

# SUGAR

## The Science of Sweet

By Darcy S. O'Neil

[www.artofdrink.com](http://www.artofdrink.com)

# INTRODUCTIONS' & AGENDA

## WHO, WHAT AND WHY

### PRESENTERS



Darcy S. O'Neil

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Michael Glassberg

Swizzle Stick Bar

### PART ONE

Properties of Sugars  
& Sweeteners

### PART TWO

Using Sugar in Drinks  
and making Garnishes

# THE HEALTH QUESTION

**WHAT WOULD A CHEF DO? ADD MORE BUTTER!**

**Should we worry about too much sugar?**

Only if it puts the drink out of balance. If someone is going to consume three or four drinks per hour, sugar is not the problem.

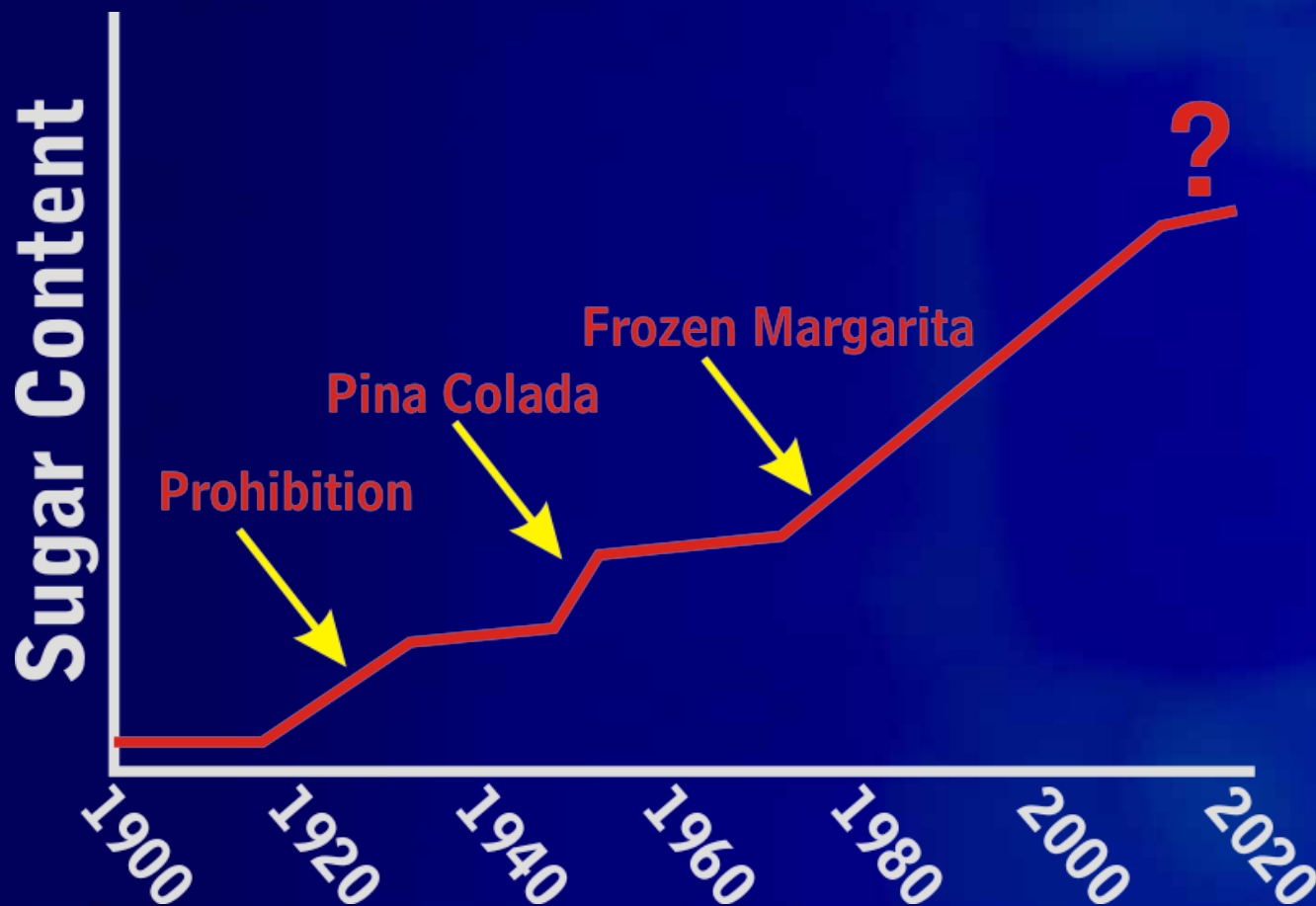
Moderate consumption of sugars and sweeteners is not a problem.



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# SUGAR TRENDS IN COCKTAILS

## SWEET, SWEETER AND SWEETEST



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# SUGAR AND BEHAVIOR

## THE DRUG OF CHOICE FOR THIS GENERATION

- Sugar is proven to have Addictive qualities
- Sugar releases opioids and dopamine
- Sugar can produce addictive type behaviors' such as cravings, bingeing and withdrawal

*People don't binge on broccoli!*



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# SUGAR & COCAINE

MORE IN COMMON THAN YOU THINK

Intense sweetness surpasses cocaine reward

*"findings clearly demonstrate that intense sweetness can surpass cocaine reward, even in drug-sensitized and -addicted individuals"*

Lenoir M, Serre F, Cantin L, Ahmed SH. (University Bordeaux) 2007



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# CANDY-TAILS

## DEALING WITH SUGAR ADDICTS

- Avoid prolonged eye contact
- Tell them what they want to hear
- Make it sweet, but balanced
- Fruit flavours help
- Think long term
- Stay honest
- Don't judge



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# TYPES OF SWEETENERS

## IT WAS ONCE JUST HONEY!

- Glucose, sucrose, fructose and maltose
- Plant Syrups and Sap
- Natural Sugar Alcohols
- Artificial Sweeteners
- Protein Sweeteners
- Other "Herbal" Sweeteners



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# SUGARS & CARBOHYDRATES

## JUST THE BIG FAT FACTS

Calories

4

per gram

Intake

164

Pounds per  
Year



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# GLYCEMIC INDEX

## HANGOVER HELPER INDEX

Glucose

**96**

Sucrose

**64**

Fructose

**22**

Honey

**58**

HFCS

**62**

Sorbitol

**9**

**COCKTAIL  
APPROVED**

# SUCROSE: TABLE SUGAR

## OUR SECRET LOVE AFFAIR

- Sucrose is a disaccharide made of fructose / glucose
- Decomposes at 186°C (367°F) to form caramel
- Highest viscosity compared to fructose/glucose
- Maintains sweetness in presence of sour tastes
- Cheap and easy to source



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# COMMERCIAL SUGAR PROPERTIES

## BEET & CANE

### Granulated

- Standard table sugar which is 100% sucrose

### Castor / Fruit / Super-Fine

- Very fine sugar crystals for easy dissolving
- Still 100% sucrose

### Confectioners / Powdered Sugar

- **Avoid** using in cocktails, contains corn starch



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# OTHER CANE PRODUCTS

## PAYING MORE FOR LESS

### Brown Sugar

- Table sugar mixed with molasses

### Raw Sugar (Turbinado / Muscovado)

- Partially process sugar, crystalline, flavourful

### Molasses / Treacle

- Un-crystallized syrup produced in refining sugar

### Golden Syrup

- Bright golden syrup with caramel like flavours



# GLUCOSE

## HANGOVER ACCELERANT



- Primary source of energy for humans
- About 80% as sweet as sucrose
- Helps prevent sucrose crystallization
- Useful in simple syrup and "pulled sugar"
- Easily overpowered by acidic flavours
- "Flat" taste



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# FRUCTOSE

## NOT AS BAD AS YOU THINK

- Primarily found in fruits, often called “fruit sugar”
- Clean flavour, with a cooling sensation on tongue
- Perceptually 1.8 times as sweet as Sucrose
- Sweetness significantly reduced with citric acid



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# FRUCTOSE & ETHANOL

## RESEARCH SAYS....

- May increase clearance of alcohol from the system
- Blood alcohol clearance increased by 90%
- Fruit based drinks may already have this effect
- Won't reduce alcohol induced hangovers



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# INVERT SUGAR

## THE MARKETABLE NAME FOR HFCS

- Sucrose that's been split into Fructose & Glucose
- Usually a mix of sucrose, fructose and glucose
- Name comes from how it rotates light
- Resists crystallization (shelf-stable)
- About 1.2 times sweeter than sucrose
- Sucrose naturally inverts in acidic environment



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# INVERT SUGAR

## EVIL VILLAIN OR MISUNDERSTOOD SAMARITAN

- Effectively the same sugars as sucrose
- Sweeter taste with lower viscosity
- More susceptible to acidic flavours
- Nobody likes the name



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# MALTOSE

## NO MALTOSE NO BEER OR WHISKY

- Is a disaccharide made of two glucose molecules
- Least common disaccharide found in nature
- Found in germinating grains, like barley
- Sweetness: 40% of sucrose / Glycemic Index: 105
- Potential to reduce hunger or signal satiety
- "Malty" flavour, with mild after-taste
- Light malt powder (beer making) is very close

# TAGATOSE & TREHALOSE

## THE TRENDY SUGARS

- 92% and 45% as sweet as Sucrose, respectively
- 1.5 and 4 of the calories per gram, respectively
- Both are naturally occurring sugars
- Found in mushrooms, honey and fermented items
- Tagatose is flavor enhancing and improves mouthfeel
- Trehalose suppresses bitter, stringent, harsh flavours



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# SUGAR ALCOHOLS

SORRY, NOT THAT TYPE OF ALCOHOL

## Glycerine and Sorbitol

- 60% and 75% as sweet as sucrose, respectively
- Naturally occurring in stone-fruits and berries
- Glycerol common in spirits (smoothes out "edges")
- Generally frowned as "synthetic" or "additive"

**Useful as a stabilizer / emulsifier for Bitters**



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# SUGAR ALCOHOLS: XYLITOL

## THE COOL REFRESHING RIMMER

- Relative sweetness similar to sucrose (1:1)
- Closer in flavour to fructose
- Sweetness easily overpowered by acid
- Crystals leave a cooling sensation on tongue
- Good for sugar rims



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# SUGAR ALCOHOLS: ERYTHRITOL

## SWEET WITHOUT THE GUILT

- Naturally occurring in fruits and fermented beverages
- 65% as sweet as sucrose with only 0.2 cal/gram
- Crystals give cooling sensation on tongue
- Doesn't dissolve as easily as sucrose
- Clean fructose like flavour
- Does not cause gastric distress!
- Used in Japan since 1990



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# Warning

**Excess consumption of sugar alcohols  
may cause gastric distress.**

If you work with sugar alcohols  
Erythritol is the better option,  
followed by Xylitol, to avoid the  
aforementioned gastric distress.

**Sugar Alcohols are best blended with natural sugars**

# SWEETNESS PERCEPTION

## TIME FOR A TASTING

- Taste each solution from left to right



Erythritol

- Rinse with water between tastings
- Note what you taste



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# HONEY

## THE BEARS DRINK OF CHOICE

- Composed of fructose (32%) / glucose (26%)
- Unique flavour that works well in cocktails
- Studies show alcohol metabolized 40% faster
- 1oz of honey for every 50lbs of bodyweight
- May have gastroprotective effects against alcohol
- Won't do anything for the hangover



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# MOLASSES

## TASTY WASTE

- Made from the dreges of the sugar refining
- Fancy grade: cooking and cocktails
- Blackstrap: cow chow, rum and health nuts
- 36% Sucrose | 6% Fructose | 3% Glucose | 24% Water
- Total Sugar: 49% | pH: 5 | 0.8% Sulphur
- Aside from Rum, strong flavour limits use



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# AGAVE, MAPLE, BIRCH SYRUP, PALM

## THE BLOOD OF PLANTS

- Agave syrup mostly fructose and glucose
- Levels vary, but always higher fructose (60% to 90%)
- Maple Syrup and Birch Syrup come in "grades"
- The heavier "B" Grade (cheaper) is for cooking
- "A" Grades good for cocktails, "B" can be diluted
- Palm sugar is flavourful, but similar to maple syrup
- Tend to increase cocktail costs



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# ARTIFICIAL SWEETENERS

## AVOID LIKE BANANA LIQUEUR

### Aspartame, Sucralose, Acesulfame-K, Saccharin

- Many people dislike the lingering “after-taste”
- Super-Tasters can detect a metallic flavour

### Neotame

- Extremely sweet, 10,000X sweeter than sucrose
- Flavour enhancing qualities, especially with Mint
- Chemically related to aspartame



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# GLYCOSIDES: LICORICE ROOT

## LIKE SWEETENING EVERYTHING WITH PASTIS

- 30 to 50 times sweeter than sucrose
- Slower onset and lingering licorice taste
- Generally regarded as safe, but 200mg limit
- Good for ulcers and chest congestion
- Bad for water retention and hypertension
- Not really useful in cocktails
- Popular in Japan



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# NEOHESPERIDINE DC

## THE BARTENDERS CHOICE?



- Discovered in the 1960's
- Extracted from the peel of citrus fruit
- 340 times the sweetness of sucrose
- Synergistic with citrus and sugar alcohols
- Flavour Enhancer at 4 to 5 ppm
- Sweetener at 15 to 20 ppm
- Anti-Bitter properties



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# PROTEIN SWEETENERS

COMING TO A BOTTLED COCKTAIL NEAR YOU SOON

## Monellin (Serendipity Berries)

- 1500 times as sweet as a 7% sucrose solution
- Heating above 50°C renders it tasteless
- pH affects sweetness (none below 2)

## Thaumatococin

- 2000 Times the sweetness of sugar
- Slow build up of sweetness
- Licorice-like aftertaste



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# MIRACULIN & CURCULIN

## THE MIRACLE PROTEINS

- Comes from the Miracle and Curculigo fruit
- Both exhibit taste modifying function
- Turn sour flavours into sweet
- Miracle fruit has no flavour or sweetness
- Curculin is naturally sweet
- Neither is heat stable



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# GUANIDINOACETIC ACID

## THE WORLDS HEAVY WEIGHT CHAMPION

- 100,000 times sweeter than sucrose



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# LACTISOLE

## THE ANTI-SWEETENER

- Sweetness inhibiting taste modifier
- Isolated from the Columbian coffee bean
- Can reduce sucrose sweetness by 2/3
- Used in jams to suppress excess sweetness
- Allows fruit flavours to come through



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# ZIZIPHIN & HODULCINE

## THE ANTI-SUGAR TWINS

- Gymnemic acids are anti-sweet compounds
- Can make sucrose solutions taste like water
- Works on artificial and protein sweeteners
- Has no effect on other tastes (bitter, sour, etc.)
- Can take 10 minutes to recover sweet taste



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# ZINC SULFATE (SALT OF VITRIOL)

## ANY EASY SWEETNESS INHIBITOR

- Zinc Sulphate is found in health supplements
- Has been shown to improve sense of taste
- Inhibits sweetness at low levels
- Taste is slightly astringent / metallic
- Can affect taste for a few minutes



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# ZINC ANTI-SWEETENERS

## FOR THE CURIOUS

- Dissolve 4 oz Zinc Sulphate in 1 Cup Water
- 1-2 drops reduces sweetness 50% in a 1 in 10 solution (2 tsp sugar in 3½ oz water)
- Possible other dynamics in alcohol drinks
- 1 Drop contains 5mg elemental Zinc
- Zinc supplements contain 50mg



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# PART II: WORKING WITH SUGAR

# SALT

## MORE SALT LESS SUGAR OR MORE SUGAR LESS SALT?

- Salt can increase the perception of sweetness
- Sweet does not affect saltiness
- 0.2% salt increases sweet perception up to 10%
- Most effective on fructose and xylitol
- Salt is a very effective flavour enhancer



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# BITTER

## THE AVERSIVE TASTE

- Bitter reduces the perception of sweet
- Sugar reduces the perception of bitter
- Natural sweeteners are more effective
- Sucrose is the most effective



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# ETHANOL & SUGAR

## WHAT EVERY UNDER AGE DRINKER KNOWS

- Sugars are very effective at masking ethanol
- Ethanol can be sweet to Non-Tasters
- Increased perceived sweetness through aroma



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# ACID: SWEET & SOUR

## THE TANGO OF TWO TASTES

- Sourness is the easiest way to modify sweetness
- This relationship is pH dependant
- 2g (½ tsp) Citric Acid in 3 oz water has a pH of 2.0
- Lemons and limes contain about 1.4g / oz citric acid
- 2 tsp Vinegar in 3 oz of water has a pH 2.9
- Carbonic acid (seltzer) pH 5.5 has little effect on sweetness, but works with other acids



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# SUGAR ACID RATIO'S

## ACHIEVING BALANCE

Sucrose

Sucrose

Fructose



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# AROMA

## A TOOL FOR THE TALENTED

- Aroma's have a significant effect on sweetness
- Juniper aromas can make drinks taste less sweet
- Gin is the obvious cocktail choice
- Sweet aromas increase the perceived sweetness
- Vanilla, Caramel and Banana are obvious



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# AROMA AND SWEETNESS

## A DELICATE BALANCING ACT

### Gin-to-the-Fire

- 1 oz Death's Door Gin
- ½ oz Barenjager Honey Liqueur
- ¼ oz Lime Juice
- 1 oz Grapefruit Juice
- 1 oz Sparkling Water
- 1 Drop Vanilla Tincture
- Dash Fee's Old Fashion Bitters



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# SIMPLE SYRUP

## THE COMMON STUFF

- Mix 2 Cups Sugar to 1 Cup Water (2:1 Simple Syrup)
- One teaspoon of 2:1 Simple Syrup = 1 Teaspoon Sugar
- “Cold Processed” syrup is stable (i.e. won’t invert)

2:1 Simple Syrup is the best option



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# SIMPLE SYRUP ADJUNCTS

## TEXTURIZATION OF SIMPLE SYRUP

### Gum Arabic

- Gum Arabic increases viscosity and is an emulsifier
- Provides a "silky" character to cocktails

### Maltodextrin

- Maltodextrin can improve mouthfeel
- $\frac{1}{4}$  to  $\frac{1}{2}$  cup Maltodextrin for 26oz of 2:1 syrup
- Pectin increase viscosity and mouthfeel
- Sodium Bicarbonate helps stability if heating



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# GOMME SYRUP

## THE GOOD STUFF

1 Litre Water

600 grams Gum Arabic

1.8 kilograms Sugar

1 Quart Water

4 pound Sugar

1¼ pounds Gum Arabic

1 pound of Gum Arabic costs about \$10



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# CAMELIZED SUGAR

## ALL THAT'S GOOD IN THE WORLD

- Caramelized sugars are very important flavour components in food and drink
- Oxidization of sugar to create unique flavour / aroma
- Steak, bread, fried food, etc. rely on caramelization for their unique and alluring flavours
- Excess caramelization leads to burnt / bitter flavours
- Used in the spirit industry to add colour



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# CARAMEL SYRUP

## CULINARY NAPALM

- Making caramelized sugar can be dangerous
- Use the largest stainless steel pot you can find
- Use oven mits or gloves when handling
- Have ice water close, you'll know why when it hits you
- Sugar can go exothermic at high temps  
(i.e. it continues to heat up even with the stove off)
- If it burns, pitch it out, or keep it for colouring bitters



# DARK CARAMEL SYRUP

## NOTHING GOOD IS EVER EASY

Large Stainless Steel Pot, Spoon and Thermometer

2 cups White Sugar

1+1 cup Water

¼ cup Corn Syrup

¼ tsp Tartaric Acid

¼ cup Maltose (Optional)

Combine sugar, 1 cup water, acid and corn syrup. Heat until on high until 360°F or the syrup turns scarlet red.

Remove from heat, cool for a few minutes and CAREFULLY add remaining water and maltose. Stir and bottle.

# CARAMEL SWIZZLE STICKS

## CULINARY NAPALM

4 cups Sugar

1 cup Water

For something interesting, add "Rum Extract"

- In a very clean pan bring mixture to 330°F - 340°F
- Pour on Silpat or marble, and allow to cool
- Prepare sticks when cool enough to handle
- For clear sticks, use a mold, and pour hot
- Less sweet than you'd think



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# SUGAR CUBES

## DESIGNER CUBES FOR DESIGNER ABSINTHE

- Use chocolate molds to form unique shapes
- You can find chocolate molds on the Internet
- Look for 4 gram to 8 gram sizes
- Be cautious with dye, may mix poorly colorwise

2 Cups Sugar

1-2 tsp Water

Dye or flavouring optional



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# PULLED SUGAR GARNISHES

## NO LIMES, JUST MOLTING SUGAR

- Same process used to make candycanes
- Garnishes only limited by your creativity
- Easily add flavours to garnishes

### Examples

Juniper Swizzle Sticks

Honey Bee Garnish



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# WORK WITH PULLED SUGAR

## HOT! HOT! HOT!

- 1). Professional Candy Thermometer
- 2). A stainless steel pot or copper pot
- 3). A marble slab or Silpat
- 4). A heat lamp 250 watts
- 5). A metal spatula or metal dough cutter
- 6). A hair dryer with a warm and cool setting
- 7). Rubber gloves.
- 8). A rubber bulb pump or air pump
- 9). A metal or wooden tube



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# PULLED SUGAR: SUCROSE

## MAKING CANDYCANES, BUT COOLER

- 5 cups sugar | 1 cup water | ¼ tsp Cream of Tartar
- Flavouring: ½ tsp of an extract or more if desired
- Bring to a boil and continue heating until 320°F
- Pour onto silpat or marble and "work" with scrapper
- Once cool enough "pull" the mixture until glossy
- Shape into any form you desire

Tip: Work with plasticine to practice shapes



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# PULLED SUGAR: ISOMALT

## THE ROOKIES CHOICE

- Sugar Alcohol with equal sweetness to sucrose
- Stays clear when heated (no caramelization)
- Crystallizes slow (easier to work with)
- No Acid required when heating
- Doesn't become sticky in high humidity

4 parts Isomalt

1 part water

Boil to 160°C/320°F



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# CARAMEL SWIZZLE STICKS

## ART? NOT MY FORTE



# BLOWN SUGAR

## THE ULTIMATE COCKTAIL GARNISH

Sugar            60 oz  
Water            14 oz.  
Glucose        10 oz.  
Cream of tartar 2 g

Sugar pan must be immaculately scrubbed clean.  
Sugar, water, glucose bring to 145°C, add acid,  
continue to 160°C to 162°C. Pull 40 times, 40%  
humidity maximum.



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