

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

رَبِّ اشْرَحْ لِي صَدْرِي 0 وَيَسِّرْ لِي أَمْرِي 0  
وَاحْلُلْ عُقْدَةً مِّنْ لِّسَانِي 0 يَفْقَهُوا قَوْلِي 0

اے میرے رب! میرا سینہ کھول دے اور میرے لیے میرا کام آسان کر دے اور  
میری زبان کی گرہ کھول دے تاکہ لوگ میری بات سمجھ سکیں

رَبِّ زِدْنِي عِلْمًا

MY LORD! INCREASE ME IN KNOWLEDGE.

# FST- 311. FOOD BIOCHEMISTRY 3(2-1)

**Program:** B. Sc. (Hons). Food Science and Technology  
**Semester:** V (R + SS)  
**Academic Year:** Fall -2020  
**Session:** 2018-2022

**Course Teacher:**

**Dr. Shahid Mahmood Rana**  
**Associate Professor**



**INSTITUTE OF FOOD SCIENCE AND NUTRITION (IFSN)**  
**UNIVERSITY OF SARGODHA, SARGODHA-PAKISTAN**



# FST-311. L # 13: FLAVORS IN FOOD APPLICATION

- FLAVOR
- TRIGEMINAL SENSES
- FLAVORANT
- FLAVORS NAMES
- FLAVOR FORMING PROCESSES IN FOODSTUFFS
- FLAVOR PERCEPTION
- FLAVOR: TRIGEMINAL RESPONSE
- TASTES
- TRIGEMINAL STIMULANTS
- NATURAL FLAVORING SUBSTANCES
- NATURE IDENTICAL FLAVORING SUBSTANCES
- NATURAL FLAVORING SUBSTANCES
- ARTIFICIAL FLAVORING SUBSTANCES
- SOURCES OF AROMAS IN FOOD
- HERBS AND SPICES
- VOLATILE BLENDS

# FLAVOR

“FLAVOR IS THE **SENSORY IMPRESSION** OF FOOD OR OTHER SUBSTANCE, AND IS DETERMINED PRIMARILY BY THE **CHEMICAL SENSES OF TASTE AND SMELL**”.

- THE "**TRIGEMINAL SENSES**", WHICH DETECT **CHEMICAL IRRITANTS** IN THE **MOUTH AND THROAT**, AS WELL AS **TEMPERATURE** AND **TEXTURE**, ARE ALSO IMPORTANT TO THE OVERALL GESTALT OF FLAVOR PERCEPTION
- GESTALT MEANS AN ORGANIZED WHOLE THAT IS PERCEIVED AS MORE THAN THE SUM OF ITS PARTS

# FLAVOR: TRIGEMINAL SENSES

## TRIGEMINAL SENSES

“TRIGEMINAL NERVE (5<sup>TH</sup> CRANIAL NERVE) IS A NERVE RESPONSIBLE FOR SENSATION IN THE FACE AND MOTOR FUNCTIONS SUCH AS BITING AND CHEWING”.

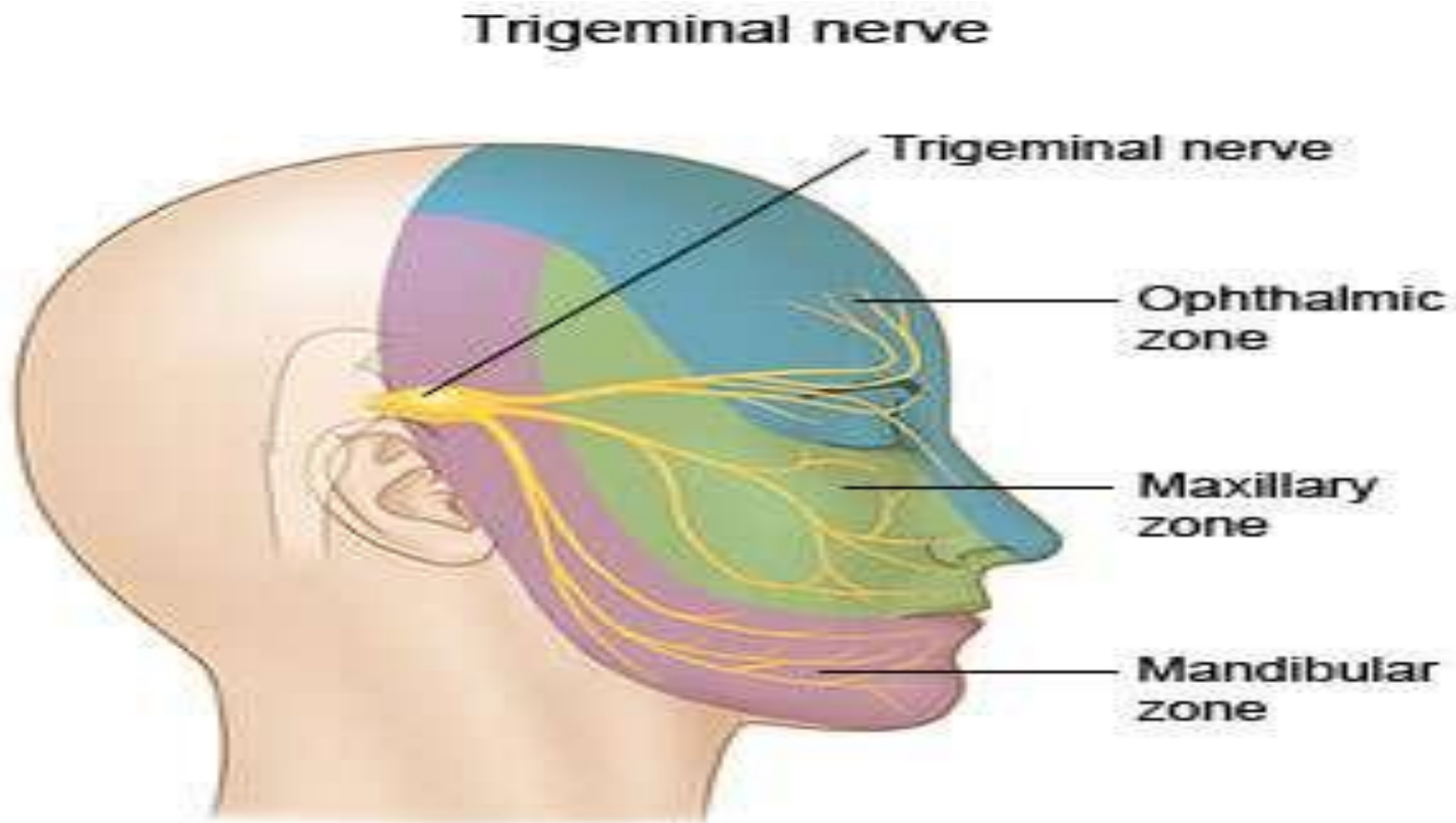
## FLAVORANT

- A SUBSTANCE THAT GIVES ANOTHER SUBSTANCE FLAVOR, ALTERING THE CHARACTERISTICS OF THE SOLUTE, CAUSING IT TO BECOME SWEET, SOUR, TANGY, etc.
- A FLAVOR IS A QUALITY OF SOMETHING THAT AFFECTS THE SENSE OF TASTE

# FLAVORANT

- A "FLAVORANT" IS DEFINED AS A SUBSTANCE THAT GIVES **ANOTHER SUBSTANCE FLAVOR**, ALTERING THE CHARACTERISTICS OF THE **SOLUTE**, CAUSING IT TO BECOME **SWEET, SOUR, TANGY** etc.
- A FLAVOR IS A **QUALITY** OF SOMETHING THAT AFFECTS THE SENSE OF **TASTE**.

“THE TRIGEMINAL NERVE (THE FIFTH CRANIAL NERVE, OR SIMPLY CN V) IS A NERVE RESPONSIBLE FOR SENSATION IN THE FACE AND MOTOR FUNCTIONS SUCH AS BITING AND CHEWING; IT IS THE LARGEST OF THE CRANIAL NERVES”.

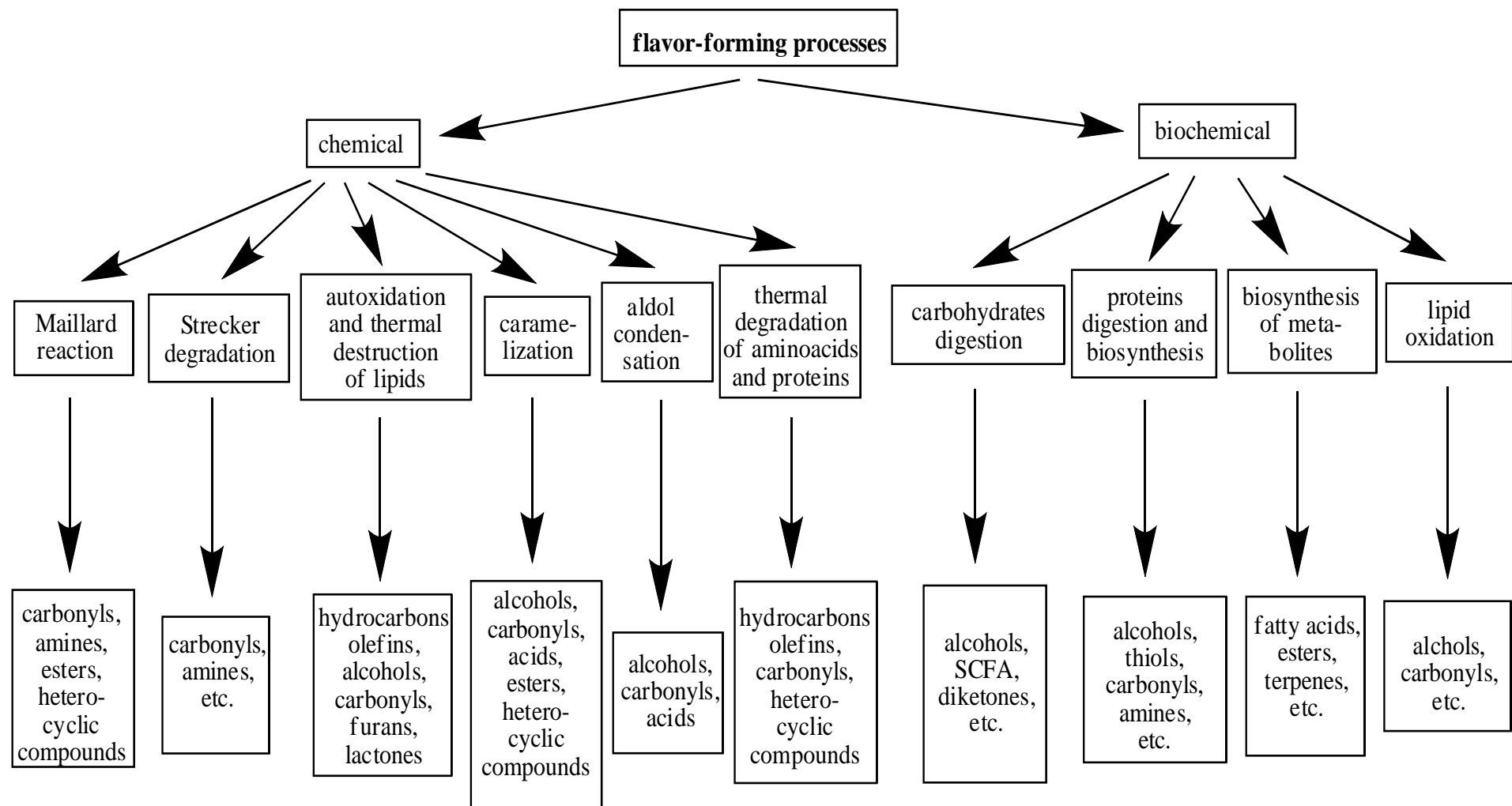


# FLAVORS NAMES

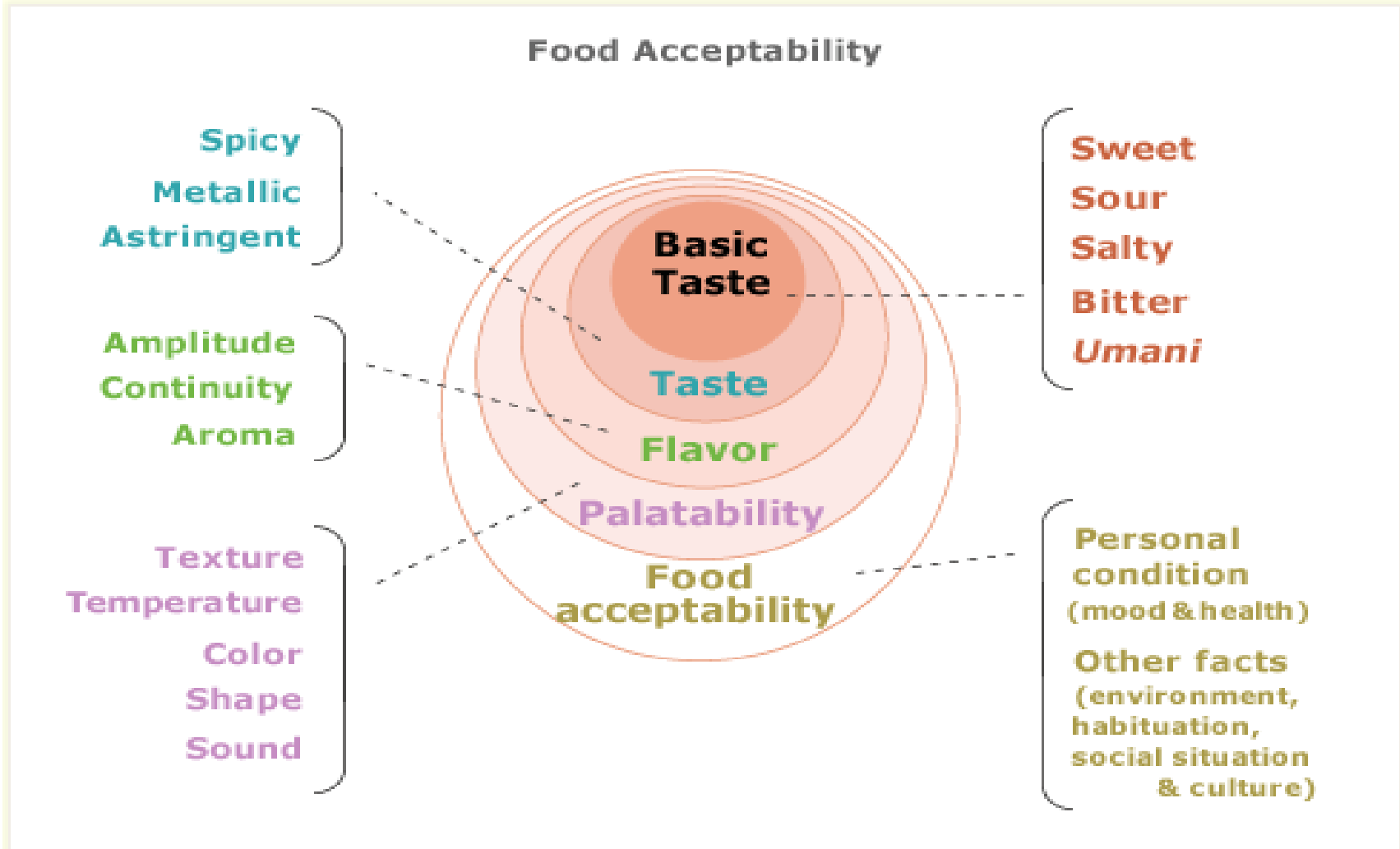




# FLAVOR FORMING PROCESSES IN FOODSTUFFS

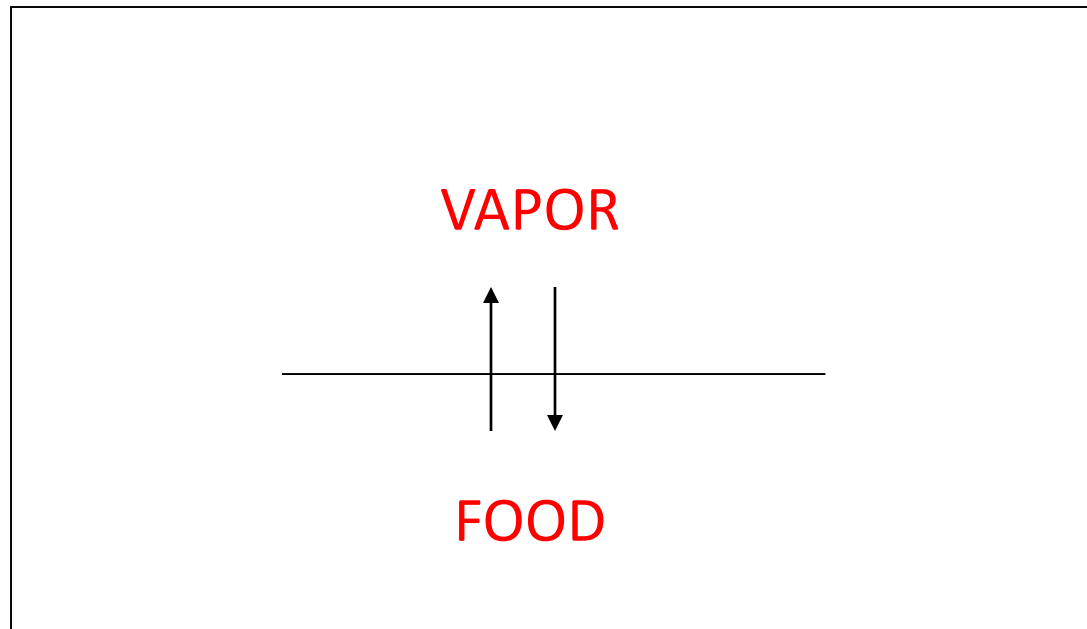


# FLAVOR PERCEPTION



# FLAVOR: TRIGEMINAL RESPONSE

**TASTE** (TRIGEMINAL RESPONSE) + **AROMA**



**WHAT TYPE OF MOLECULES DO YOU EXPECT TO HAVE AN AROMA?**

# TASTES

- SWEET

SUGAR

SACCHARIN

- SOUR

ACIDS

- SALTY

SALT

- BITTER

CAFFEINE

THEOBROMINE

QUININE

- UMAMI

MONOSODIUM GLUTAMATE

# TRIGEMINAL STIMULANTS

- HEAT

CAPSAICIN

- COOLING

MENTHOL

- ASTRINGENT

COLD TEA

BANANA PEEL

# NATURAL FLAVORING SUBSTANCES

- THESE FLAVORING SUBSTANCES ARE OBTAINED FROM **PLANT** OR **ANIMAL** RAW MATERIALS BY **PHYSICAL**, **MICROBIOLOGICAL**, OR **ENZYMATIC** PROCESSES
- THEY CAN BE EITHER USED IN THEIR **NATURAL** STATE OR **PROCESSED** FOR HUMAN CONSUMPTION, BUT CANNOT CONTAIN ANY NATURE-IDENTICAL OR ARTIFICIAL FLAVORING SUBSTANCES

# NATURE IDENTICAL FLAVORING SUBSTANCES

- THESE ARE OBTAINED BY SYNTHESIS OR ISOLATED THROUGH CHEMICAL PROCESSES, WHICH ARE CHEMICALLY AND ORGANOLEPTICALLY IDENTICAL TO FLAVORING SUBSTANCES NATURALLY PRESENT IN PRODUCTS INTENDED FOR HUMAN CONSUMPTION
- THEY CANNOT CONTAIN ANY ARTIFICIAL FLAVORING SUBSTANCES

# ARTIFICIAL FLAVORING SUBSTANCES

- THESE ARE **NOT IDENTIFIED** IN A NATURAL PRODUCT INTENDED FOR HUMAN CONSUMPTION, WHETHER OR NOT THE PRODUCT IS PROCESSED
- THESE ARE TYPICALLY **PRODUCED** BY **FRACTIONAL DISTILLATION** AND ADDITIONAL CHEMICAL MANIPULATION OF **NATURALLY** SOURCED CHEMICALS, CRUDE OIL, OR COAL TAR
- ALTHOUGH THEY ARE CHEMICALLY DIFFERENT, IN SENSORY CHARACTERISTICS THEY ARE THE SAME AS NATURAL ONES



# SOURCES OF AROMAS IN FOOD

## NATURAL FLAVORS

- **HERBS** AND **SPICES** (REACTION AFTER CUTTING)
- **FRUIT** (BIOSYNTHESIS DURING RIPENING)

## PROCESS FLAVORS

- **BROWNING**
- **LIPID OXIDATION**
- **FERMENTATIONS**

## ARTIFICIAL FLAVORS

- CHARACTER **IMPACT** COMPOUNDS

# HERBS AND SPICES

- HERBS: AROMATIC SOFT-STEMMED PLANTS
- SPICES: ALL OTHER AROMATIC PLANT MATERIALS
  - ROOTS
  - BUDS
  - SEEDS
  - BARK

# VOLATILE BLENDS

## PEPPERMINT

- MENTHOL
- MENTHONE
- MENTHOFURAN

## SPEARMINT

- CARVONE
- CARVONE DERIVATIVES

## NUTMEG

- SABININE
- PINENE
- MYRISTICIN

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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رَبِّ زِدْنِي عِلْمًا

MY LORD! INCREASE ME IN KNOWLEDGE.

# FST-311. L # 14: FLAVORS IN FOOD APPLICATION-II

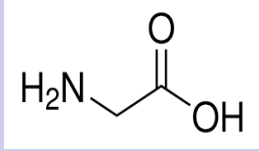
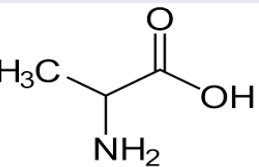
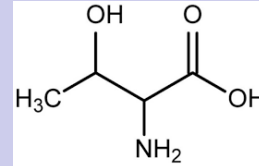
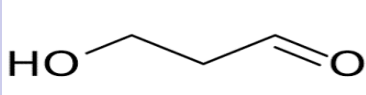
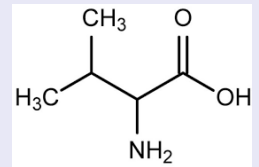
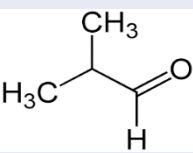
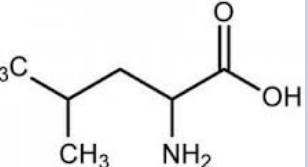
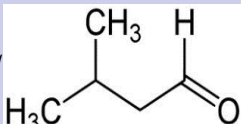
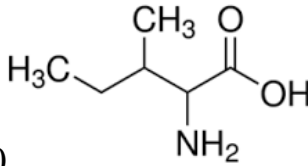
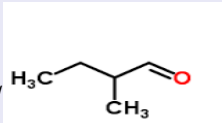
- **NATURAL, NATURE-IDENTICAL AND ARTIFICIAL (SYNTHETIC)**
- **ACID SALTS AND FLAVORS**
- **AROMA OF THE STRECKER ALDEHYDES**

# FLAVOR

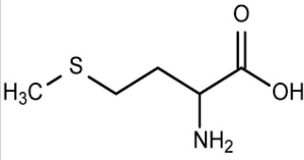
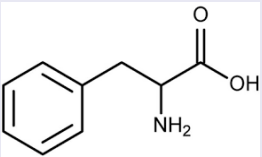
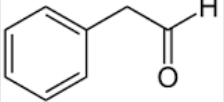
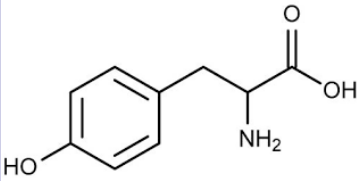
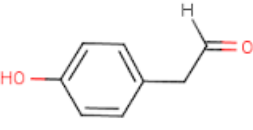
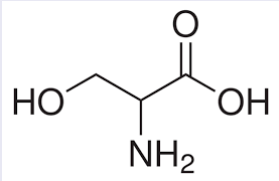

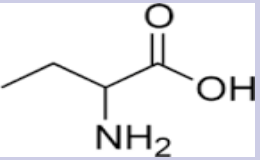
## NATURAL, NATURE-IDENTICAL AND ARTIFICIAL (SYNTHETIC)

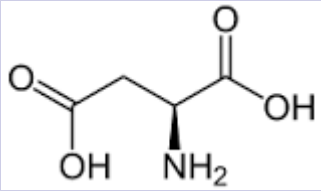
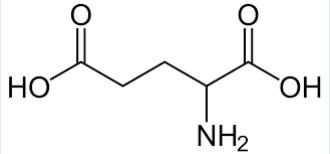
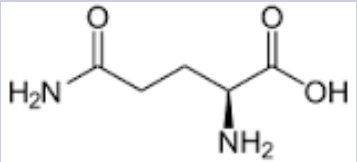
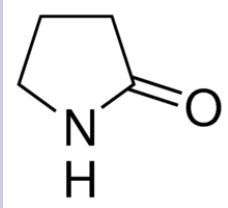
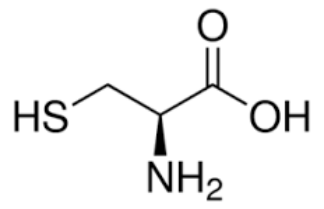
SUBSTANCE	ODOR
DIACETYL	<b>BUTTERY</b>
ISO-AMYL ACETATE	<b>BANANA</b>
BENZALDEHYDE	<b>BITTER ALMOND</b>
CINNAM ALDEHYDE	<b>CINNAMON</b>
ETHYL PROPIONATE	<b>FRUITY</b>
METHYL ANTHRANILATE	<b>GRAPE</b>
LIMONENE	<b>ORANGE</b>
ETHYL DECADIENOATE	<b>PEAR</b>
ALLYL HEXANOATE	<b>PINEAPPLE</b>
ETHYL MALTOL	<b>SUGAR, COTTON CANDY</b>
ETHYLVANILLIN	<b>VANILLA</b>
METHYL SALICYLATE	<b>WINTERGREEN</b>

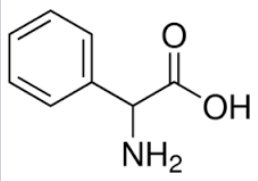
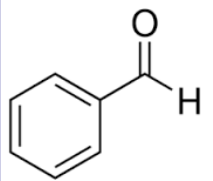
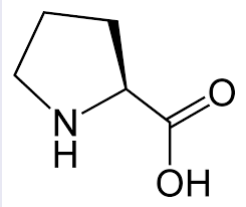
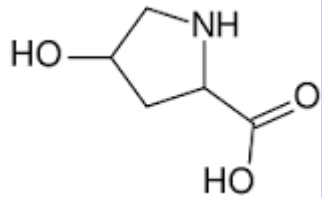
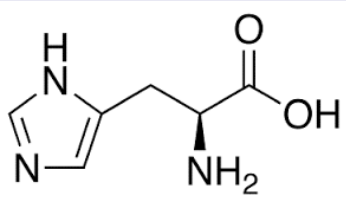
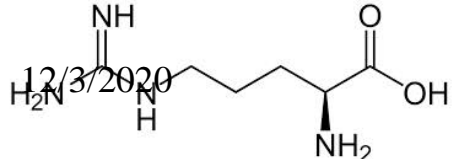
Acid Salts	Description
<p><b>Glutamic acid Salts</b></p>	<ul style="list-style-type: none"> <li>• This amino acid's sodium salt, monosodium glutamate (<b>MSG</b>), is one of the <b>most commonly</b> used flavor enhancers in food processing</li> <li>• <b>Mono-</b> and <b>diglutamate</b> salts are also commonly used.</li> </ul>
<p><b>Glycine Salts</b></p>	<ul style="list-style-type: none"> <li>• Simple amino acid salts typically combined with <b>glutamic</b> acid as flavor enhancers</li> </ul>
<p><b>Guanylic acid Salt</b></p>	<ul style="list-style-type: none"> <li>• Nucleotide salts typically combined with <b>glutamic</b> acid as flavor enhancers</li> </ul>
<p><b>Inosinic acid Salts</b></p>	<ul style="list-style-type: none"> <li>• Nucleotide salts created from the breakdown of <b>AMP</b> (<b>adenosine mono-phosphate</b>), due to high costs of production, typically combined with <b>glutamic</b> acid as flavor enhancers</li> </ul>
<p><b>5'-Ribonucleotide Salts</b></p>	<ul style="list-style-type: none"> <li>• Nucleotide salts typically combined with other <b>amino</b> acids and <b>nucleotide</b> salts as flavor enhancers</li> </ul>

AMINO ACID	STRECKER ALDEHYDE	ODOR AT 100 °C	ODOR AT 180 °C
<p>Glycine</p> 	<p>HCHO FORMALDEHYDE</p>	<p>Caramel-like, soft, ester-like</p>	<p>Burnt sugar</p>
<p>Alanine</p> 	<p>CH<sub>3</sub>CHO ACETALDEHYDE</p>	<p>Caramel-like, spicy, fruity</p>	<p>Burnt sugar</p>
<p>Threonine</p> 	<p>HYDROXYPROPANAL</p> 	<p>Chocolate</p>	<p>Burnt</p>
<p>Valine</p> 	<p>2-methyl PROPANAL</p> 	<p>Straw, green, rye bread</p>	<p>Chocolate, pungent</p>
<p>Leucine</p> 	<p>3-methyl BUTANAL</p> 	<p>Bread, malty, green</p>	<p>Cream cheese</p>
<p>Isoleucine</p> 	<p>2-methyl BUTANAL</p> 	<p>Fruity, ester, green</p>	<p>Cream cheese</p>



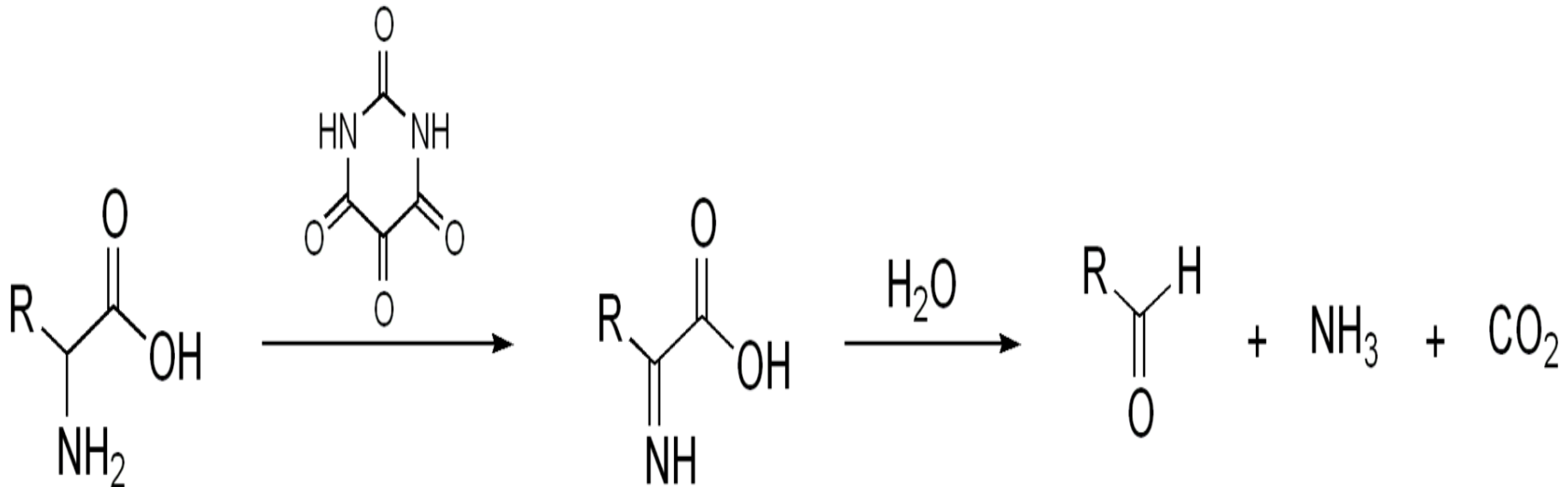
Amino acid	Strecker aldehyde	Odor at 100 °C	Odor at 180 °C
<p>Methionine</p> 	<p>METHIONAL CH<sub>3</sub>SCH<sub>2</sub>CH<sub>2</sub>CHO</p>	<p><b>Fermented cabbage, sour, unpleasant</b></p>	<p><b>Fermented cabbage, sour</b></p>
<p>Phenyl alanine</p> 	<p>2-phenyl Acetaldehyde</p> 	<p><b>Floral, violet, honey,</b></p>	<p><b>Floral – violet, lilac</b></p>
<p>Tyrosine</p> 	<p>2-(4-hydroxyphenyl)-Acetaldehyde</p> 	<p><b>Caramel-like</b></p>	<p><b>Caramel-like</b></p>
<p>Serine</p> 	<p>HYDROXYACETALDEHYDE HYC</p> 	<p><b>Maple syrup</b></p>	<p><b>Maple syrup</b></p>
<p>α-amino butyric acid</p> 	<p>PROPANAL CH<sub>3</sub>CH<sub>2</sub>CHO</p>	<p><b>Caramel-like, Maple syrup</b></p>	<p><b>Burnt sugar</b></p>

Amino acid	Strecker aldehyde	Odor at 100 °C	Odor at 180 °C
<b>Aspartic acid</b> 		<b>Sweet, candy</b>	<b>Burnt sugar</b>
<b>Glutamic acid</b> 	Butanal and propanal	<b>Caramel like</b>	<b>Burnt sugar</b>
<b>Glutamine</b> 	Pyrrolidone 	<b>Chocolate</b>	<b>Hard caramel</b>
<b>Cysteine</b> 	Acetaldehyde, propanal	<b>Sulfide, smell of H<sub>2</sub>S, cooked meat</b>	<b>Sulfide, smell of H<sub>2</sub>S</b>

Amino acid	Strecker aldehyde	Odor at 100 °C	Odor at 180 °C
<p>Phenyl-glycine</p> 	<p>Benzaldehyde</p> 	<p><b>Almond</b></p>	<p><b>Almond</b></p>
<p>Proline</p> 		<p><b>Burnt proteins</b></p>	<p><b>Sweet smell</b></p>
<p>Hydroxy proline</p> 		<p><b>Potatoes</b></p>	<p><b>Potatoes</b></p>
<p>Histidine</p> 		<p><b>No specific</b></p>	<p><b>Burnt sugar</b></p>
<p>Arginine</p> 	<p>FST-311. V (SS+R) - Dr. Shahid Mahmood Rana</p>	<p><b>Burnt sugar</b></p>	<p><b>Burnt sugar</b></p>

# STRECKER ALDEHYDE

- **The Strecker degradation** is a chemical reaction which converts an  **$\alpha$ -amino acid into an aldehyde** containing the side chain, by way of an **imine** intermediate.
- It is named after **Adolph Strecker (1862)**, a **German** chemist.



An imine is a functional group or chemical compound containing a carbon–nitrogen double bond.

