Bourbon

Presented to the
Society of Flavor Chemists
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by

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World's Second Oldest Profession

- Easy to make
- Consistency is the KEY!
- What does it take?

Warning

We strongly caution you not to add yeast to this product or allow it to stand in a warm place. Fermentation will occur and the wine formation will destroy the grape juice!

Sugar + Yeast = Alcohol

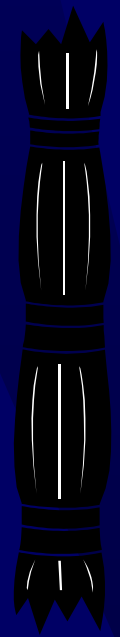
- Why are different spirits different?
  - Yeast
  - Sugar source
  - Fermentation conditions
  - Distillation conditions
  - Post Distillation Processes

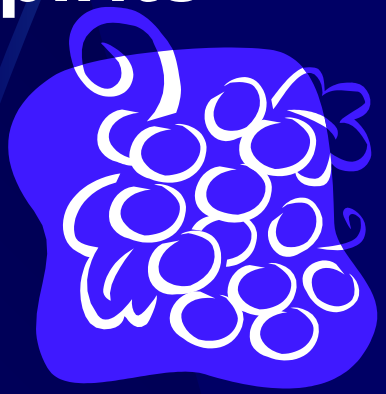
Yeast

- Different yeasts give different flavors to spirits
- Beer/Wine vs. Spirits

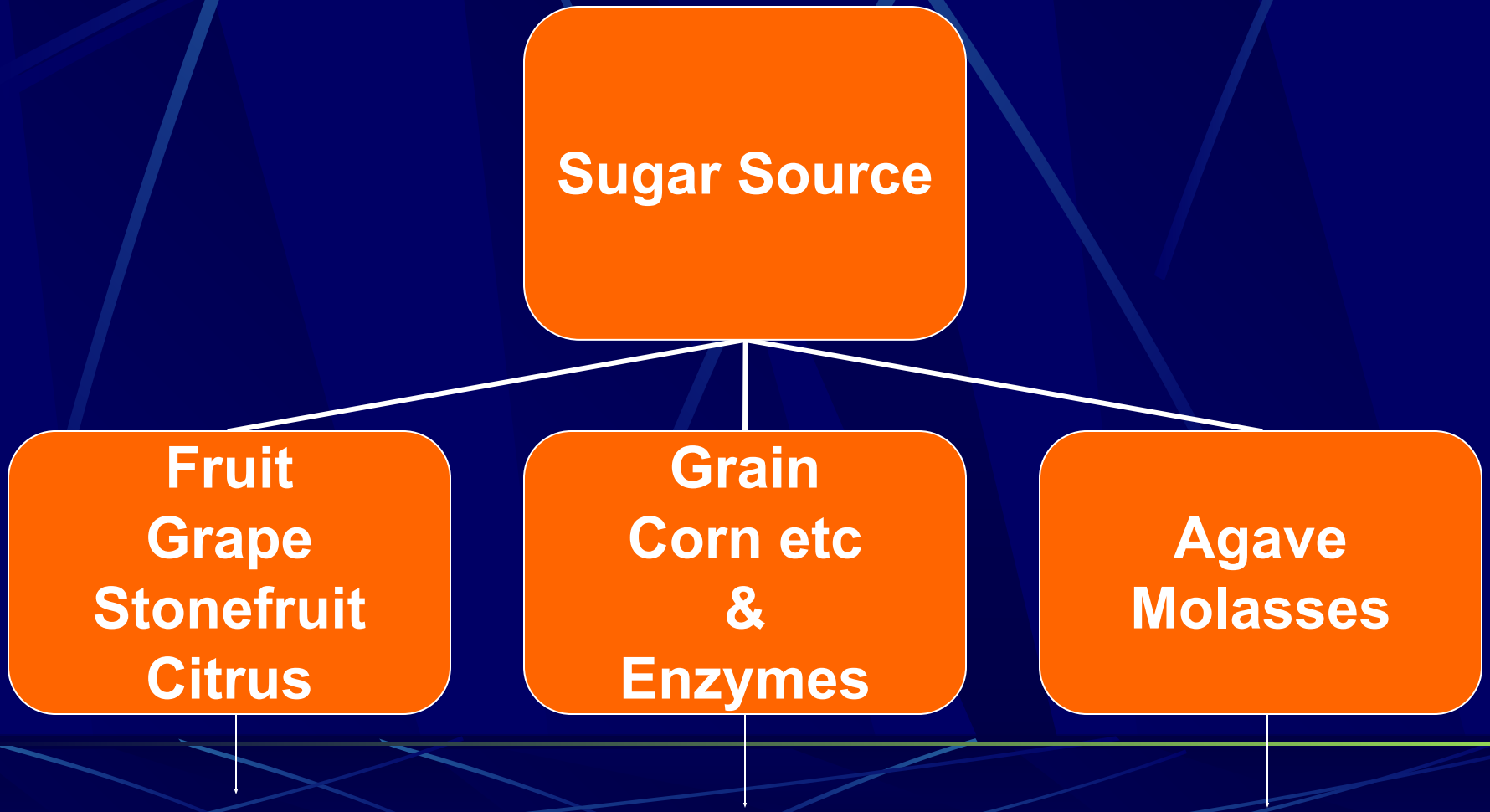
Sugar Sources

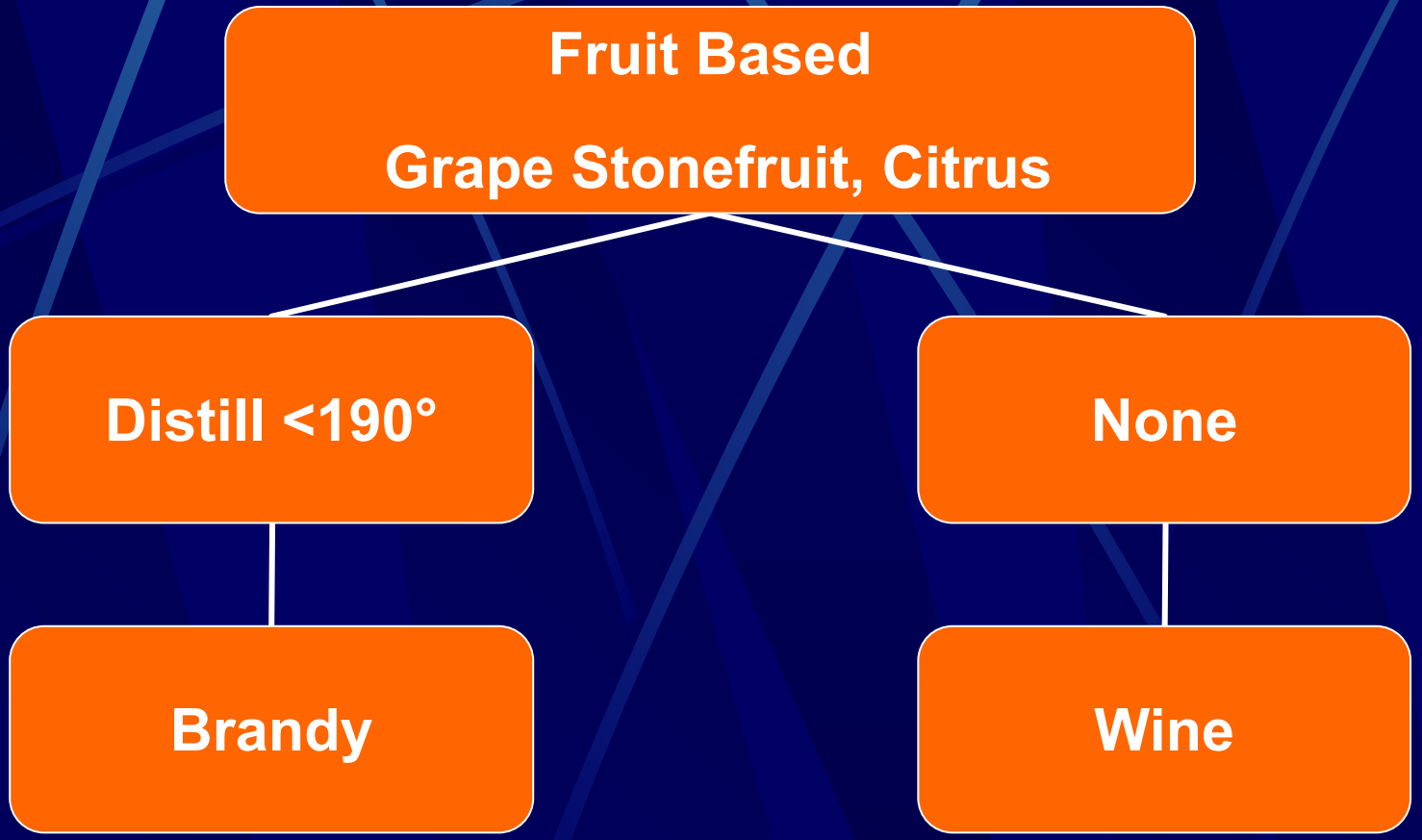
- **Different Sugars Make Different Spirits**
  - Grain
  - Fruit
  - Molasses
  - Agave

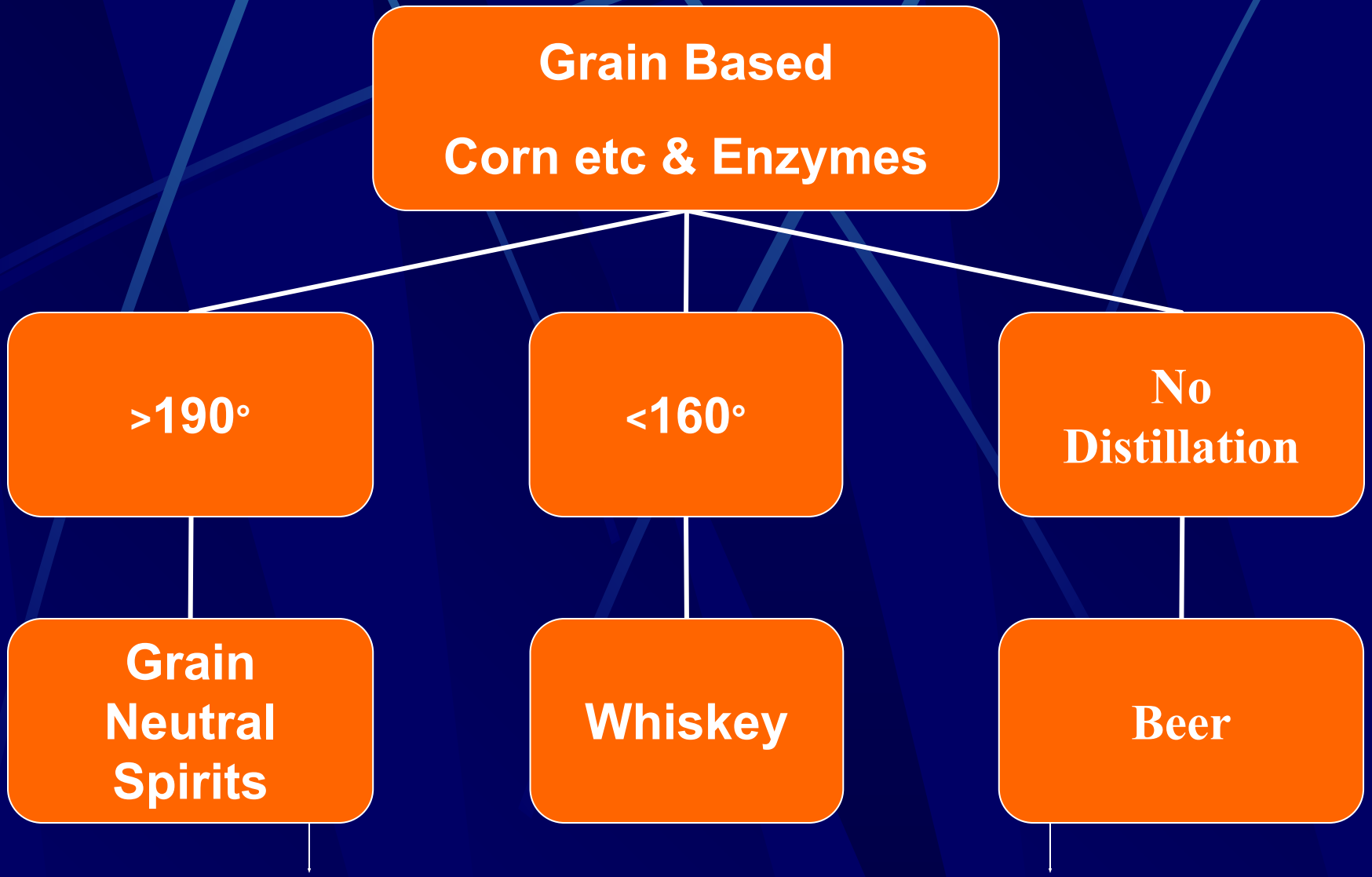




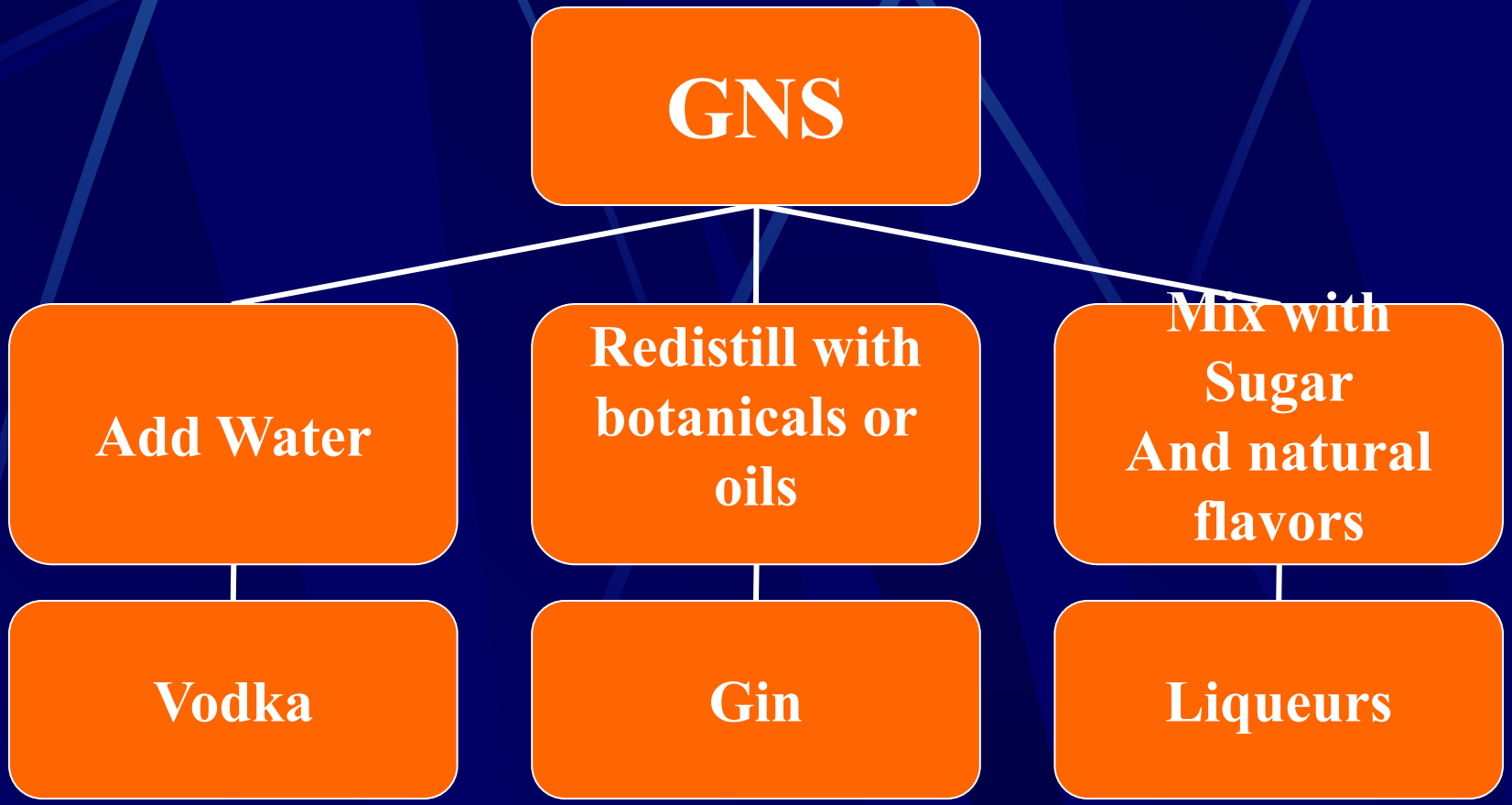
Sugar Source & Final Products

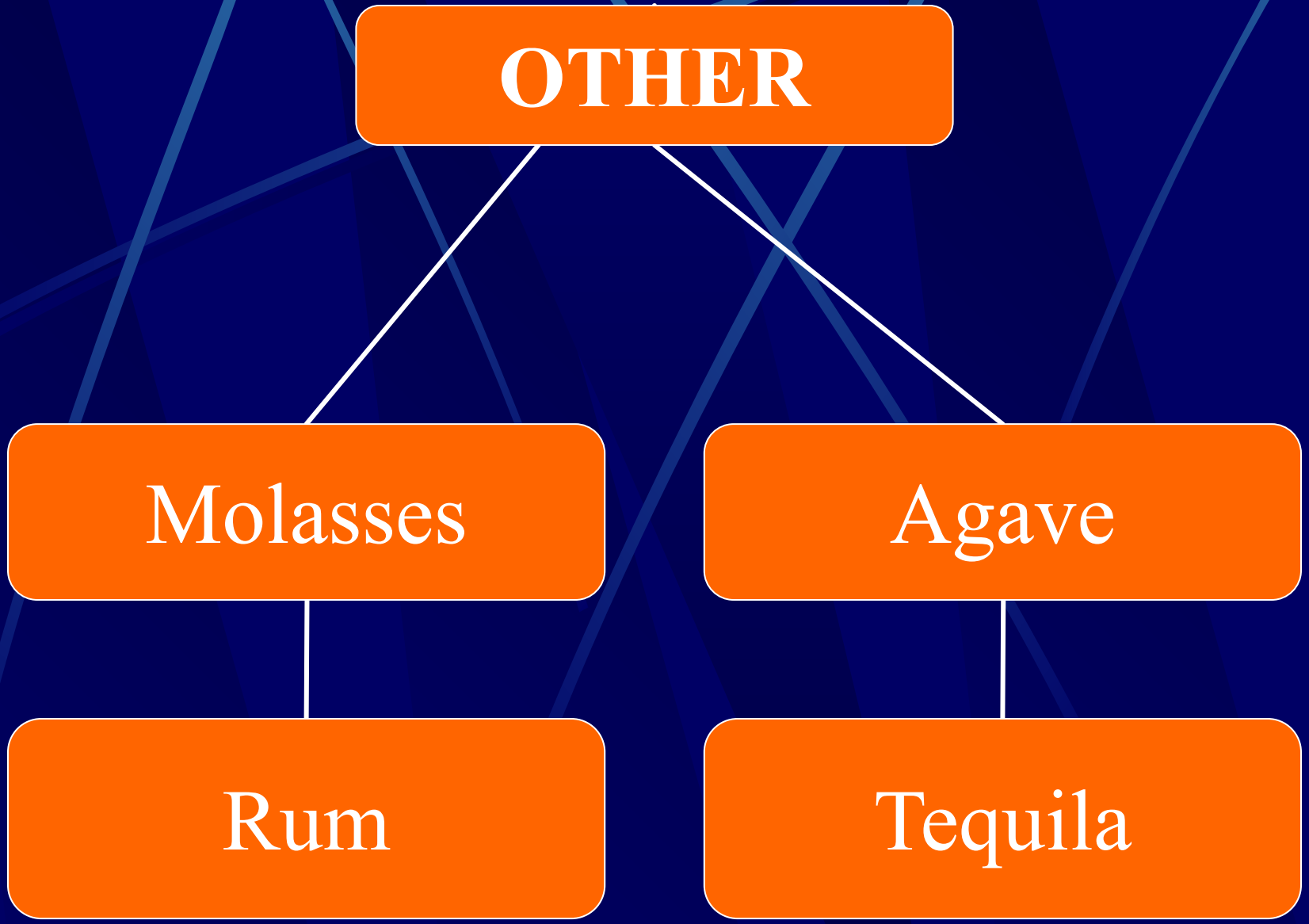



Fruit Based
Grape Stonefruit, Citrus
Distill <190°
None
Brandy
Wine


Grain Based
Corn etc & Enzymes
>190°
<160°
No Distillation
Grain Neutral Spirits
Whiskey
Beer

Grain Neutral Spirits




OTHER
Molasses
Agave
Rum
Tequila

Standard of Identity Whiskey

- From grain
- Distilled below 190 proof
- Stored in oak containers
- Includes mixtures including GNS
- Minimum bottling proof 80

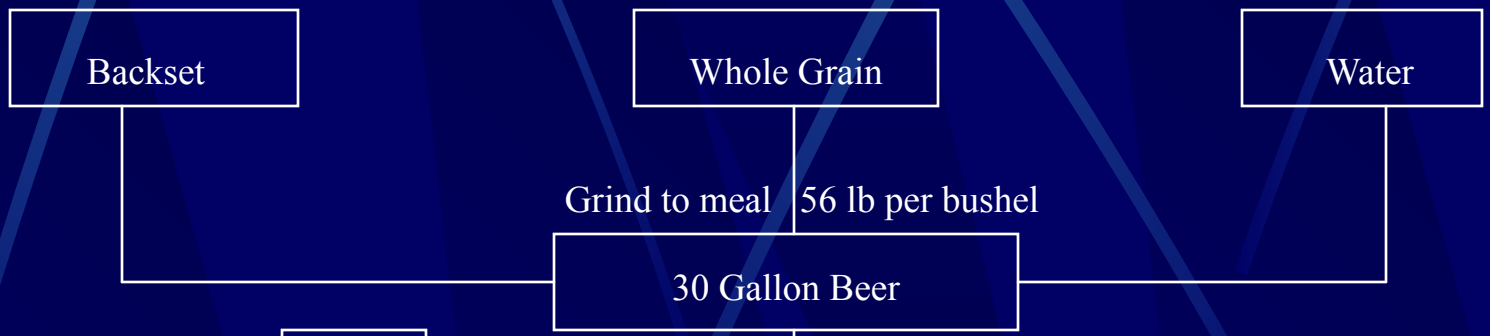
American Whiskey

- Straight
- Blended

Standard of Identity
American Straight Whiskey

- 100% whiskey
- Distilled at less than 160 proof
- Stored at less than 125 proof
  - New oak barrels
  - Charred barrels (except corn)
  - minimum 2 years
- 51% of named grain
  - Bourbon at least 51% corn
  - Jim Beam 78% corn
  - Rye at least 51% rye

Mash Preparation



One bushel of grain will produce about 2.25 cases of 80° spirits after aging loss

Malt

Yeast

Heat to 160°F (taste Mash A)

Add Pre-Malt to keep beer liquid

Heat to 220°F to complete liquefaction and hydration (taste slide B)

Cool to 145°F

Add conversion malt to convert starches to sugar

Cool to 70°F (taste mash C)

Add yeast, Ferment, Distill, Age in Barrels

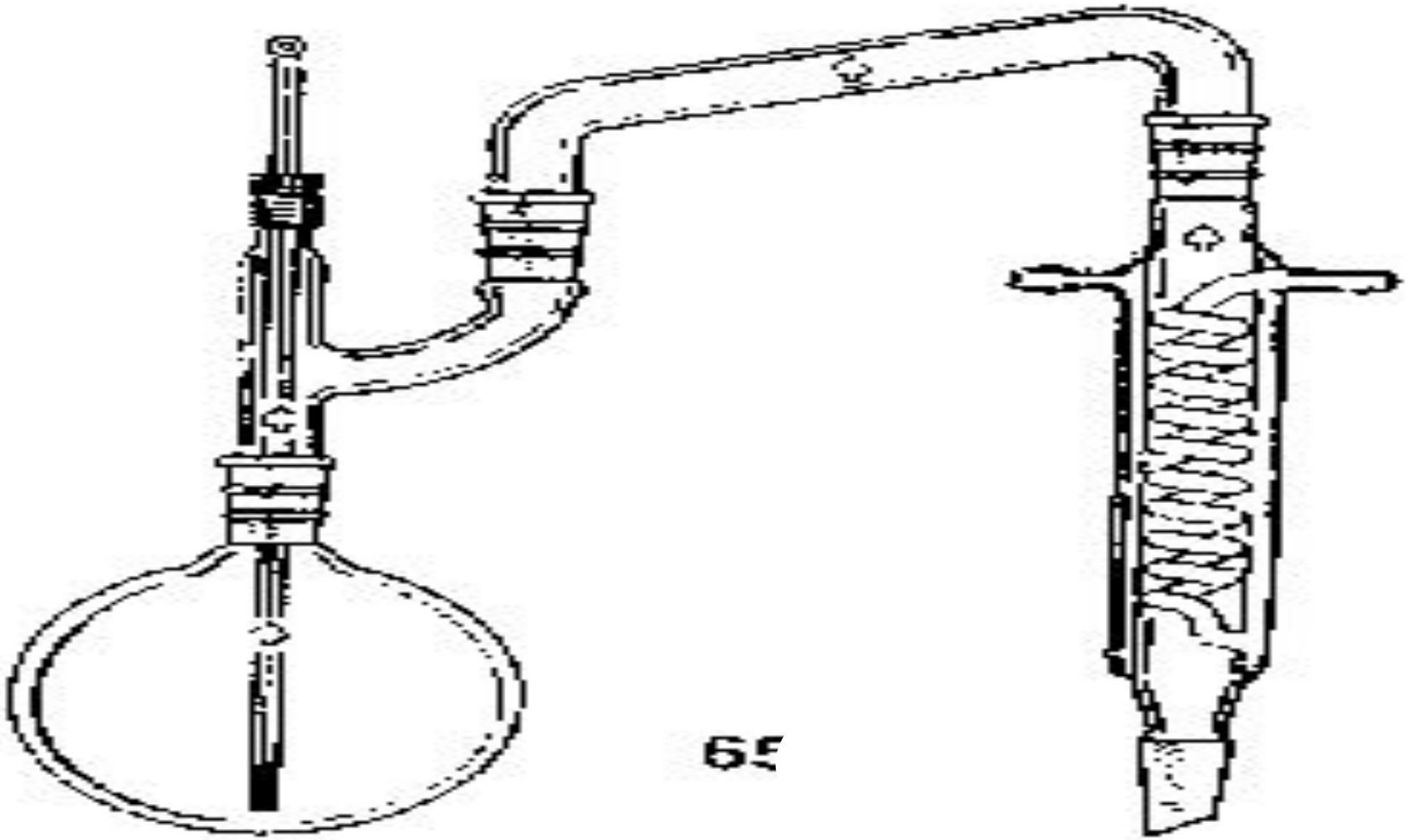
Mash Tasting Key

- A. Cooked grain only
- B. Cooked grain with liquefaction enzymes
- C. Cooked grain liquefied and converted

Distillation

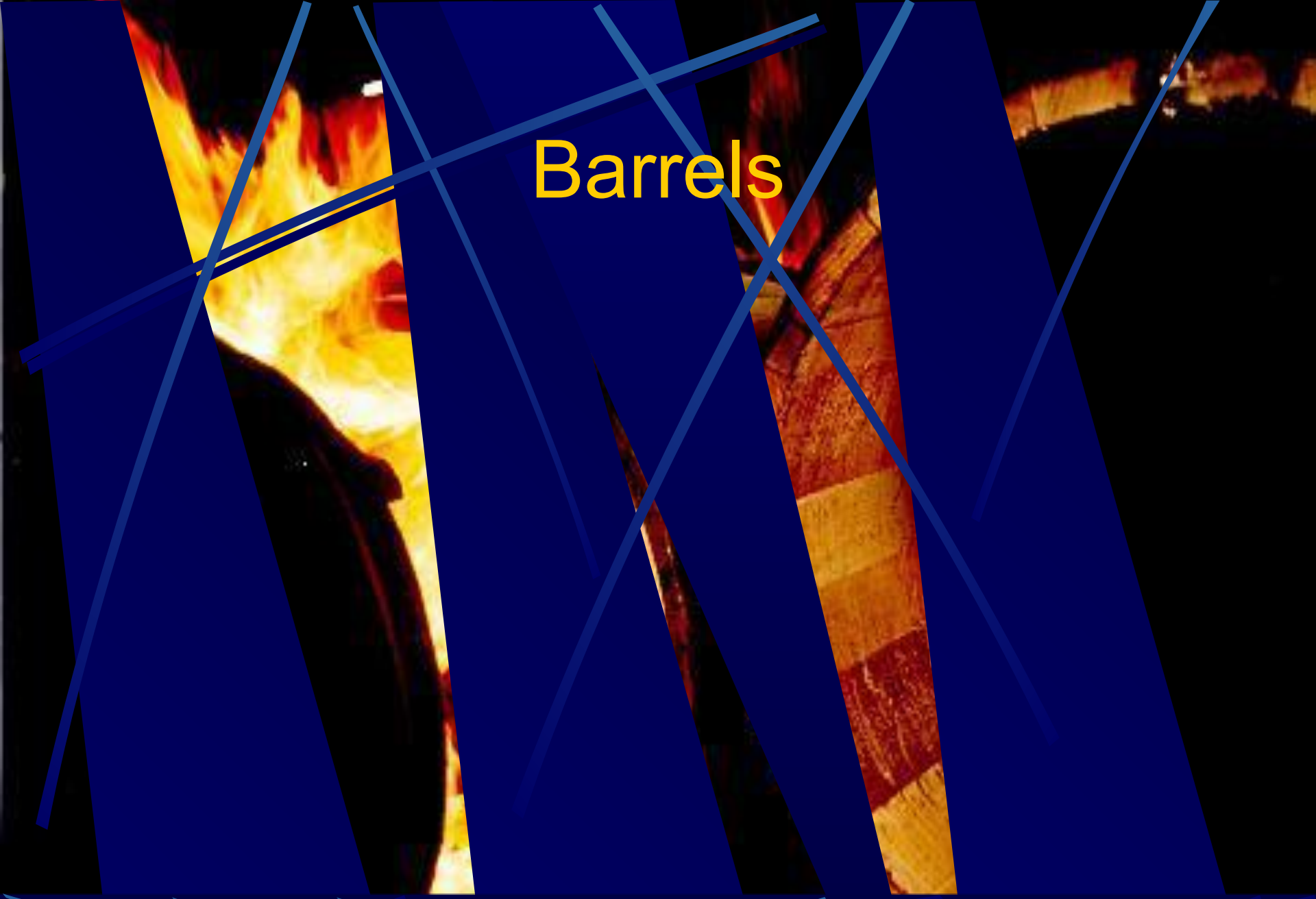
- Distill means to separate
- High proof distillation yields low flavor spirits
- Low proof distillations yield high flavor spirits

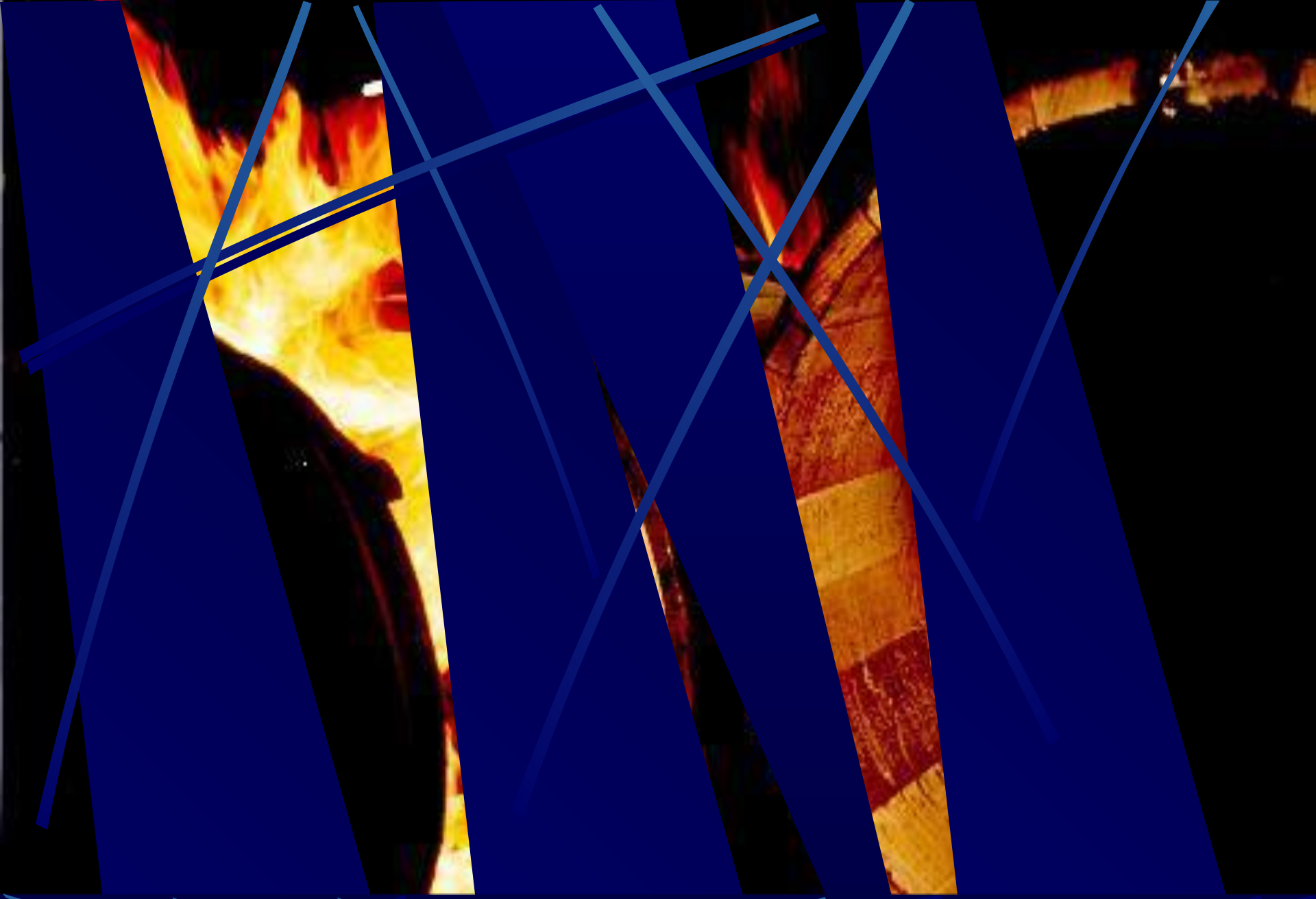
Distillation



- How Does It Work?
- What Does Distill Mean?

Barrels





Barrel Aging

- Charcoal Filtration
- Oxidation
- Esterification
- Extraction
- Evaporation

Charcoal Filtration

- The char layer in the barrel
- Removes impurities
- Does not impart color

Oxidation

- Barrel allows some oxygen to pass
- Converts alcohols to aldehydes and acids
- Other

Esterification

- Alcohols and acids combine to form esters

Extraction

- Caramel layer under char
- Heating of cellulose and lignin during charring
- Occurs slowly with the seasons
- Imparts color and flavor
  - Barrel congeners

Evaporation

- Soakage 7%
- Outage 4% annually
- 10 year old whiskey
  - 50 gallon barrel
  - Lose 3.5 gallons day one
  - Lose 40% over time
  - Net: recover about 30 gallons
- Proof can go up or down

What's Next?

- Currently each of our two stills use about 500,000 pounds of grain per day
- This leaves a grain residue of approx 125,000 pounds mostly protein and fiber
- This residue is dried and sold as cattle feed

Drying Process

- Still bottoms are centrifuged
- Liquid portion evaporated through a two step process to a thick syrup
- Syrup is sprayed back onto the wet grain and sent through a flash drier

Syrup

- Major components of the syrup are
  - Lipids
  - Protein
  - Amino acids
  - Organic acids

The Question

- Are there some interesting proteins and/or sugars or other ingredients that could be used for novel or lower cost reaction flavors or flavor ingredients?

Tasting

- First we Taste
- Then we can drink

Thank You

- Questions?