Chapter 20
Chemical Texture Services
“Results! Why, man, I have gotten lots of results. I know several thousand things that won’t work.”

— Thomas A. Edison
Objectives

• Explain the structure and purpose of each of the hair’s layers.

• Explain the chemical actions that take place during permanent waving.

• Explain the difference between an alkaline wave and a true acid wave.

• Explain the purpose of neutralization in permanent waving.
Objectives (continued)

- Describe how thio relaxers straighten the hair.
- Describe how hydroxide relaxers straighten the hair.
- Describe curl re-forming and what it is best used for.
Chemical Texture Services

• Cause a chemical change that alters the natural wave pattern of the hair

• Allow you to offer clients a variety of styling options not otherwise available
Alter Wave Patterns

- Curl straight hair
- Straighten overly curly hair
- Soften coarse, straight hair
Types of Services

- Permanent waving: adding wave or curl to hair
- Relaxing: removing curl, leaving hair smooth and free
- Curl re-forming: loosening overly curly hair into softer curls or waves
Hair Structure

- Cuticle: tough outer layer of hair; surrounds the inner layers and protects hair from damage
Hair Structure (continued)

- Cortex: middle layer of hair located beneath cuticle; responsible for hair strength and elasticity
- **Medulla**: innermost layer of hair, often called pith or core; does not play a role in restructuring; missing in some types of hair
pH and Texture

• *pH* means potential hydrogen. It represents the quantity of hydrogen ions and measures the acidity and alkalinity of a substance.

• pH scale has a range of 0 to 14; 7 is neutral.
  – Below 7 is acid.
  – Above 7 is alkaline.
  – Hair is 4.5 to 5.5.
Building Blocks of Hair

- Amino acids: compounds made of carbon, oxygen, hydrogen, nitrogen, and sulfur
- Peptide (end) bonds: chemical bonds that join amino acids together end-to-end in long chains to form polypeptide chains
- Polypeptide chains: formed by peptide bonds linked together
- Keratin proteins: make up about 97 percent of hair’s structure
Building Blocks of Hair (continued)

• Side bonds: disulfide, salt, and hydrogen bonds that cross-link polypeptide chains together

The Amino Acid Content of Hair

All the protein structures of hair are made from these eighteen amino acids:

- Cysteic acid
- Aspartic acid
- Threonine
- Arginine
- Serine
- Glutamic acid
- Proline
- Glycine
- Alanine
- Valine
- Cystine
- Methionine
- Isoleucine
- Leucine
- Tyrosine
- Phenylalanine
- Lysine
- Histidine

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Building Blocks of Hair (continued)

[Diagram showing the structure of hair composed of amino acids connected by bonds]

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Building Blocks of Hair (continued)

[Diagram showing the structure of hair with hydrogen bonds, salt bonds, and disulfide bonds.]
Keratin Proteins

- Made up of long, coiled chains of amino acids linked together end-to-end like beads by end bonds
Side Bonds

- Disulfide: formed when sulfur atoms in two adjacent protein chains are joined; only broken by chemicals; account for about 1/3 of hair’s strength
Side Bonds (continued)

- Salt: relatively weak physical side bonds resulting from an attraction between negative and positive electrical charges; can be broken by water; account for about 1/3 of hair’s strength

- Hydrogen: weak physical side bonds resulting from an attraction between opposite electrical charges; easily broken by water; account for about 1/3 of hair’s strength
Two-Step Process of Permanent Waving

- Physical change: caused by wrapping the hair on tools
- Chemical change: caused by the processing of waving solution and neutralizer
Perm Wrap

• A perm wrap is essentially a wet set on perm tools instead of rollers.

• Wet set breaks hydrogen bonds only.

• Perm breaks disulfide bonds that are stronger and more resistant.
Curl Determination

• Size, shape, and type of tool determine shape of new curl.

• Perm softens hair to conform to new shape after wrapping.

• Uniform, even tension produces the resulting curl (too much tension can mark or break the hair).
Perm Tools

- Tools come in a wide variety of sizes and shapes that can be combined with different wrapping methods to provide a range of styles.
Types of Tools

- Concave rods have smaller circumference in middle than on ends.
- Straight rods have consistent diameter.
• Soft bender rods are about 12 inches long with equal diameter; they are made of soft foam and take a variety of shapes.
• Loop or circle rods fasten together to form a circle.
End Papers

- Double flat wrap
- Single flat wrap
- Bookend wrap
Sectioning

- Panels: size, shape, and direction of panels vary based on type of wrapping pattern and type and size of tool

- Base sections: subsections of a panel based on size of tool
Base Placement

- On-base placement
- Half–off base placement
- Off-base placement
Base Direction

- The angle at which the tool is positioned and the directional wrap pattern
Wrapping Techniques

• **Croquignole**: hair wrapped from ends to scalp in overlapping concentric layers
Wrapping Techniques (continued)

- Spiral: hair wrapped at an angle to form a coil (like the grip of a tennis racket)
Wrapping Techniques (continued)

• Piggyback (double-rod wrap): hair wrapped on one rod from scalp to middle of strand; another rod used for remaining strand
Chemistry of Perm Waving

- Alkaline solutions soften and swell the hair and open the cuticle.

- Acid solutions result in far less swelling of the hair than alkaline solutions.
Reduction Reaction

• Once the waving solution is in the cortex, it breaks the disulfide bonds through a chemical reaction called reduction.

• Reduction involves either the addition of hydrogen or the removal of oxygen.
Perm Waving Reactions

- Disulfide bond joins sulfur atoms.
- Disulfide bond is broken.
- Sulfur atoms attach to hydrogen from solution.
- Polypeptide chains re-form.
Reducing Agents

• Thio compounds

• Strength of solutions: determined by concentration of thio

• *Thioglycolic acid*: causes reduction in perm solutions

• Ammonium thioglycolate (ATG): main ingredient in alkaline perms

• Perm pH: second factor in solution strength
Types of Permanent Waves

- Low-pH waves (6.5–7.0)
- Alkaline/cold wave (9.0–9.6)
- Thio-free wave (7.0–9.6)
- Ammonia-free wave (7.0–9.6)
- Acid-balanced wave (7.8–8.2)
- Exothermic wave (9.0–9.6)
- True acid wave (4.5–7.0)
Types of Permanent Waves (continued)

• Alkaline waves (cold waves): pH between 9.0 and 9.6

• Acid waves: glyceryl monothioglycolate main ingredient; low pH

• True acid waves: pH of 4.5 to 7.0; require heat to process

• Acid-balanced: pH of 7.8 to 8.2 (not true acid waves)
Types of Permanent Waves (continued)

- **Exothermic waves**: chemical reaction heats solution and speeds processing

- **Endothermic waves**: activated by outside heat source

- Ammonia-free waves: main ingredient does not evaporate as readily as ammonia
Types of Permanent Waves (continued)

- Thio-free waves: reducing agent is not ATG; use cysteamine or mercaptamine
- Low-pH waves: use sulfates, sulfites, and bisulfites; weak and do not provide firm curl; marketed as body waves or alternative waves
## Selecting Perm Type

<table>
<thead>
<tr>
<th>Perm Type</th>
<th>Active Ingredient</th>
<th>Process</th>
<th>Recommended Hair Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline/cold wave</td>
<td>ammonium thioglycolate (ATG)</td>
<td>room temperature</td>
<td>coarse, thick, or resistant</td>
</tr>
<tr>
<td>pH: 9.0 to 9.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exothermic wave</td>
<td>ammonium thioglycolate (ATG)</td>
<td>exothermic</td>
<td>coarse, thick, or resistant</td>
</tr>
<tr>
<td>pH: 9.0 to 9.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>True acid wave</td>
<td>glycercyl monothioglycolate (GMTG)</td>
<td>endothermic</td>
<td>extremely porous or very damaged hair</td>
</tr>
<tr>
<td>pH: 4.5 to 7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid-balanced wave</td>
<td>glycercyl monothioglycolate (GMTG)</td>
<td>room temperature</td>
<td>porous or damaged hair</td>
</tr>
<tr>
<td>pH: 7.8 to 8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia-free wave</td>
<td>monoethanolamine (MEA)/ aminomethylpropanol (AMP)</td>
<td>room temperature</td>
<td>porous to normal</td>
</tr>
<tr>
<td>pH: 7.0 to 9.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thio-free wave</td>
<td>mercaptamine/ cysteamine</td>
<td>room temperature</td>
<td>porous to normal</td>
</tr>
<tr>
<td>pH: 7.0 to 9.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-pH waves</td>
<td>ammonium sulfite/ammonium bisulfite</td>
<td>endothermic</td>
<td>normal, fine, or damaged</td>
</tr>
<tr>
<td>pH: 6.5 to 7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Processing

- The amount of processing time should be determined by the strength of the solution, not necessarily how long the perm is processed.

- Most processing takes 5 to 10 minutes.

- Additional time allows polypeptide chains to shift to new configuration.
Overprocessed Hair

- Does not mean overly curly. If too many disulfide bonds are broken, hair is too weak to hold a firm curl.
- Has weak curl or may be completely straight. Hair at scalp is stronger than ends.
Underprocessed Hair

• If too few disulfide bonds are broken, hair will not be sufficiently softened and will not hold the desired curl; hair at scalp is not as curly as ends; more processing time is required.
Perm Waving (Thio) Neutralization

- Neutralization stops the action of the waving solution and rebuilds the hair into its new curly form. It performs two functions:
  - Deactivates waving solution
  - Rebuilds broken disulfide bonds
Neutralization: Stage One

- Rinse hair for five full minutes.
- Towel-blot thoroughly but gently.
- If directed, apply a preneutralizing conditioner to strengthen hair.
Proper Rinsing and Blotting

- Rinse with warm water.
- Always use a gentle water stream.
- Avoid pressure on rods while rinsing.
- Rinse most fragile areas first.
- Thoroughly rinse nape area and rod bottoms.
- Rinse for recommended time.
• Smell hair; continue rinsing if needed.
• Gently blot hair with towel (hair is weak).
• Check for excess moisture, especially at nape.
• Adjust any loosened or drifted rods.
Neutralization: Stage Two

• Disulfide bonds are broken with hydrogen.
• Disulfide bonds are rebuilt.
• Hydrogen bonds attract oxygen.
• Water molecule is formed.
• Water is removed.
• Side bonds are re-formed.
Partial Perms

- Used when the entire head is not permed
  - Hair long on top, but short and close on sides
  - Some hair too short to wrap on rods
  - Sleek crown and curly perimeter desired
  - Volume desired in certain areas only
  - Transition techniques used
Perms for Men

• Many men are looking for added texture, fullness, style, and low maintenance that only a perm can provide.

• Perms look fuller, make straight or coarse hair more manageable, and help control stubborn cowlicks.

• Techniques are the same for men and women.
Preliminary Test Curls

• Determine correct processing time

• Identify expected results

• Determine curl results for the rod size and wrapping technique
Perm Safety Precautions

• Protect client clothing.
• Determine allergic reaction.
• Examine scalp.
• Determine extent of damage.
• Determine prior hydroxide relaxers.
• Perform metallic salt test.
• Apply protective barrier cream.
Perm Safety Precautions (continued)

- Do not dilute or add ingredients
- Keep solution away from eyes and skin
- Always follow manufacturer’s directions
- Wear gloves when applying solutions
- Replace wet cotton or towels
- Discard unused products
Practical Procedures

- Pre- and Post-Service
- Preliminary Test Curl
- Basic Perm Wrap
- Curvature Perm Wrap
- Bricklay Perm Wrap
- Weave Perm Wrap
- Double-Rod Wrap
- Spiral Wrap
Chemical Hair Relaxers

- Chemical hair relaxing is the process of rearranging the basic structure of extremely curly hair into a straighter or smoother form.
Extremely Curly Hair

- Extremely curly hair grows in long, twisted spirals, or coils. Cross-sections are highly elliptical; they vary in shape and thickness along their lengths. The thinnest and weakest sections are located at the twists.
Thio Relaxers

- Main ingredient: ammonium thioglycolate (ATG)
- Usually have a pH above 10
- Usually have a higher concentration of ATG
- Have a thicker *viscosity*
- Break disulfide bonds and soften hair
Thio Neutralization

• The neutralization used with thio relaxers is an oxidizing agent, usually hydrogen peroxide. The oxidation reaction caused by the neutralizer rebuilds the disulfide bonds that were broken by the thio relaxer.
Japanese Thermal Straighteners

- Hair is shampooed and conditioned.
- Straightener is distributed evenly.
- Hair is processed to desired curl reduction.
- Hair is thoroughly rinsed (10 minutes).
- Hair is conditioned and blown dry.
- Sections are flat ironed.
- Hair is neutralized and blown dry.
Hydroxide Relaxers

• Examples:
  – Sodium hydroxide
  – Potassium hydroxide
  – Lithium hydroxide
  – Guanidine hydroxide

• Not compatible with thio relaxers
• Have a pH of 13.0 or more
• Lanthionization
Types of Hydroxide Relaxers

- Metal hydroxide relaxers: ionic compounds formed by a metal such as sodium (Na), potassium (K), or lithium (Li) that is combined with oxygen (O) and hydrogen (H). Metal hydroxide relaxers include sodium hydroxide (NaOH), potassium hydroxide (KOH), and lithium hydroxide (LiOH).

- The active ingredient is the hydroxide ion.
• Lye-based relaxers: sodium hydroxide relaxers, also known as caustic soda
  – Oldest and most common type of relaxers
  – Same chemical used in drain cleaners and chemical hair depilatories
Types of Hydroxide Relaxers (continued)

- No-lye relaxers: lithium hydroxide and potassium hydroxide often sold as *no-mix, no lye* relaxers
  - Even though not lye, chemistry identical and little difference in their performances
• Guanidine hydroxide relaxers: also sold as no-lye relaxers.
  – Hydroxide ion is active ingredient
  – Require two components to be mixed
  – Straighten hair completely
  – Less scalp irritation; use for sensitive scalp
  – Do not reduce hair damage
  – More drying to hair
Types of Hydroxide Relaxers (continued)

• Low pH relaxers: ammonium sulfite and ammonium bisulfite most commonly used
  – Compatible with thio; not compatible with hydroxide
  – Do not completely straighten extremely curly hair
  – Can be used on color-treated, damaged, or fine hair
Base and No-Base Relaxers

• Base: require application of base cream to protect skin and scalp during relaxing

• No-base: do not require protective base cream since they already contain a base cream that melts at body temperature; protective cream may be applied around ears and hairline.
Relaxer Strengths

- **Mild**: formulated for fine, color-treated, or damaged hair
- **Regular**: intended for normal hair texture with medium natural curl
- **Super**: used for maximum strengthening on extremely curly, coarse hair
Periodic Strand Testing

• Processing time varies according to strength of relaxer and hair type and condition. You may stretch the strand to determine if curls are removed, or smooth and press the strand to the scalp with the back of comb or fingers. If strand remains smooth, it is sufficiently relaxed.
Hydroxide Neutralization

• Process does not involve oxidation or rebuilding disulfide bonds.

• Hair remains at a high pH.

• Acid-balanced shampoo or normalizing lotion is used.

• Caution: Hair that has been treated with hydroxide relaxers is unfit for thio relaxers or soft-curl perms.
## Selecting the Correct Relaxer

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>pH</th>
<th>Marketed As</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium hydroxide</td>
<td>12.5–13.5</td>
<td>lye relaxer</td>
<td>very effective for extremely curly hair</td>
<td>may cause scalp irritation and damage the hair</td>
</tr>
<tr>
<td>lithium hydroxide and potassium</td>
<td>12.5–13.5</td>
<td>no-mix, no-lye relaxer</td>
<td>very effective for extremely curly hair</td>
<td>may cause scalp irritation and damage the hair</td>
</tr>
<tr>
<td>hydroxide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>guanidine hydroxide</td>
<td>13–13.5</td>
<td>no-lye relaxer</td>
<td>causes less skin irritation than other hydroxide relaxers</td>
<td>more drying to hair with repeated use</td>
</tr>
<tr>
<td>ammonium thioglycolate</td>
<td>9.6–10.0</td>
<td>thio relaxer, no-lye</td>
<td>compatible with soft curl permanents</td>
<td>strong, unpleasant ammonia smell</td>
</tr>
<tr>
<td>ammonium sulfite/</td>
<td>6.5–8.5</td>
<td>low-pH relaxer, no-lye</td>
<td>less damaging to hair</td>
<td>does not sufficiently relax extremely curly hair</td>
</tr>
<tr>
<td>ammonium bisulfite</td>
<td></td>
<td>relaxer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Keratin Straightening Treatments

- Contain silicone polymers and formalin, which release formaldehyde gas when heated to high temperatures
- Do not break bonds; treatment applied, hair blown dry, and flat iron set at 450°F is used on narrow sections to polymerize a coating on the hair
- Eliminate up to 95 percent of frizz and curl
- Last three to five months
Steps to Keratin Straightening

• Perform consultation.

• Pre-conditioning: Equalize porosity.

• Permanent color/highlights: Use mild to regular shampoo.

• Toners or demigloss: Perform three to five days after keratin treatment.
Relaxer Safety Precautions

• Do thorough hair analysis and consultation.
• Examine the scalp for abrasions.
• Keep accurate and detailed client records.
• Have client sign a release statement.
• Do not apply hydroxide over thio.
• Do not apply thio over hydroxide.
• Do not relax hair treated with metallic dye.
• Do not relax overly damaged hair.
Relaxer Safety Precautions (continued)

• Do not shampoo prior to hydroxide relaxer.
• Make sure hair and scalp are dry.
• Apply protective base cream.
• Wear gloves.
• Protect client’s eyes.
• Flush eyes if solution touches.
• Do not allow product to touch ears, scalp, or skin.
Relaxer Safety Precautions (continued)

- Perform periodic strand tests
- Avoid scratching scalp
- Do not overlap relaxer on hair strand
- Adjust strength for fine/damaged hair
- Do not remove more than 80 percent of curl
- Thoroughly rinse relaxer from hair
- Use normalizing lotion
• Use neutralizing shampoo with color indicator to confirm restored pH.

• Use conditioner and wide-tooth comb to eliminate excessive stretching when combing tangles.

• Do not use hot irons or excessive heat on chemically relaxed hair.
Practical Procedures

- Virgin Relaxer – Hydroxide
- Retouch Relaxer – Hydroxide
- Soft-Curl Permanent
Summary and Review

• Name the structures of and purpose for each of the hair’s layers.

• What are the chemical actions that take place during permanent waving?
Summary and Review (continued)

• What is the difference between an alkaline wave and a true acid wave?
• Why do permanent waves need to be neutralized?
• How do thio relaxers straighten the hair?
• How do hydroxide relaxers straighten the hair?
• What is curl re-forming and what is it best used for?
Congratulations!

You have completed one unit of study toward course completion.