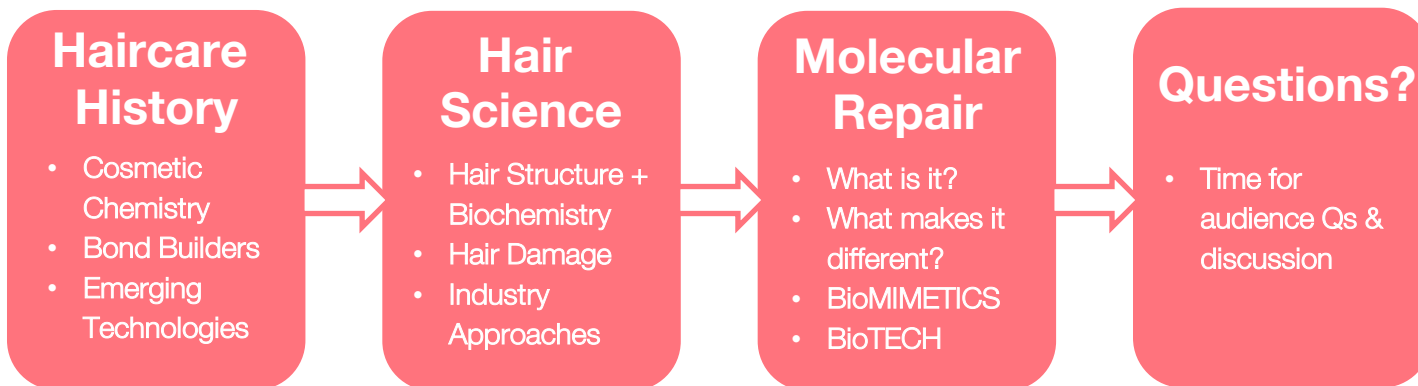


The Future of Hair Health: Molecular Repair Technology



Presented by Meagan Schlapp
K18 Hair Product Development & Formulation
Science Education

Session Overview



Hair Care Industry Evolution

1

Manageability: Surface Modification

Cosmetic chemistry approaches to alter how hair looks + feels to improve experience—but not address underlying cause

2

Preservation: Bond Builders

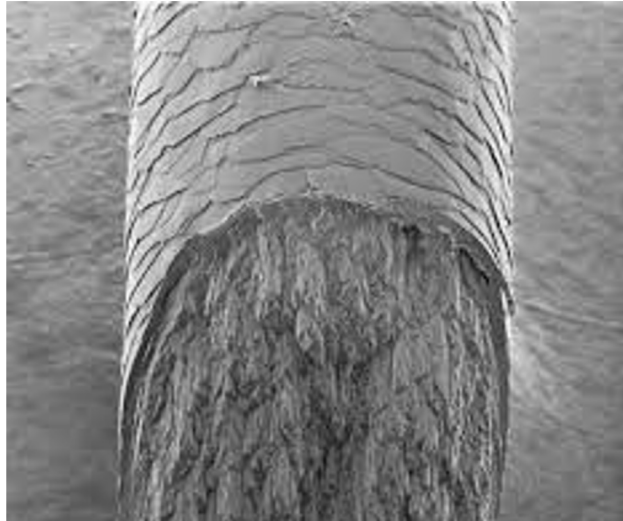
New active agents to artificially reconnect specific bonds and reinforce proteins

3

Next Generation: Molecular Repair

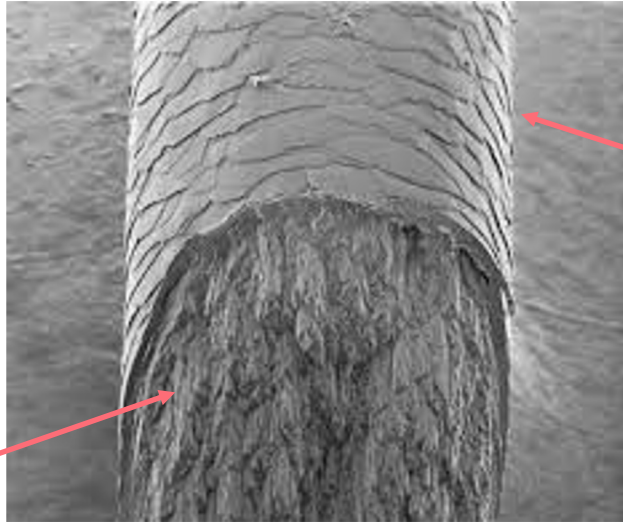
Evolution beyond cosmetic chemistry & bond builders – holistic multi-bond repair of internal structure

Splitting Hairs



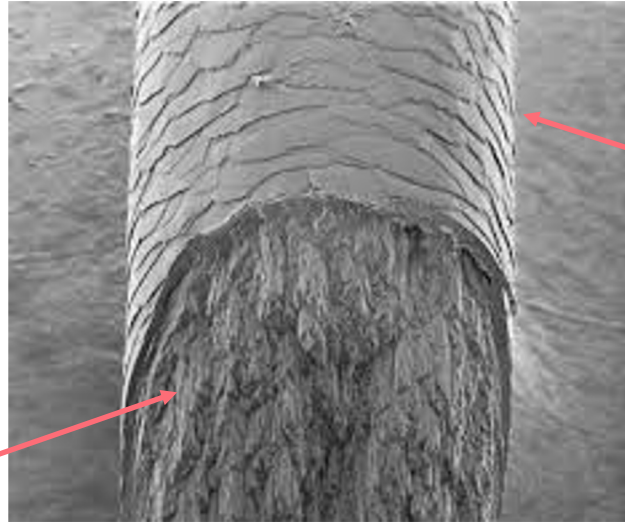
Electron microscope image of a hair fiber

Splitting Hairs



Electron microscope image of a hair fiber

Splitting Hairs



Cuticle scales

Fibrous cortex

Electron microscope image of a hair fiber

Enter the World of Hair:

Cuticle

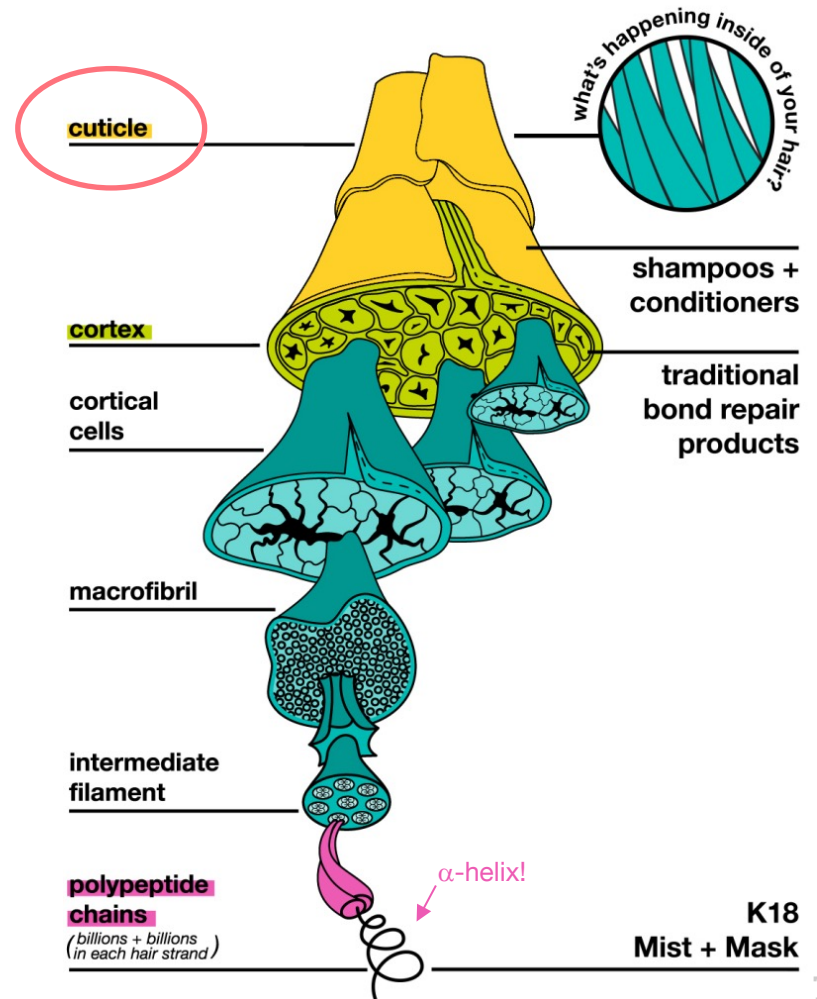
- The exterior of hair—the cuticle—is made of flattened, overlapping scales
- These swell or “open” when wet; altered by pH



“closed” – lay flat

“swelled” – stick out + spaces

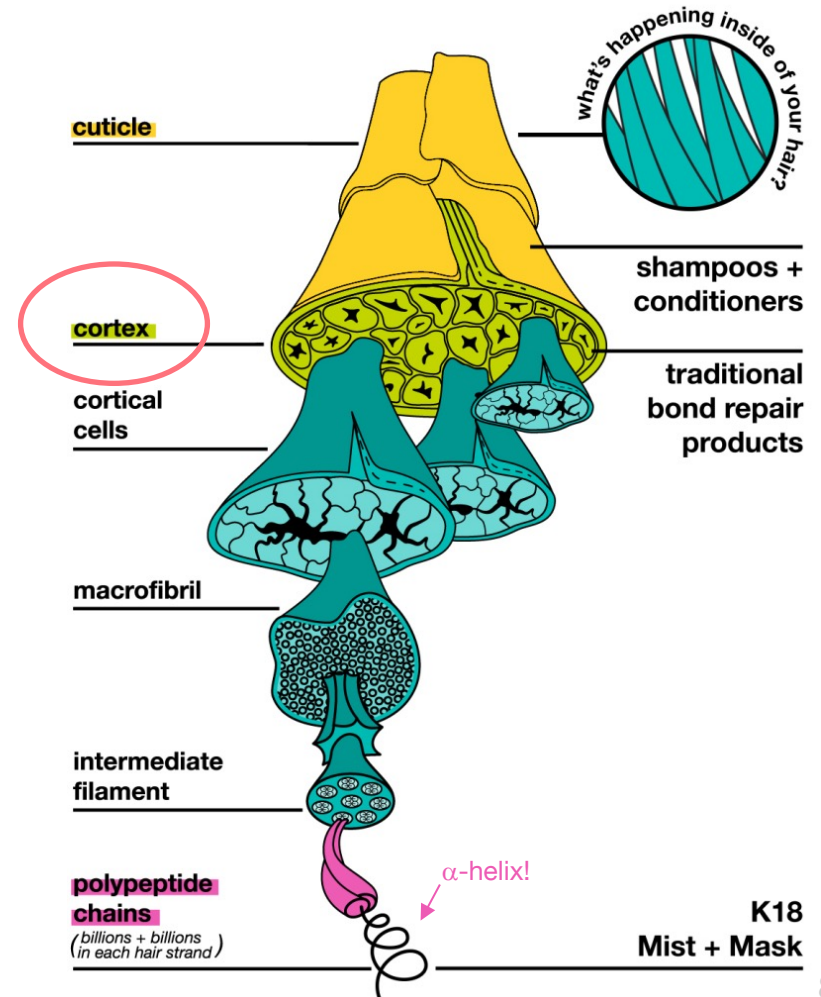
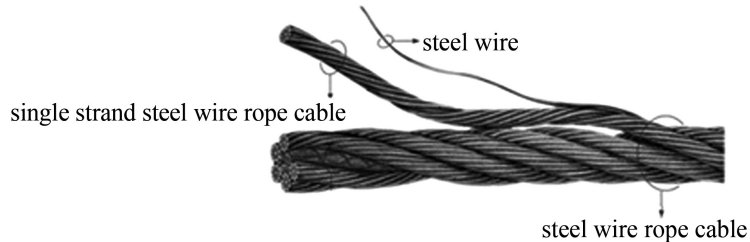
- First line of defense: acts like a **barrier**, protecting the inside of hair (the cortex)



Enter the World of Hair:

Cortex

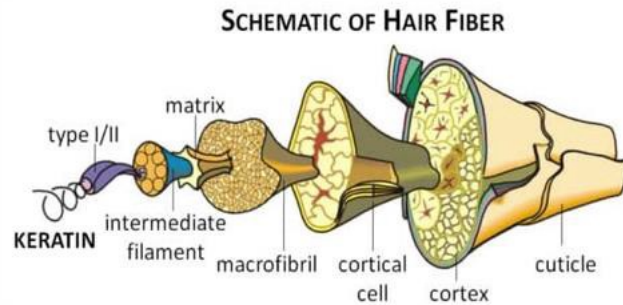
- Structured much like a rope or cable, the cortex is made up of long, **intertwining fibers** of keratin
- These combine in great numbers to generate lots of **strength**



Proteins & Bonds

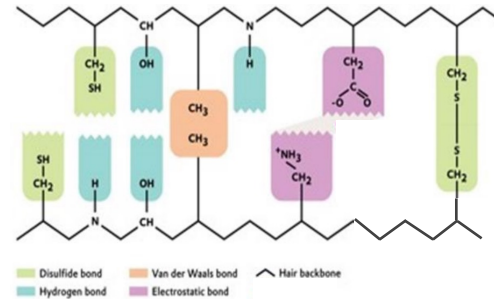
Structure

Hair is made up of **protein** (keratin)



Bonds

Work together to stabilize proteins

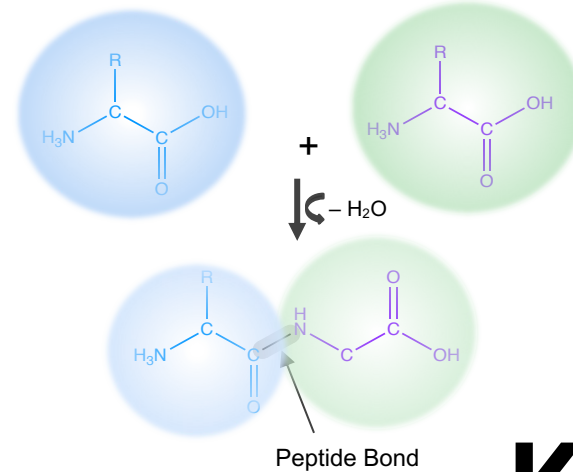
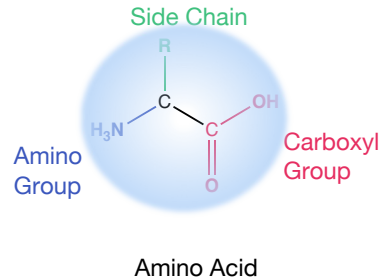


Proteins & Bonds

Bonds → Structure

Amino acids are the building blocks of proteins.

They are linked by **peptide bonds**.



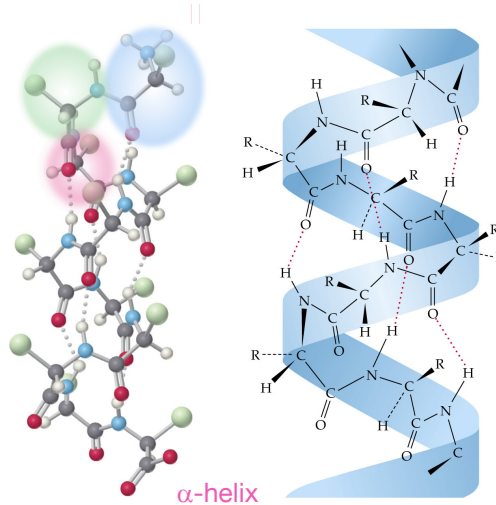
Proteins & Bonds

Bonds → Structure

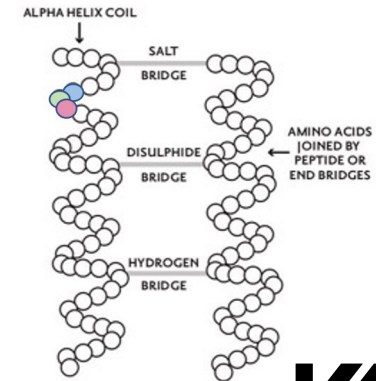
Chains of amino acids linked by peptide bonds form proteins.

These polypeptide chains are further stabilized by other bonds.

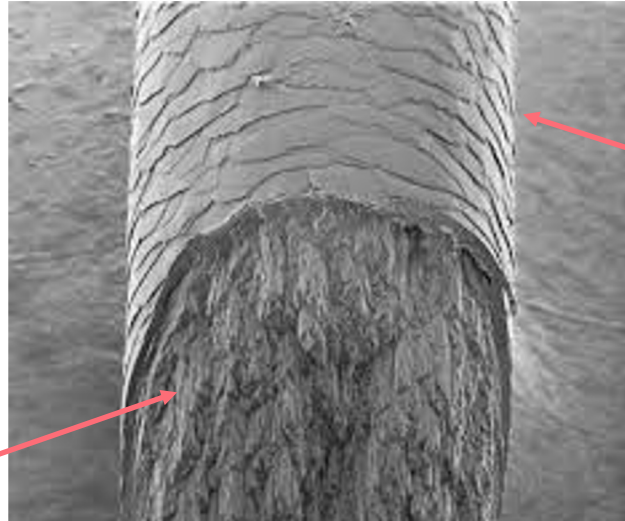
The α -helix is the basic unit of fibrous keratin in the cortex



CROSS BRIDGING IN HAIR STRUCTURE



Splitting Hairs

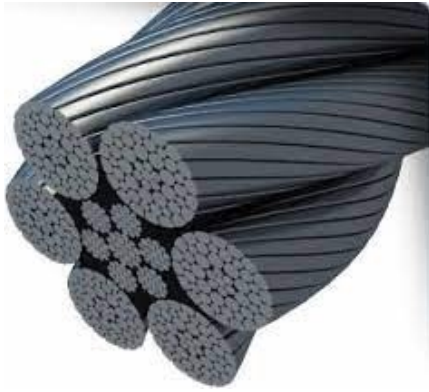


Cuticle scales

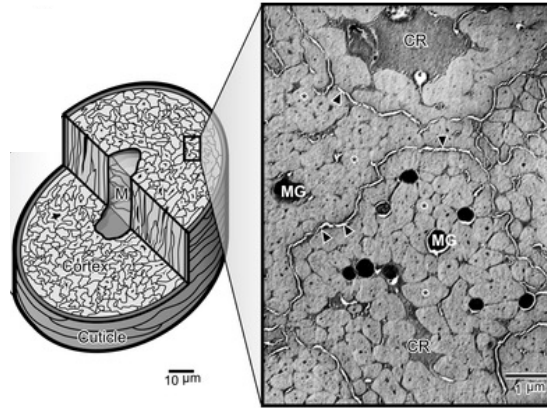
Fibrous cortex

Electron microscope image of a hair fiber

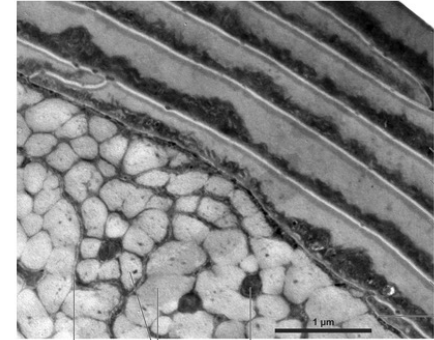
Splitting Hairs



Cut-across of a cable



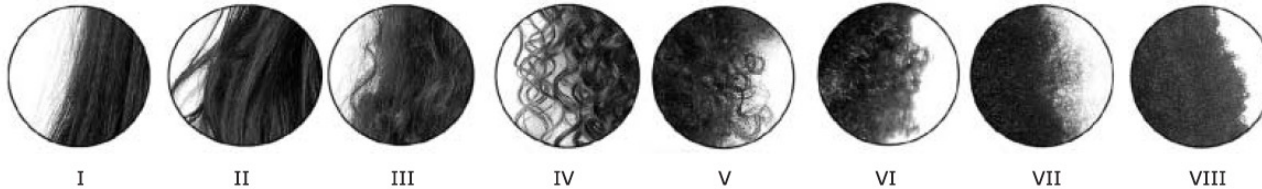
Cut-across of a hair fiber



All Hair is Chemically Equal

Human Hair Proteins + Keratin

- The structure of hair + the genes coding its proteins = the **same** in all hair types
- Curl is determined by **follicle shape + distribution** of keratin within hair fiber
- Modern methods categorize hair by shape into 8 curl types I-VIII:



Chemical Services + Environment Damage Hair

Virgin hair = myth

Bleach, Color, Perms, Relaxers

High pH (10-12)
Oxidizing chemicals
Severe protein damage

Water, Heat, Mechanical

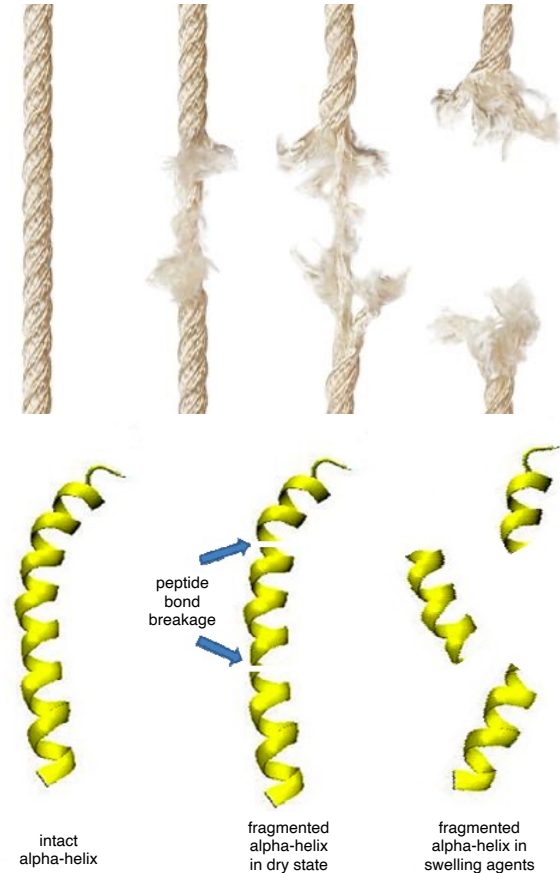
Wet hair = weak hair
Heat degrades structure
Brushing + styling cause
breakage

Environmental Exposure

Metals in water
UV from sunlight
Urban pollution

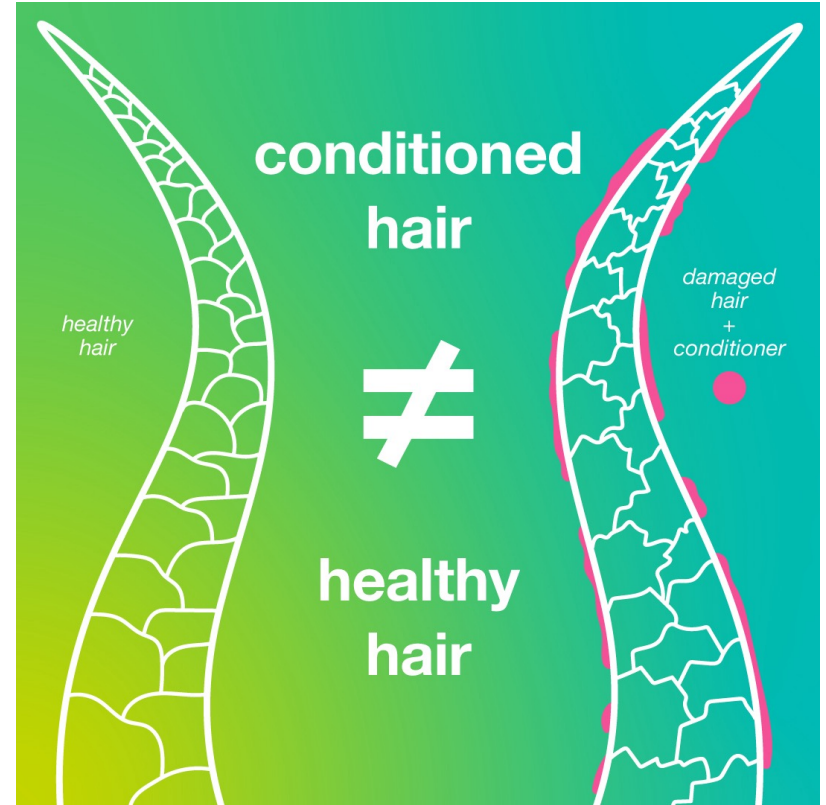
Breaking Bonds + Damaging Structure

- Damaged hair loses the integrity of its protein structure
- As **bonds break** due to chemical aggressors, mechanical forces, environmental factors, the fibrous **cortex begins to degrade**
- Disulfide bonds are only one small piece of the whole puzzle (MANY kinds of bonds)
- Breaks in the main keratin chain backbone = major cause of **damage** to hair that result in **loss of mechanical strength + elasticity**.



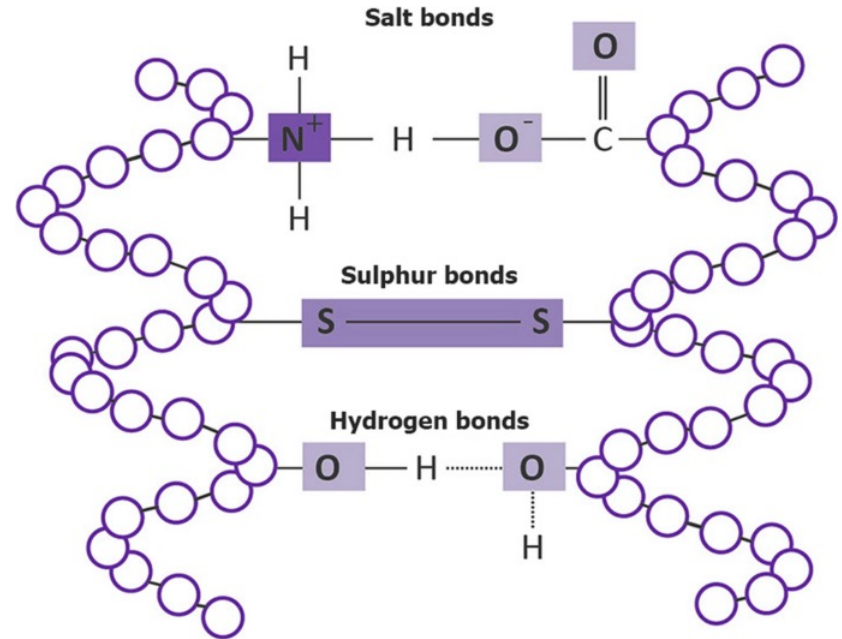
Cosmetic Chemistry

- Traditional cosmetics are formulated to improve hair manageability
- Achieved by **modifying the surface** of hair fibers
- Depositing a conditioning agent such as a polymer, silicone, or oil
- These coat hair making it look shinier, feel softer + smoother, and style easier
- But **do not** address the structure of hair inside



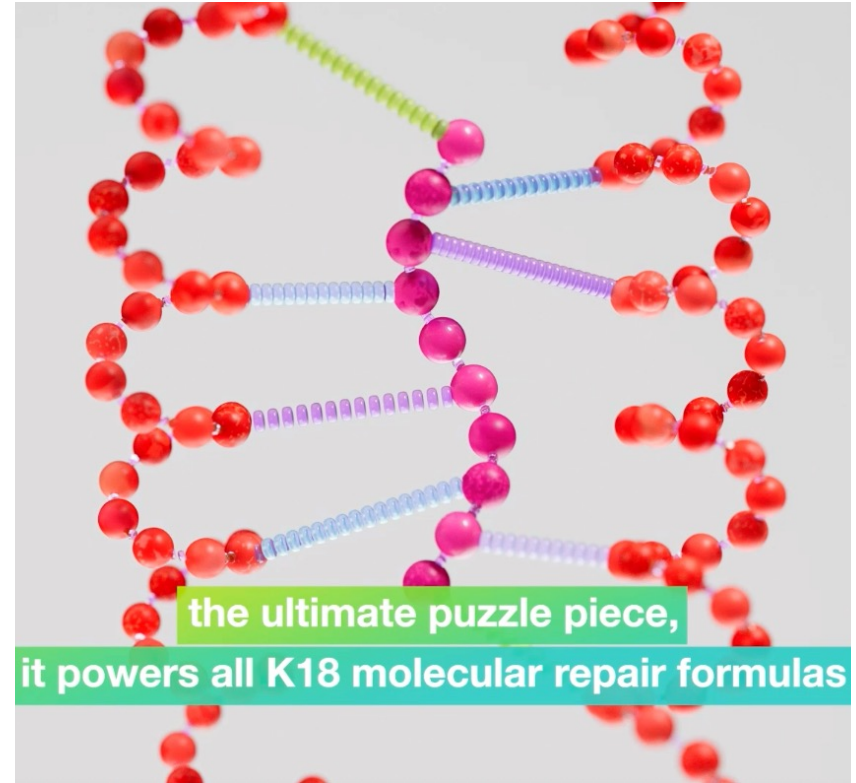
Bond Builders

- Bond builders target elements of hair structure
- Zero in on **one specific type of bond** of hair fibers
 - Disulfide bond
 - Ionic bond
 - Hydrogen bond
- If this single bond type is disturbed, the active's link to hair structure can be compromised
- Missing the greater picture

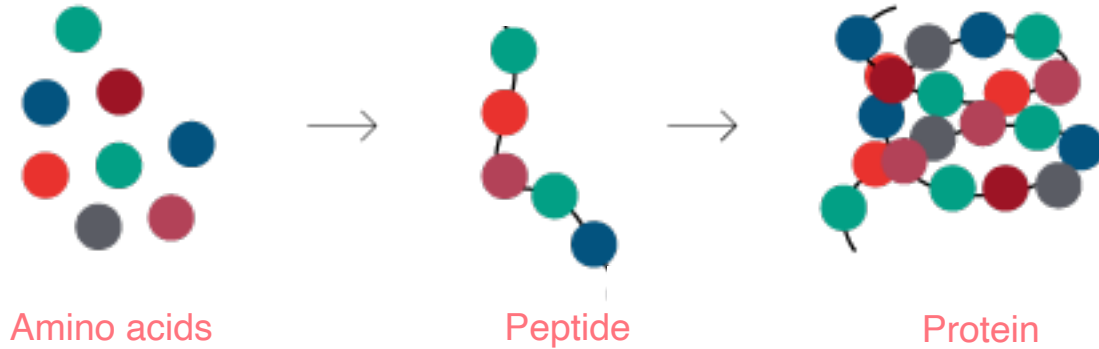


Molecular Repair

- Structure = strength!
- Understands that molecules are held together by many **many types of bond**
- Forms a network of different bonds to stitch broken proteins back together
- **Reconnecting breaks in structure**, in all dimensions, to **restore strength & elasticity**
- **Optimized from our biology** to be the BEST fit



Peptides & Hair

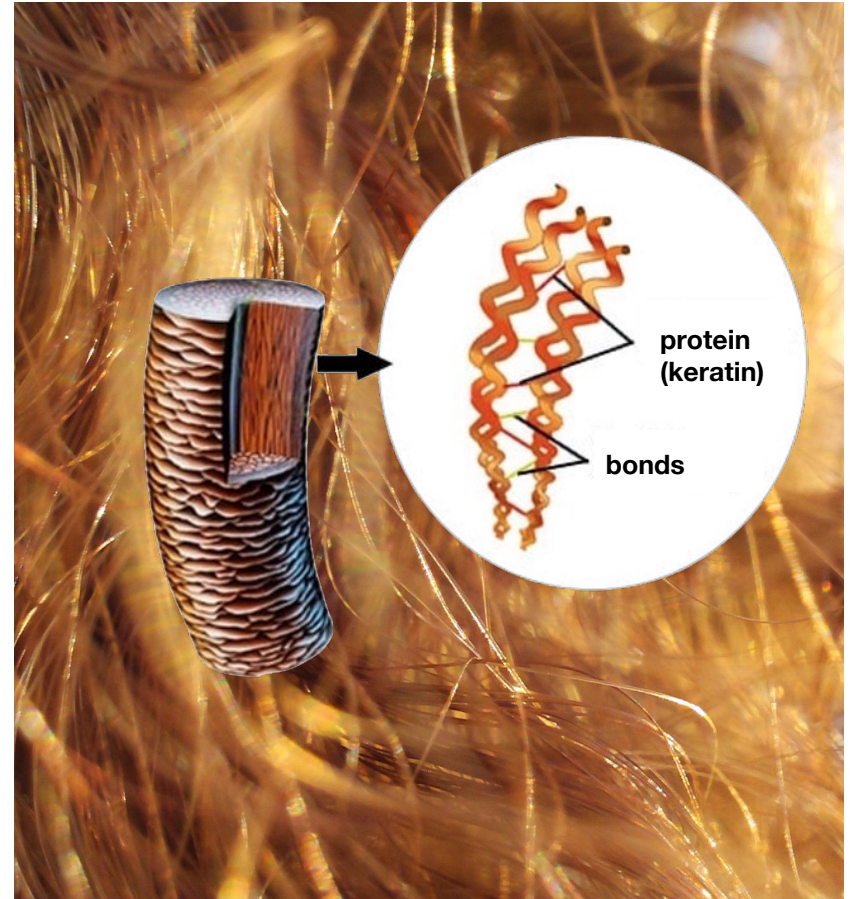


Peptides are short chains of amino acids

Proteins are much longer chains of amino acids that have specific structure

What is Biomimetics?

- Biomimetic = mimics (imitates) biology
- Hair is made up of mostly protein (like keratin)
- The K18 peptide mimics the natural structure of hair proteins
- K18 scientists studied the proteins that make up human hair to find a **biologically-identical peptide** capable of repairing hair



What is Biotechnology?

- **Biotech = technology that uses biology**
- Naturally produced compounds are often the inspiration; biotech enables us to produce them more sustainably
- Microbes express genes or transform materials
- Solfarcos uses **microbes as factories** to produce & research different peptides



K18 & Hair

Why is K18 so good at binding to hair keratin?

Biomimetic peptide made of the **same building blocks** as hair keratin—identical to those in our hair!

It is just the right:

- **Size or length** (NUMBER of amino acids)
- **Composition** (TYPE + ORDER of amino acids)

To travel past the cuticle and into the **cortex** of hair + reconnect breaks in protein chains.

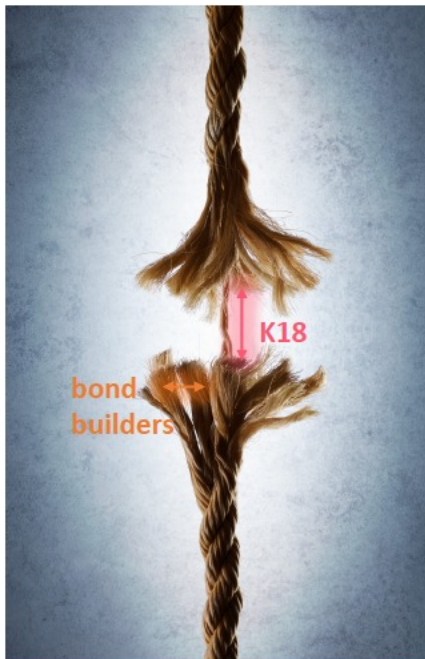
It interacts via **different types of bonding** with hair proteins!

Hydrophobic, disulfide, and polar bonds are some examples of the interactions between hair keratin and the K18 peptide that enable it to stitch broken proteins back together.



Just like letters in a word, the **number, order, + type** of amino acids change the nature of a peptide

K18 & Hair



hair strength where it matters

K18 reinforces bonds at multiple points of the hair fiber
for holistic strength + true hair repair

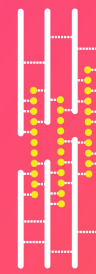
healthy
hair

damage

breakage

bond
building

K18PEPTIDE™



- bonds
- ⊗ bond building
- K18PEPTIDE™



Biomimetic Peptide + Molecular Repair

- The K18 peptide leverages **molecular repair** through **biomimetic hair science**
 - **Biomimetic** = mimics natural structure of hair proteins
- K18 repairs hair **from the inside out** (different than traditional cosmetic chemistry)
- The K18 peptide is **unique** – composition + size (number, type, order of amino acids) matter!
- The peptide forms **numerous kinds of bond** with hair proteins to reconnect structural breaks
 - **K18 reinforces strength in all dimensions**

thank you!

questions?