0 - 5.5
Viscosity = 4000 - 7000 cps

Emulsions

Mix of Oil & Water

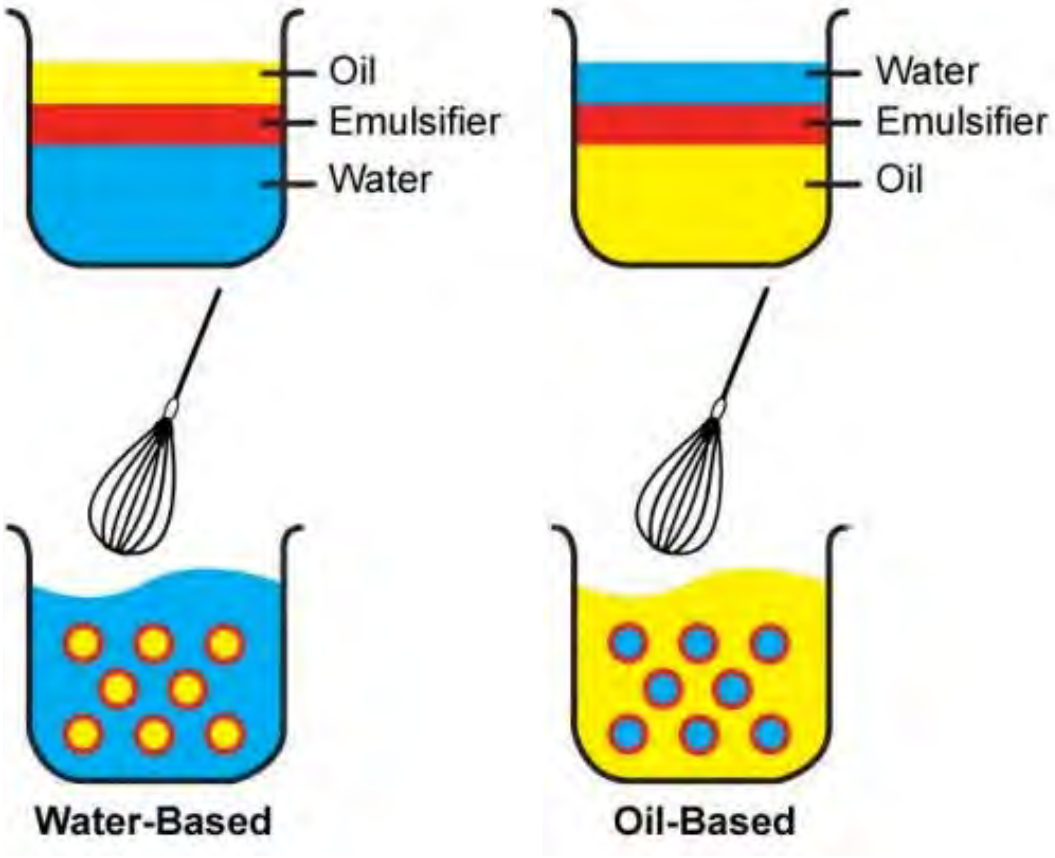
Held together with Emulsifier

Examples

- Lotions
- Conditioners
- Moisturizers

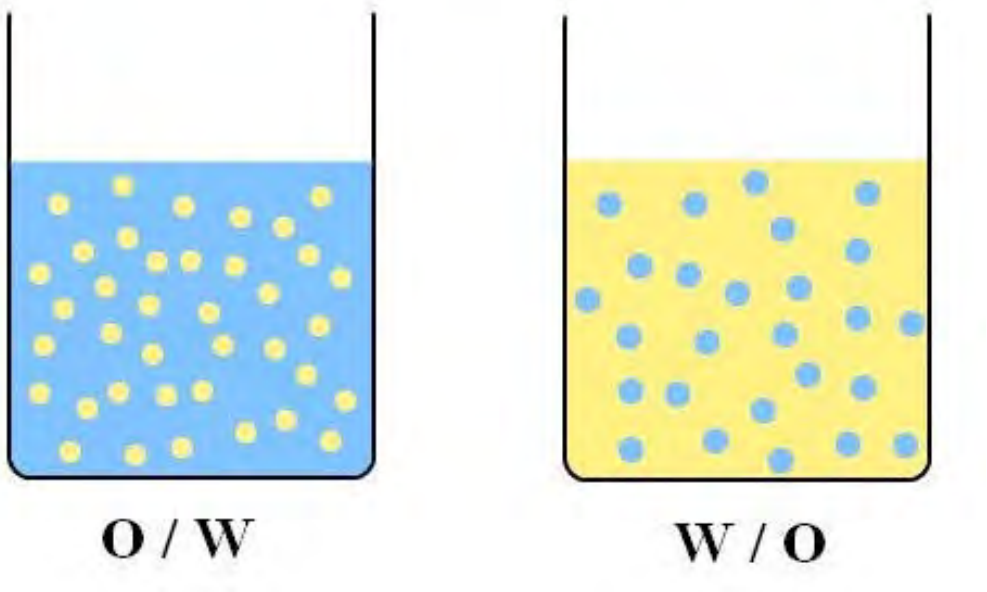
Emulsions Components

- Internal phase
  - Discontinuous phase
- External phase
  - Continuous phase
- Emulsifier

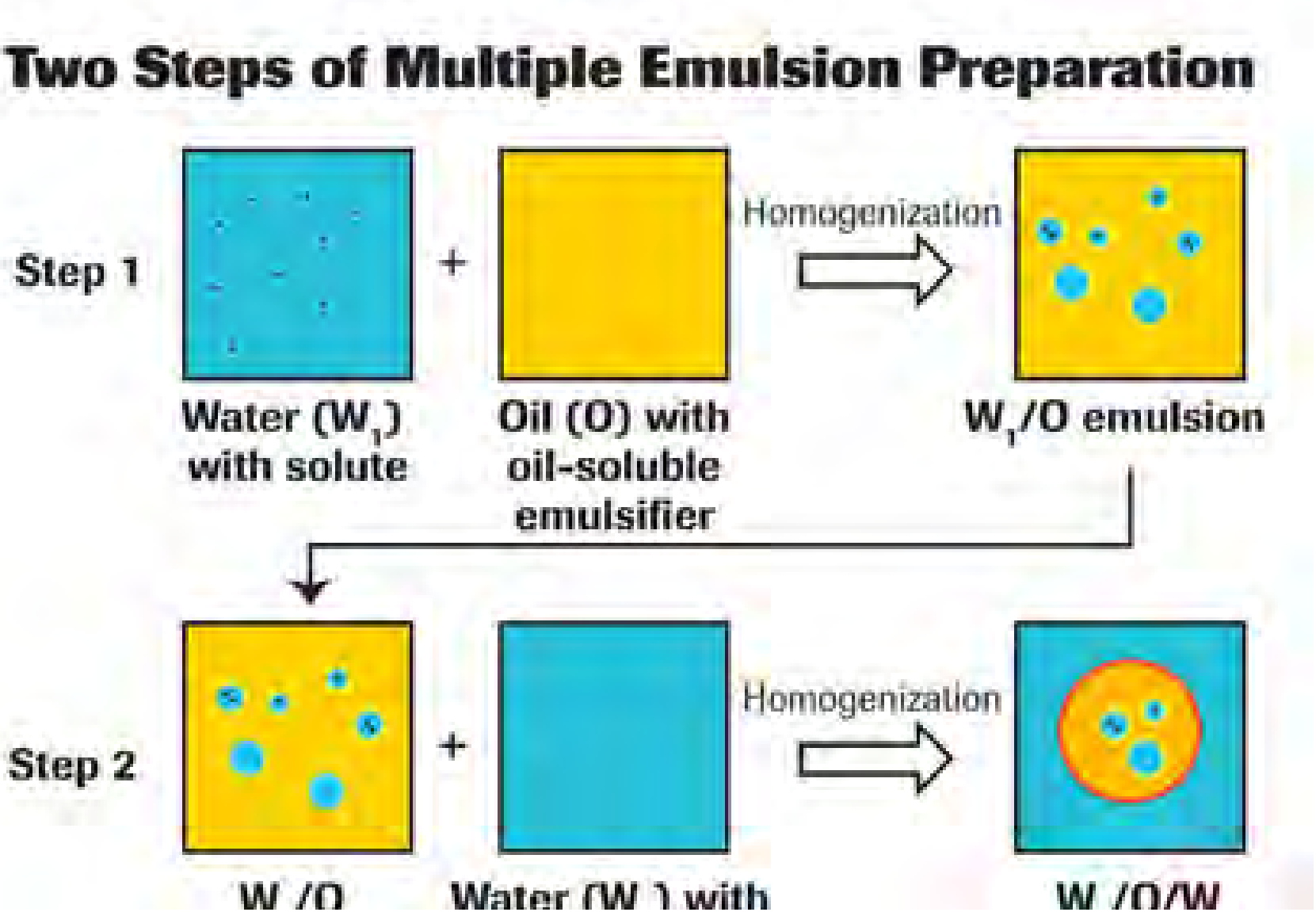


Emulsions Types

- Configuration
  - Oil in Water (O/W)
  - Water in Oil (W/O)
  - Multiple emulsions (W/O/W)

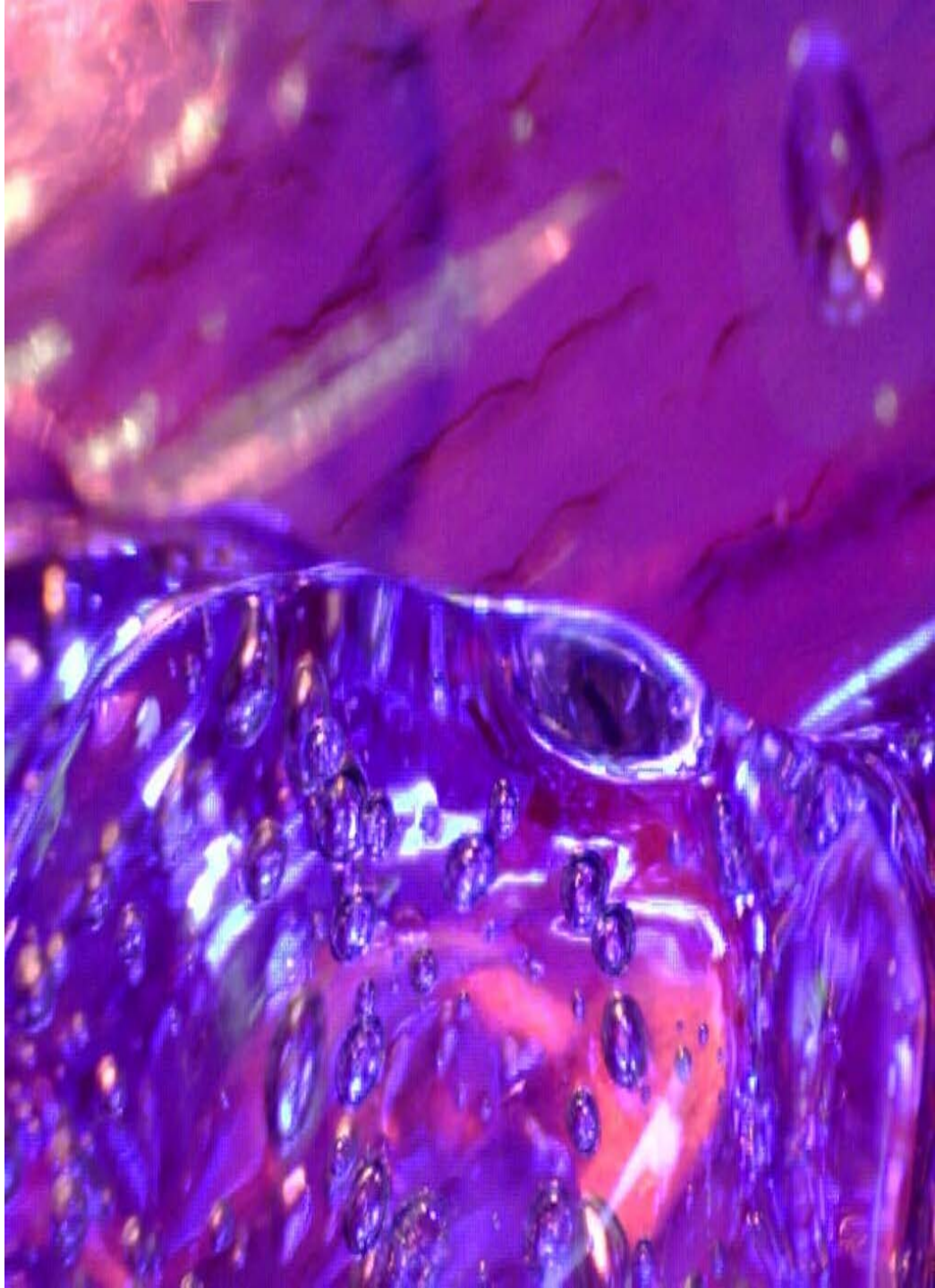


Multiple Emulsions



Gel formula

- Thickened solution or emulsion



Types of Gel

- Styling Gels
  - Normal Hold
  - Extra Hold
- Shaving gel
- Hand gels

Natural Styling Gel

Formula Name

Tier 3 Natural Standard Gel

Batch size
500

	Purpose	INGREDIENT	%	Amt. In Batch
1	Aesthetic – Solvent	Water	90.400	452.00
2	Functional – Conditioning	Sorbitol	2.500	12.50
3	Functional – Conditioning	Glycerin	3.500	17.50
4	Functional – Hold / Thickening	Dehydoxanthan Gum	2.000	10.00
5	Aesthetic – Preservative	Benzyl Alcohol	1.000	5.00
6	Aesthetic – Fragrance	Fragrance	0.200	1.00
7	Functional – Hold	Acacia Gum	0.400	2.00
		TOTAL	100.000	500.00

Procedure:

1. Begin mixing item #1 in container. Begin heating to 45C
2. Add items 2,3, &4
3. Premix item 5&6. Add to formula
4. Cool to 30C. Add item #7

Specifications

pH = 5.5 – 6.0

Viscosity = 15,000 – 20,000 cps

Cosmetic Chemistry Quiz

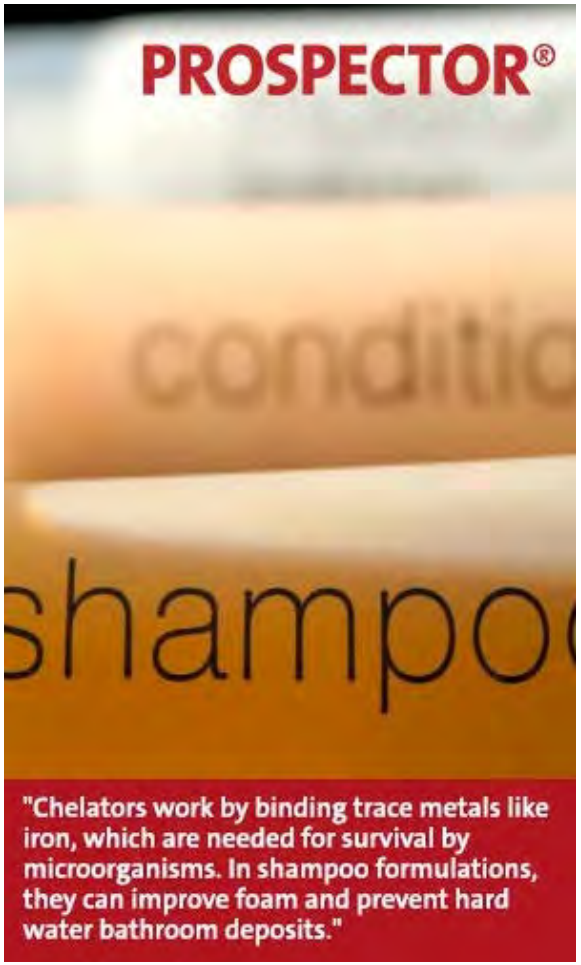
Which one is the FAKE beauty gadget?

- Ceramic unipolar magnet that controls acne
- Wand that shoots oxygen into your skin to smooth, tone & stimulate
- Hand held laser that makes your hair grow
- Electronic headband that relaxes muscles to remove wrinkles

Creating Cosmetic Formulas

Sources for Starting Formulas

- Patents
- Books
  - Harry's Cosmeticology
- Chemical suppliers
  - Prospector.com
- Trade journals
  - Happi.com
- Colleagues
- Ingredient lists – LOIs



Getting information from patents

- Google patents
- Sections of patent
- Finding formulas
- Finding testing ideas
- Working around patents

Knockout Results

	pH	Viscosity	Foam
Control Formula	5.5	9000	8
Sodium Lauryl Sulfate	6.0	4000	3
Sodium Laurylmethosulfate	5.7	6000	4
Sodium Chloride	5.5	500	8
Cocoamide DEA	4.8	2000	5
Glycerin	5.4	9000	8
Fragrance	5.5	12000	10