



# India Pale Ale

**The evolution of one of the world's most popular beer styles**

Mitch Steele

Brewmaster and Cofounder

New Realm Brewing Co.


Atlanta, Georgia USA

# India Pale Ale-Objectives

- Quickly review the 4 periods that exemplify the style
- Review brewing procedures and ingredients for each period
- Newer trends in IPA



# 4 periods of IPA brewing

- 
- ▶ London Years (George Hodgson and Hodgson's Bow Brewery)
  - ▶ Burton Years: IPA's heyday in the 1800s
  - ▶ The Temperance Years: The 1900s when prohibition, temperance movements, wars, taxation, and corporate conglomeration almost killed the style
  - ▶ The Craft IPA Revolution
    - ▶ Old School IPA
    - ▶ Variations on the American IPA style
    - ▶ New versions of the Style
    - ▶ New trends in IPA Brewing





# The London Years: 1750-1820

- Characteristics (estimated)
  - 17.5 °P (1.070 sg) OG
  - ~70 IBU
  - 100% Pale Malt
- We really do not know much about this beer.
  - Advertisements
  - Price Sheets

**HODGSON'S PALE ALE**

And they have now landing from the *Esther*, Taylor's Stout, and Hodgson's Pale Ale, in excellent condition.

LAMB, BUCHANAN, & CO.

*Castlereagh-street, Aug. 5, 1833.*

No. 1239.—VOL. XXV.

FRIDAY, JANUARY 30, 1835.

PRICE SEVENPENCE

[illegible][illegible]

**HODGSON AND CO.'S EAST INDIA PALE ALE.**  
**J. WILLSON**, from **HODGSON AND CO.'S**, London, begs leave to call the attention of Merchants, Private Families, &c. to the very superior **ALE** brewed by this well-known House, to which he is **Sole AGENT**. The very desirable qualities of keeping in any climate, and not bursting the bottle, have long enabled it to maintain the high character it possesses, as peculiarly suited for Exportation. Being brewed from the finest East Kent Hop, it contains a particularly fine tonic property, and is consequently much recommended by the faculty, even to invalids.  
 No. 2, Mersey Chambers, Old Churchyard, Liverpool.

R I S S E T I Y H O U S E



# The Burton Years 1820-1900

- 
- Allsopp, Salt and Bass: The major players
  - Characteristics:
    - Very pale
    - Very dry
    - 16.25-17.5°P (1.065-1.070 SG) OG
    - 70 IBU
    - Described as “sparkling, champagne-like, with a peculiar, fine flavor”





# The Burton IPA Ingredients

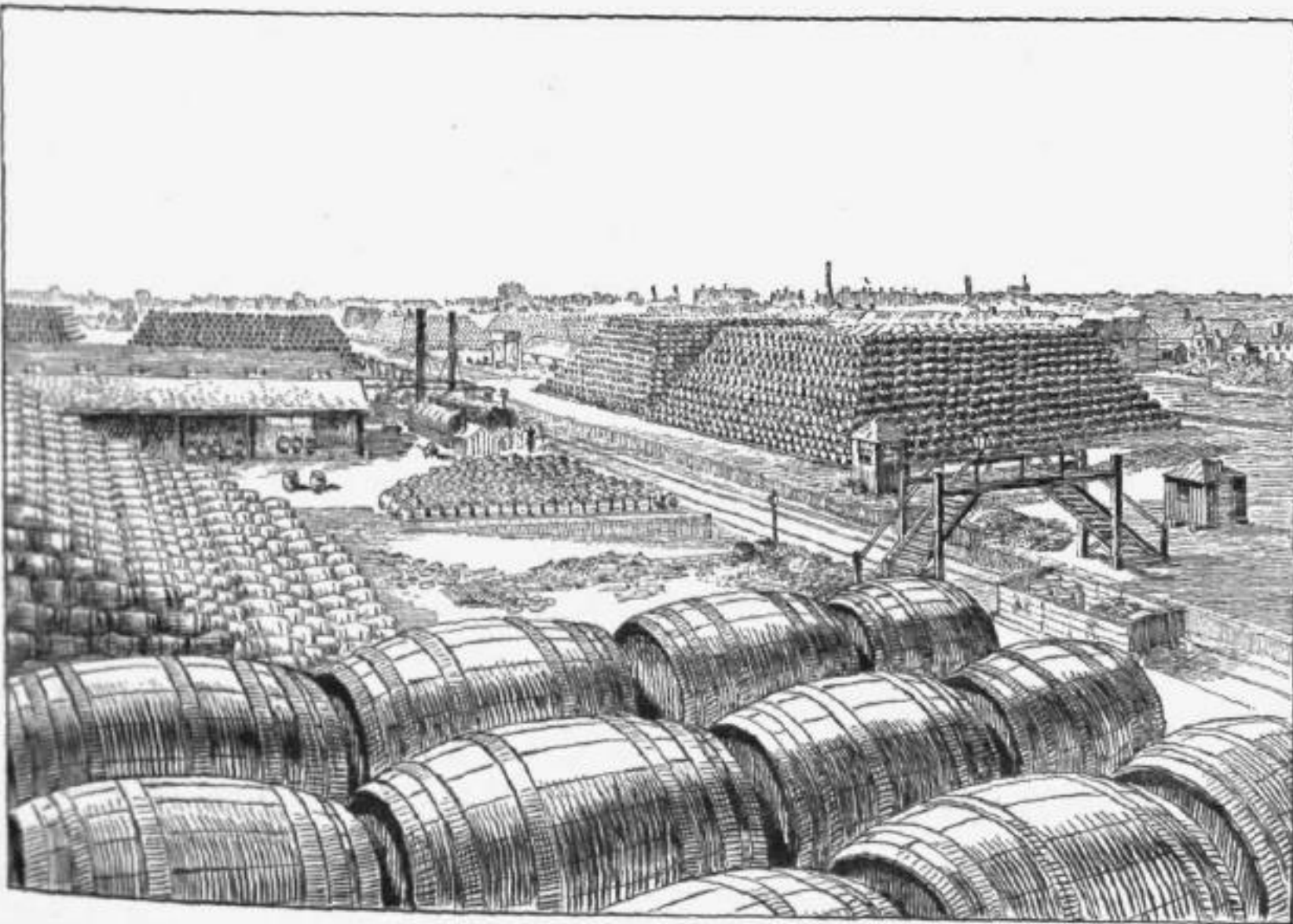
- Malt: 100% Extra Pale (or White) Malt
- Hops: 100% East Kent Goldings
- Yeast: Burton or London Ale Yeast
- Water: Burton well water
  - High in Calcium, Magnesium and Sulfate



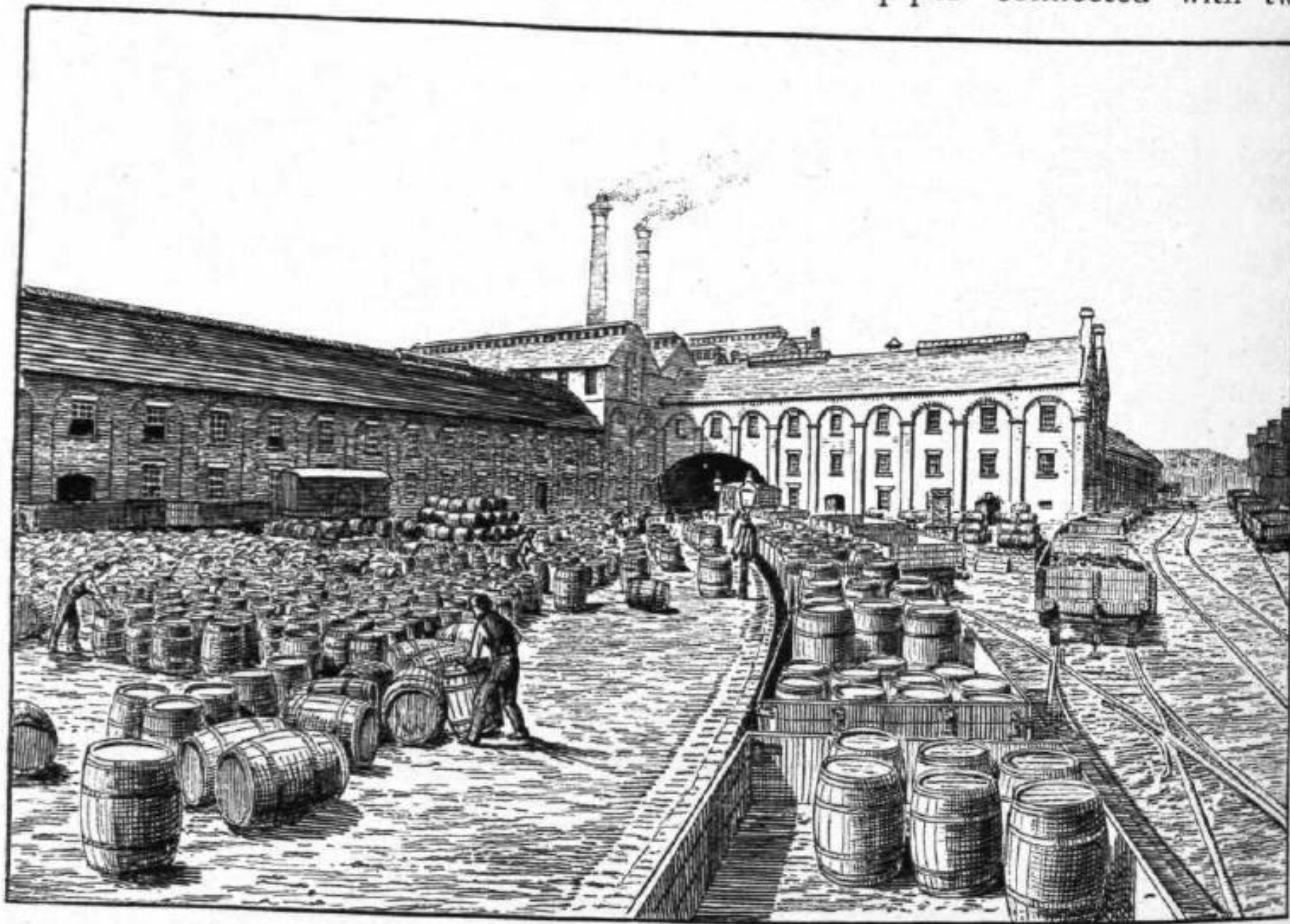
# Burton IPA Brewing procedures

- Infusion Mash
- Double/triple mash or sparge
- Collect worts of different gravities and blend to hit target final gravity (partigyle)
- Low intensity, long (3 hour) boil
- Hopped at 5-9 pounds/bbl
- Hopback for straining and trub removal
- **Extra long aging: Up to 1-1.5 years in oak barrels**





HAWKINS' LANE PREMISES.



MIDDLE BREWERY, FROM NEAR ENGINEERS' OFFICES.





# 1878 English Military Specifications for purchased IPA

- ▶ IPA had to be brewed with 100 percent malt.
- ▶ OG had to be 15 °P (1.060 SG) minimum.
- ▶ Hops had to be used at 20 pounds per quarter minimum (about 4–5 pounds per barrel, 16-19 g/l), plus 11 pounds/5kg new hops in the dryhop in barrels.
- ▶ Beer had to be casked not more than 21 days after brewing.
- ▶ Casks were required to be made from well-seasoned Baltic or Bosnian oak staves, free from sap, strong, stout, and well made. Casks had to be steamed at a temperature of not less than 230° F (110°C), and the staves were required to be one inch thick.
- ▶ Beer had to be brewed between November and May.
- ▶ Beer for bottling was to be kept on hand for 9–12 months before bottling and to have one summer and one autumn fermentation before bottling.



# The case for Brettanomyces

- IPAs went through multiple seasons of fermentation in England before shipping, leaving the beer very dry and fully end fermented
- Bungs on casks were removed during secondary fermentations, so the beer was flat when shipped
- British yeast cultures were discovered to have multiple strains, including Brettanomyces in the early 1900s. Brettanomyces Bruxellensis
- Brettanomyces can survive in the pores of wood
- Casks used to ship IPA were broken down and shipped back to England for re-use
- Beer arriving in India, despite being completely fermented and flat when loaded onto ships, was often described as “sparkling” and was carbonated upon arrival
- Flavor descriptions include comparisons to Champagne, and “fine, peculiar” flavor
- *Or could the carbonation be a result of **Hop Creep**??*



# AMSINCK'S No 25 EAST INDIA PALE ALE

- **Brewing liquor:** hard Burton Water, boil for 15 minutes and let cool to strike temperature
- **Malt Bill:** 100% New Burton White Malt
- **Mashing:**
  - Double mash system
  - No sparging
  - 1<sup>st</sup> mash:
    - 165°F (74°C) strike temperature
    - 1.3 qts water/pound malt (2.7:1) (2.7L water/kg malt)
    - Hold 2 hours. Expected temp drop to 150°F (65.6°C)
  - 2<sup>nd</sup> mash
    - 1.3 qts 180°F (82°C) water/pound malt (2.7 l water/ kg grain)
    - Hold 1 hr, Expected temp drop to 165°F (74°C)



# AMSINCK'S No 25 EAST INDIA PALE ALE

- **Hopping:** East and Mid Kent Goldings split evenly among the 2 boils: 2.5 oz/gallon (5 lbs/bbl or 19.3 g/l)
- **Boil:**
  - 1<sup>st</sup> wort: boil 2 hours with 50% of hops. Transfer through a hop back and leave the hops in the hopback.
  - 2<sup>nd</sup> wort: Boil 2 hours with the rest of the hops. Run wort over 1<sup>st</sup> hops in hopback.
- **Fermentation:**
  - Combine worts
  - Pitch at 58°F (14.4 °C) and allow free rise to 72°F (22.2 °C) over 4 days
  - Rack at about 7°P/ 1.028. Cask at 7 days.





# AMSINCK'S No 25 EAST INDIA PALE ALE

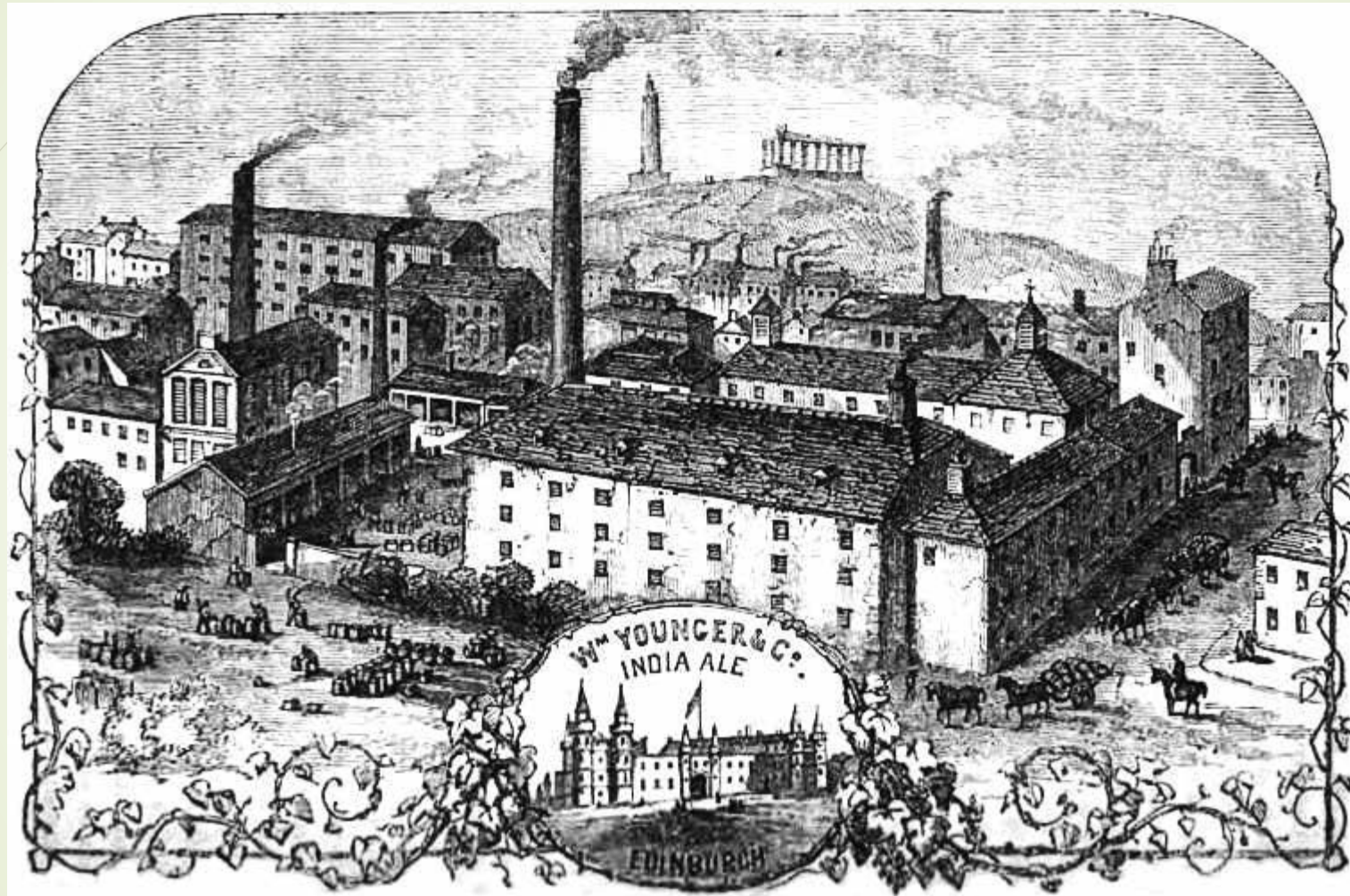
- Dry-Hop: 0.77 oz/gallon (1.5 lbs/bbl, 5.8 grams/l) EKG
- Age extended time on dry hops
- Analytical targets:
  - OG 16.8°P (1.067 SG)
  - TG 3°P (1.012 SG)
  - IBU ~159 Calculated
  - ABV ~7%

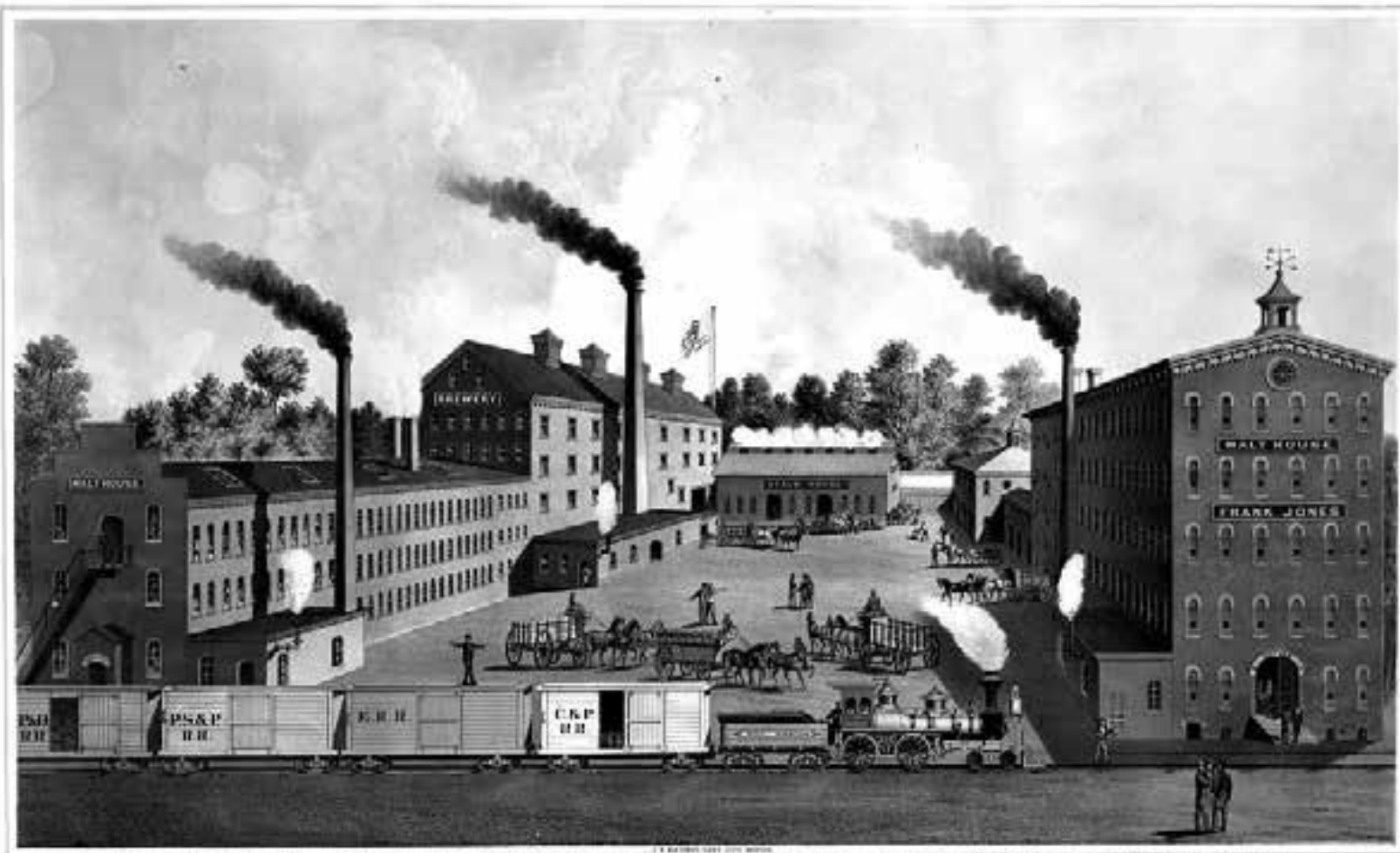


# Other 1800s IPA brewing regions

- Scotland
  - Huge supplier to India
  - Shorter, more intense boil (=more color?)
  - Similar hopping rates, more widespread use of noble hops
- United States and Canada:
  - Similar approach to Burton brewers
  - Aged in barrels/hogsheads, vats or foudres up to a year.
  - More widespread use of American ingredients





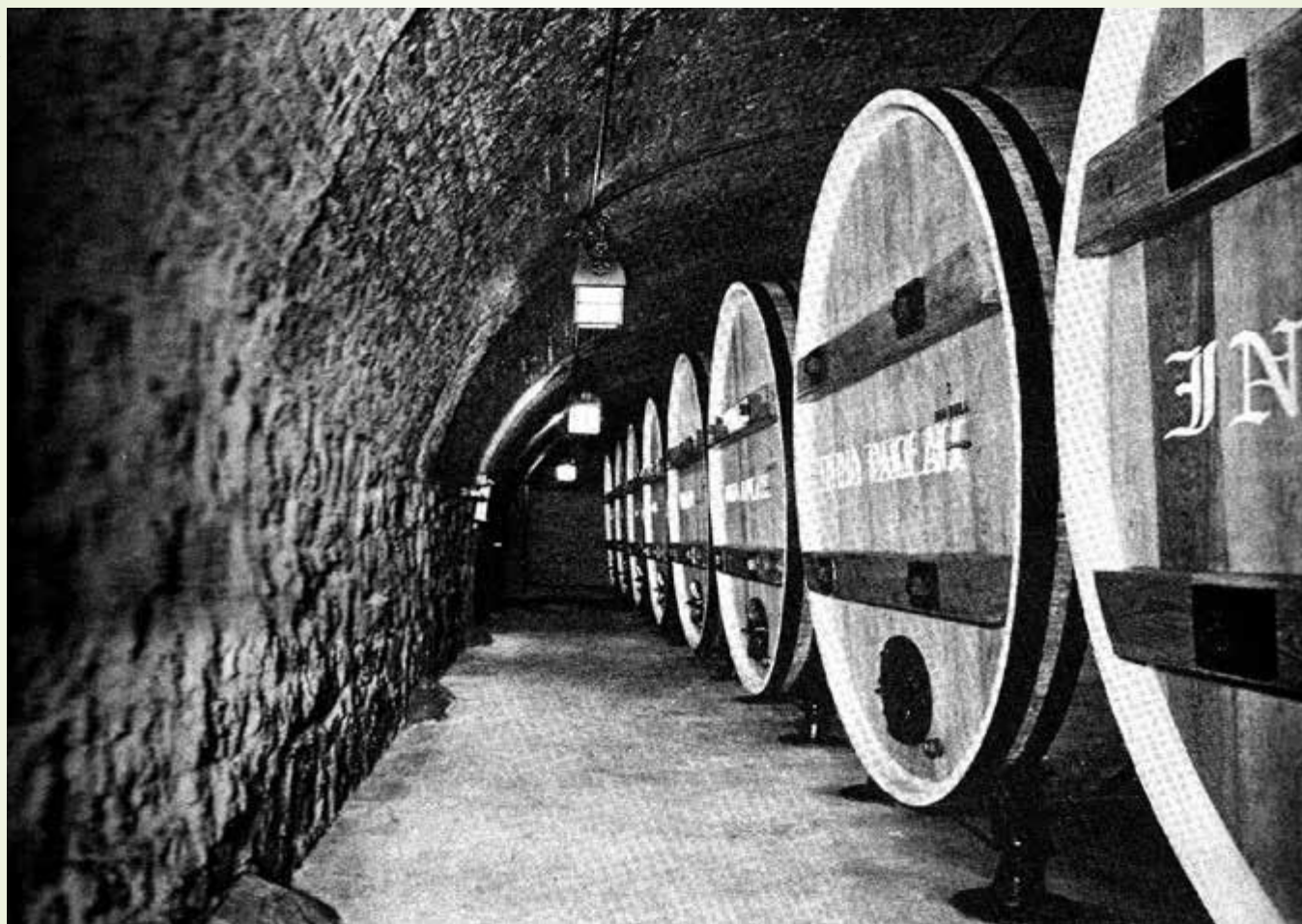


## **FRANK JONES' BREWERY & MALT HOUSES.**

PORTSMOUTH, N.H.

DEPOT 82 & 84 WASHINGTON ST. BOSTON.







# On a train or boat

Evans' India Pale  
Ale shows to the  
best advantage.  
Nothing can change  
it—hence the

## Safest drink

at all times and the  
best health insur-  
ance. It does not  
contain a particle of  
sediment, dregs or  
yeast cells.

*The finest ale brewed in the  
world.*



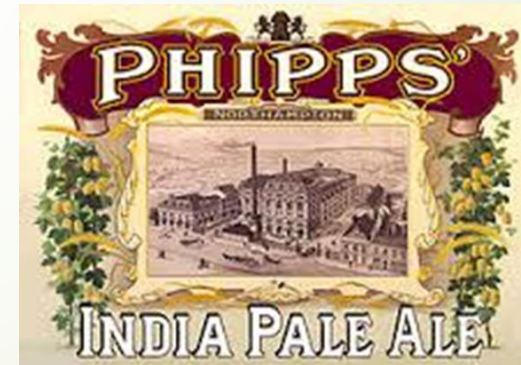
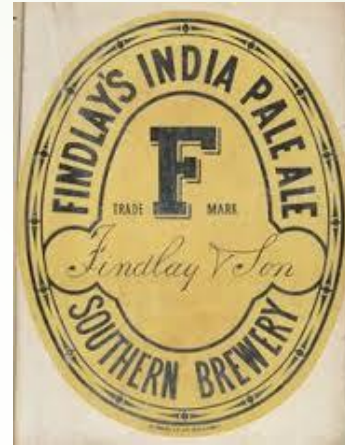
C. H. EVANS & SONS,  
Established 1786. HUDSON, NEW YORK.  
At all Summer Resorts.

1897

# Other 1800s IPA brewing regions

## ➤ Australia

- *The present custom of drinking alcohol to excess .. will continue.* Marcus Clarke, *The Future Australian Race*, 1878
- Late 1800s, 10% of beer consumed came from England
- Colonial Ale, London Porter and IPA brewed in Australia, latter part of 1800s.
- Economic collapse and the transition to lager brewing
  - Foster Brewing Co. 1895





From Martyn Cornell's  
Zythophile  
Blog, published 14 May,  
2013:

Was this the very first use  
of the  
term "India Pale Ale"?

ON SALE at the Stores of A. B.  
SPARK,  
Rum, brandy, and geneva in bond ;  
Taylor's and East India pale ale ;  
Madeira wine, in pipes and hogsheds ;  
Red wine in cask ;  
Superior port and sherry in bottle ;  
Teneriffe wine in quarter casks ;  
An invoice of the finest wearing apparel,  
from the house of Messrs. M'Callan and  
Sons, London ;  
An invoice of books ;  
A 100 gallon still complete ;  
Turpentine, and boiled linseed oil ;  
White lead, black, red, and green paints ;  
Stoved salt, tin plates, duck, dowlas, drill,  
sacking ;  
Flannel, blue and black cloths and cassi-  
meres ;  
Slops, damask table cloths ;  
Hoop, nail, rod, round, square, and bar  
iron, &c. &c.

Advertisement for East India Pale Ale,  
Sydney Gazette, Saturday August 29 1829



J. WOOD, Secretary.

## **Taylor's Brown Stout.**

**T**AYLOR and Co.'s Brown Stout, East India Pale Ale, (the best summer drink), and prime XXX Ale, for SALE, at No. 1 on the Wharf, (Austalian Company's Stores.)—Apply there to **JAMES GRANT.**

EIPA, 'the best summer drink', in the Colonial Times, Hobart  
February 19 1830

## **BARCLAY AND PERKINS' EAST INDIA ALE.**

**A** FEW HOGSHEADS of the above superior Article, ex *Renown*, on Sale at the Stores of the undersigned.

**GEORGE BUNN,**  
98, George-street.

**October 26, 1832.**

Barclay and Perkins' East India Ale,  
Sydney Herald, October 29 1832





# The Temperance Years-1900-1985

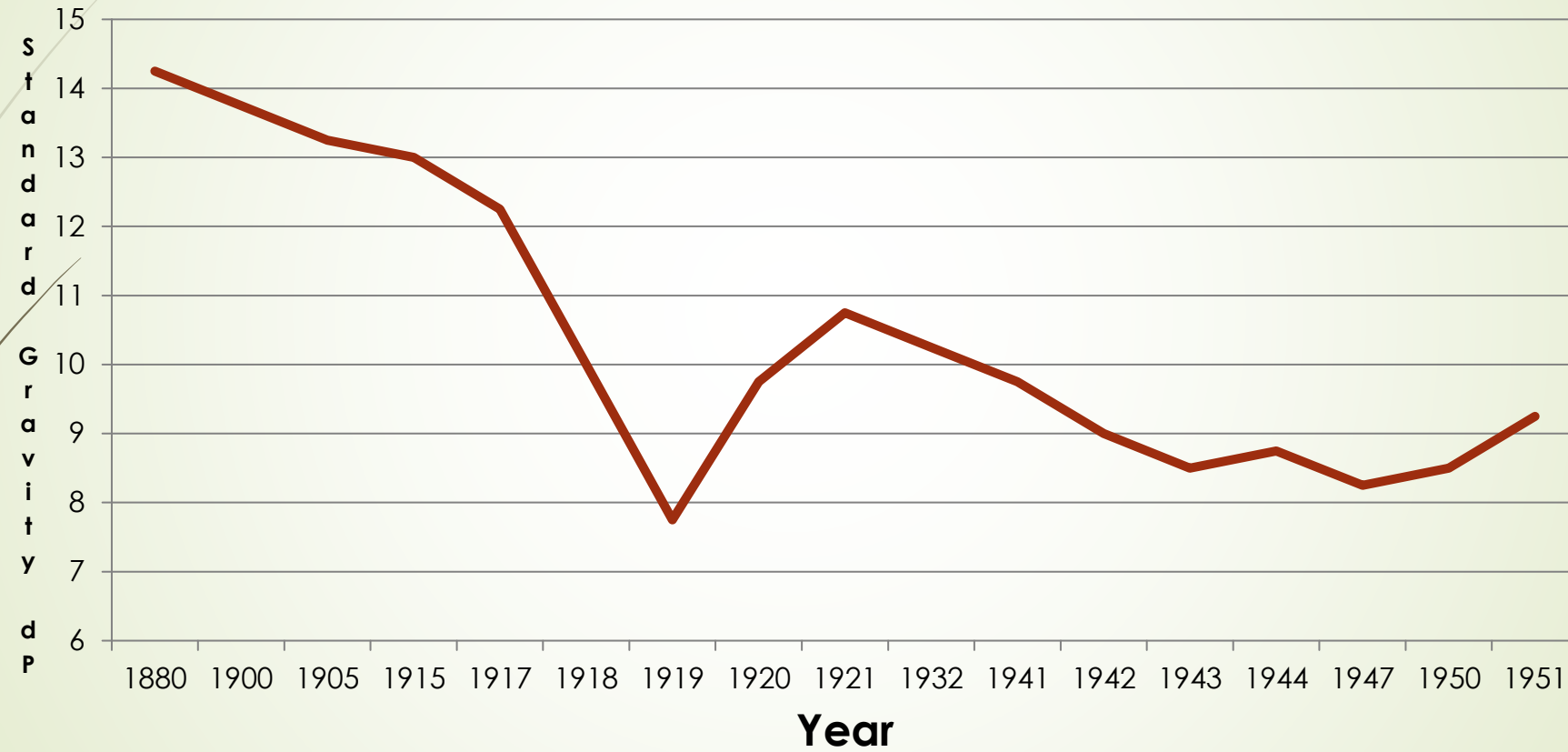
- The Pilsner revolution
- Alcohol consumption frowned upon
- Tax changes in England
- Prohibition in the United States and Canada
- Energy and ingredient shortages in WWI and WWII
- Characteristics:
  - Lowering of original gravity and alcohol contents
  - Sugars used
  - 8-14°P (1.032-1.056 SG) OG
  - 30-50 IBU

# ANALYSIS OF ALLSOPP IPA

ANALYSIS of ALLSOPP IPA		
Year	1901	1921
OG dP	15.14	13.46
OG (SG)	1061.57	1054.4
FG Plato	2.23	1.14
FG SG	1008.62	1004.4
Attenuation	85.27%	91.91%
Real FG	4.7	3.37
ABV	6.8	6.56
ABW	5.44	5.25
Real Attenuation	68.96	74.96



## English Beer Standard Gravity Values





# 1900s IPA Ingredients

- Malt: 100% Pale Malt. Barley sourced from multiple locations around the world.
- Sugars or corn grits
- Hops: 100% East Kent Goldings still preferred, but Fuggles and California hops used
- Hopping rates-1-4 lbs/bbl (5-16 g/l)
- Yeast: Burton or London Ale Yeast
- Water: Burtonized water



# Barclay Perkins 1928 IPA (recipe supplied by Ron Pattinson and Kristen England)

➤ **Brewing liquor:** London soft with salts added

➤ **Malt Bill:**

- British Pale Ale Malt 57.4%
- American 6-Row 17.6%
- Flaked Maize 13.2%
- Invert #3 Sugar 11.8% Added to boil

➤ **Mashing:**

- Traditional infusion mash
- 1.68 qts water/pound grain (3.5 l/kg)
- 90 minute rest at 152°F





# Barclay Perkins 1928 IPA (recipe supplied by Ron Pattinson and Kristen England)

## ➤ **Boil:**

- 135 minute boil

## ➤ **Hopping:** Target 41 IBU in finished beer

- 120 minutes: Cluster 16.3%
- 60 minutes Fuggles 54.7%
- 30 minutes Fuggles 29%

## ➤ **Fermentation:**

- Ferment at 63°F (17.2°C)
- Nottingham Ale Yeast, London ESB yeast, or English Ale yeast



# Barclay Perkins 1928 IPA (recipe supplied by Ron Pattinson and Kristen England)

- Dry-Hop: EKG 0.042 oz/gallon (0.08 lbs/bbl)
- Analytical targets:
  - OG 11.5°P (1.046 SG)
  - TG 2.5°P (1.010 SG)
  - ADF 78.27%
  - IBU 41.2
  - ABV 4.8%
  - Color 10°L (20 EBC)



## BALLANTINE'S ALE



America's great leader among ales, adapted to the American palate through almost 100 years' experience.

The House of P. Ballantine & Sons is the oldest brewing firm in America. Behind every drop of Ballantine's brews there is a golden treasure of experience dating back to 1840; yes, it takes **experience** to create brews as fine as these.

Today this good old name is a recognized hallmark of quality. When you order Ballantine's you are sure of getting the finest brew human skill can produce.

In 12-oz. bottles and on draught

### Ballantine's XXX Ale

America's great leader among ales, adapted to American palates through almost 100 years' experience. It is a light amber, sparkling and creamy ale - delicious and thirst-quenching. It is distinguished by a high head-similar to beer, and where it is served on draught, ordinary beer-drawing equipment is used. It is full-flavored and fully aged, and at its best when served at about 55 degrees F. It contains certain health properties that are helpful in creating energy and vigor. In 12 oz. bottles and on draught.

### Ballantine's India Pale Ale

Aged in the wood for one year. This full-bodied amber ale is widely used in place of wine at dinner. Connoisseurs say it is "As smooth and mellow as old wine." It is especially delicious with seafood. It is a real "dock ale," in that it is not only fully and carefully aged but is, in addition, "dry hopped" - that is, extra hops are added in the keg to heighten the bouquet and flavor. Served at either room or cellar temperature, according to individual taste. In half or quarter-barrels and 6 oz. or 12 oz. bottles.

### Ballantine's Extra Porter

A true brewed porter made of the finest black malt without artificial coloring or syrup additions. It is a very dark brew, with a rich brown head. It has a delightful bitter-sweet flavor, and is delicious with roasts, steaks, chops, etc. Not as strong as stout, but has similar tonic qualities and is essentially beneficial to the blood and nerves. May be served alone or in conjunction with ale or beer. It is at its best at about 55 degrees F. In 12 oz. bottles or on draught.

### Ballantine's Brown Stout

Aged in the wood for one year. A very dark brown in color, with a rich brown, lasting head and distinctive bitter-sweet flavor. One of the strongest of brewed beverages, especially good with steaks, roasts, baked potatoes, etc. It has valuable nourishing and tonic properties, and is advised for enriching the blood, for athletes, for nursing mothers, for all who need a wholesome, energy-building food drink. Serve at room or cellar temperature. In 6 or 12 oz. bottles.





# Craft Brewing



- 1<sup>st</sup> Craft IPAs inspired by Ballantine IPA
- Some of the pioneers:
  - Anchor Liberty Ale
  - Sierra Nevada Celebration Ale
  - Grant's IPA
  - Rubicon IPA
  - Steelhead Bombay Bomber
- Modern classics:
  - Bell's Two Hearted
  - Goose Island IPA
  - Blind Pig IPA
  - Stone IPA
  - Port Swami IPA
  - Fat Head's Headhunter IPA



# American/West Coast IPA

- North American 2Row malt, 5-7% light crystal or light Munich
- Lots of whirlpool hops
- Target 6.5-7.5% abv, 60-75 IBU
- Brewing tips:
  - Mash temperature for making beer dry: 2.5-3.5°P
  - Use a clean ale yeast (California Ale/Chico, or a clean English strain)
  - Low use of specialty malts
  - Dry hop at 1-2.5 lbs/bbl post fermentation
  - Hops: Most C varieties, plus Amarillo, Simcoe, Citra are all good for this style



# Double/ Imperial IPA

- Mid 1990s origin
  - Blind Pig Anniversary IPA
  - Rogue I Squared Pale Ale
- Took off as a style in early 2000s-San Diego
- Brewing tips:
  - Remember that higher alcohol = higher perceived sweetness
    - Avoid crystal malts
    - Mash at low temps, long rest to enhance dryness
  - Hopping-double the dry-hop amount
    - 3-5 pounds/bbl not uncommon!





# Triple IPA

- >10% abv
- 100+ IBU
- Commercial examples:
  - Pliny The Younger
  - Knee Deep Simtra
  - Green Flash Green Bullet
  - Alpine Exponential Hoppiness
  - Stone RuinTen IPA
  - DFH 120 minute IPA (18% abv!)
  - Heretic Evil 3 collaboration
  - New Realm Radegast IPA
- Quadrupel IPA??? Hop Wine?



# Belgian IPA

- Two Approaches:
  - Brew a Belgian Golden Ale (tripel, pale, etc) and hop the crap out of it, like an IPA, using American hops
  - Brew an IPA and ferment it with Belgian yeast
- Both types:
  - Use Belgian yeast strain
  - Use IPA-friendly hop varieties
  - Result in delicious beer



# Wit IPA/ White IPA

- 2 brewing techniques:
  - Brew an IPA, ferment with Wit yeast, and add coriander and orange peel
  - Brew a Wit and hop it heavy like an IPA
- Both work!





# Black IPA

- First known Black IPA:
  - from Vermont 1990s
  - Greg Noonan's Vermont Pub and Brewery
- Brewing Tips:
  - Brew similar to IPA or Double IPA
  - Avoid significant amounts of traditional dark malts:
    - Add 3-5% Dehusked Black Malt
    - Carafa, Black Prinz, Patagonia Pearled Black
  - Choose hop varieties that complement light roast: Citrusy, piney, fruity



# Session IPA

- Originated 10+ years ago
- Difference from a “hoppy pale ale”
- Low carb versions
- Brewing tips:
  - Mostly Pale Ale malt, maybe small amounts of crystal malt or Munich malt-but don't try to achieve body with specialty malts
  - Mash temperature to achieve more sweetness than standard IPA
  - Keep bitterness mildly high: 40-60 IBUs
  - Utilize hop bursting to maximize flavor
  - Dry hop like an Imperial/Double IPA



# Other IPA Styles

- ▶ Regional hops focused: Australian, New Zealand, Germany, South Africa
- ▶ Tropical IPA-tropical fruit forward hops, lower IBU
- ▶ New hop varieties drive much of innovation in IPA
- ▶ Making other styles “IPA”-Maerzen, Pilsner
- ▶ Brett IPA: Either in primary or secondary (or both)
- ▶ IPL/ India Pale Lagers
- ▶ Blending fruit (or natural flavors) into IPAs to complement/augment hop flavors
  - ▶ Citrus, stone fruit, berries, exotic fruits, peppers
- ▶ Cocoa IPA
- ▶ Coffee IPAs-coffee actually pairs well with citrusy hop
- ▶ Tea IPA
- ▶ Spiced IPAs-Jasmine, Sage, Juniper, Mint, Lemon Verbena
- ▶ Barrel aged IPAs
- ▶ Hemp/Marijuana IPA



# New England, aka “Hazy, Juicy” IPA

- ▶ Most popular IPA style
- ▶ Grist composition
  - ▶ 30-40% Hi protein grains: Oat malt, wheat malt, and flaked grains. Pale Malt as a base. This adds fullness and softness/mouthfeel to the palate.
  - ▶ Some brewers use a lot of light crystal to add body
  - ▶ Lactose?
- ▶ Water chemistry
  - ▶ Target 2-3:1 chloride to sulfate ratio
- ▶ Mash protocol:
  - ▶ High temperature, 156°F (69°C) to emphasize fullness, for 20-30 minutes
- ▶ Brewhouse hopping:
  - ▶ Minimal bittering hops Target 10 IBU or less with kettle hopping.
  - ▶ Heavy whirlpool hops.
    - ▶ Some brewers add late after wort cools (less than 185°F/85°C) or cool w/ cold liquor?
  - ▶ Target 35-50 IBU.



# Brewing NE IPA



- Yeast
  - Most recommend VT Yeast/Conan, or London Ale 3, but many successful brewers of the style use other strains, or blends
- Fermentation:
  - Dry hop early in fermentation? 1 day after fv fill?
    - Impact on biotransformation of hop oils by enzymes in yeast  
Geraniol >> Citranellol
    - Results in “extra juicy” orange juice character
    - Galaxy, Idaho 7, Motueka, Citra, El Dorado
  - Dry Hop 2-4°P (.008-.016 SG above TG) with: 1-2 pounds per barrel:
    - Optional step, some brewers don't do this or do one of the two
- Post ferment:
  - Dry hop again
  - Dry hop total should be 5-6 lbs/bbl (19-24 g/L)
- Haze is critical. No whirlfloc, no biofine, some brewers do centrifuge



# Key differences NE and WC IPA

- Malt bill comprised of high levels of high protein non-barley grains (oats, wheat)
- High Chloride to Sulfate water salts ratio to mellow the hop bitterness and soften the mouthfeel
- Lower IBU 25-40 common
- Higher terminal gravity
  - Lactose addition in some versions
- Dry hopped during fermentation
- Very high hop addition rates
- Beer appearance and clarity





# Brut IPA

- Aka “Hop Champagne” extremely dry, pale in color and very clear
- Created by Kim Sturdevant at Social Kitchen and Brewery in San Francisco
- 70-100% malt, 0-30% adjunct, no color malts
- Low temperature mash to promote dryness
- Very little bittering hops target 25-40 IBU
- 5-7% abv
- Heavy whirlpool hops
  - Avoid C hops (except Citra) or grassy hops
  - Dank hops or European hops preferred
- Amylase enzyme added in the brewhouse mash (Don't recommend in fermentation)
  - Beer finishes below 0°P, <1.000 Specific Gravity
- Consider using this process for low carb IPA (target 4% abv)

## SUMMARY OF IPA BREWING PARAMETERS

		Historical Burton IPA	Scottish IPA	Early 1900s English IPA	Contemporary English IPA	West Coast IPA 2000-2020/American IPA	West Coast IPA Modern	Double IPA	Black IPA	New England Hazy/Juicy IPA	Brut IPA
Grains	Pale malt %	100% Extra Pale	100%	85-95%	85-100%	85-97%	100% . Blend of Pilsner and 2R	95-100%	88-95%	50-70%, may include wheat malt	70-100%
	Crystal malts?	no	no	no	15-40°L	10-60°L	no	10-20°L	10-20°L	10-40°L	no
	Typical crystal %	0	0	0	0-10%	3-15%	0	0-5%	3-10%	0-10%	0
	Adjuncts %s	none	none	Maize, sugar	Maize, sugar	none	none	Sugar	not typical	Flaked oats, flaked wheat	corn, rice or sugar
		0	0	5-15%	0-15%	0	0	0-5%	na	20-40%	0-30%
	Roasted malts	none	none	none	Munich	Munich	none	none	Dehusked black malt, Black malt extract	none	none
	Typical %s	0	0	0	0-10%	0-10%	0	none	3-7%	0	0
Mashing	Mash conversion temperature °F	148-150	150-154	152-154	150-155°F	148-153°F	148-153°F	148-150°F	148-153°F	154-157°F	148-150°F
	Conversion time	120	120-180 minutes	90 minutes	15-30 minutes	15-60 minutes	15-60 minutes	60-120 minutes	15-120 minutes	20-60 minutes	30-120 minutes
	OG*P (SG)	15-18.75 (avg 16-17) (1.060-1.075)	14-17.5 (1.056-1.070)	12.5-15 (1.050-1.060)	12.5-18.75 (1.050-1.075)	12.5-18.75	12.5-18.75	18.75-22.5 (1.075-1.090)	14-18 (1.056-1.072)	14-17°P (1.056-1.068)	12-14°P (1.048-1.056)
	Fermentability	High	High	High	70-80%	75-82%	75-82%	80-86%	75-82%	65-80%	90%
	Target TG °P (SG)	0.75-3 (1.003-1.012)	0.75-3 (1.003-1.012)	2.5-4 (1.010-1.016)	3-4.5 (1.012-1.018)	2.5-4 (1.010-1.016)	2.5-4 (1.010-1.016)	1.75-3.75 (1.007-1.090)	2.5-4.5 (1.010-1.018)	3-6 (1.012-1.018)	<0
ABV target%		6-7%	5-7%	4-6.5%	5-7%	6.3-7.5%	6.3-7.5%	7.5-10%	6-7.5%	6-7%	5-7%
Hopping	Overall Hop rates (lbs/bbl)	5 to 6	1.25-3	1.0-2.0	.75-2.5	.75-2	.75-2	3.5-8	1.5-4	2.0-8	1-4.0
	Recommended varieties	East Kent Goldings	East Kent Goldings, others	East Kent Goldings, Fuggles, US Fuggle, Cluster	East Kent Goldings, Fuggle, Target, Sovereign, Styrian	C hops, newer American hops	C hops, newer American hops	Any highly flavored hop	Any highly flavored hop	Tropical, high geraniol hops	Avoid C Hops. Use tropical, European, or grape-y hops
	Dry Hop Pounds /bbl	1	1.25-3	.25-0.5	1	0.4-2	1.5-3	.75-4	1.0-3.0	3.0-6.0	1-2.5
	Multiple Dry Hops?	Yes in casks	not typical	not typical	not typical	not typical	not typical	varies	Not typical	fermentation and post fermentation	not typical
	IBU target	~70	~70	~50	40-60	50-80	45-60	70-100+	50-80	35-50	25-40
Other Comments		Long, low intensity boil, 2-3 hours to minimize color development	Ferment cool	Most gravities dropped to 10-12°P after WWI, below 10°P after WWII	Based on GABF guidelines. Real examples are highly varied	Regional differences with TG/Body, IBU and and hop varieties	Lower IBU and crisper than earlier version			2-3:1 Chloride to sulfate ratio in water	Amylase enzyme in mash
		Age 12 months or more								High whirlpool hopping. Cold whirlpool?	



# Cold IPA



- Originated by Kevin Davey, Wayfinder Beer in Portland Oregon
- Combination of IPA and American Lager
- 20-40% adjunct (corn and/or rice), Pilsner malt base
- No crystal malts
- ~50 IBU target, 6-7% abv
- Ferment with a clean, low sulfur lager yeast at cooler temperature (60-65dF/ 15.5-18dC), not as cold as a lager
- Dry hop towards end of fermentation with newer hop varieties
  - Yeast scrubs any O2 pickup
  - Some biotransformation occurs
- Drinkability/Crushable!





# West Coast Pils

- Southern California origin: Timbo Pils, Highland Park brewery Los Angeles 2016
- German Pilsner dry hopped like an IPA
- 100% Pilsner malt
- European lager hops in brewhouse, some may amp up the hops a bit in whirlpool with American varieties
- Pilsner yeast
- Post fermentation IPA style dry hop
- ~30-40 IBU target, 4.5-5.5% abv

# Hoppy Lagers

HOPPY LAGER STYLES					
	Imperial Pilsner	India Pale Lager (IPL)	Cold IPA	West Coast Pilsner	Italian Pilsner
<b>Brief Description</b>	Big (high abv) Pilsner	IPA made as a lager (lager yeast)	Hop forward beer with Pilsner crispness	German Pilsner base dry hopped American IPA style	European pilsner dry hopped with European hops
<b>ABV range</b>	6.5-9%	6.5-7.9%	6.5-7.5%	4.5-5.5%	4-5.5%
<b>IBU range</b>	30-60	60-75	50-70	30-40	25-40
<b>Typical grains</b>	Pilsner malt, with some European specialty malts optional	2R or Pilsner malt base, small % of specialty malts	American Pilsner malt, 2R malt with high diastatic power, 20-40% adjunct (corn or rice). Or use AMG enzyme to enhance crispness	Pilsner malt, light 2R malt, with small amounts of option European specialty malts. Typically all malt	Flavorful European pilsner malt-Italian malt preferred
<b>Hot Side Hops</b>	Lager/ Land race hops. Floral, light fruity and herbal character	IPA hops	C-Hops, new European varieties, or Southern Hemisphere hops	Lager/European traditional hops. Some brewers use American hops, but most use lager hops	Traditional lager hops
<b>Yeast strain</b>	Traditional pilsner strain, standard cold ferment with extended lagering	Traditional Pilsner or lager strain, ferment cold 50-55°F	Traditional Pilsner or lager strain that produces low sulfur and low esters. Fermented warmer than normal, eg 60-65°F, but not as high as ale temperatures	Traditional Pilsner or Lager strain	Traditional pilsner strain and fermentation profile
<b>Cold Side/ Dry Hops</b>	None to a small amount of traditional lager hops	IPA Dry Hops	Dry hop at end of fermentation, use new American or European hop varieties, C Hops or Southern Hemisphere hops	IPA dry hops	Post ferment dry hop with European lager hops



# New IPA Trends

- ▶ Hoppy Lagers
- ▶ For West Coast IPA:
  - ▶ Using 30-35% Pilsner malt in the base malt recipe, up to 100%
  - ▶ Lower IBU in West Coast IPA: 65-70 IBU now 45-60 IBU
- ▶ Kviek Yeast
- ▶ Thiol research in hop industry
- ▶ Gene edited yeast for enhanced biotransformation
- ▶ New hop varieties:
  - ▶ Strata, BRU-1, Idaho 7, Cashmere, Nectarone, Krush
- ▶ Cryo Hops
- ▶ Hemp terpenes to augment hop flavor





# Summary



- IPA has evolved, and will continue to evolve
- It has become the most popular style in craft beer in the USA
- No sign of fatigue. Certain substyles have faded in popularity, others have strong staying power
- Impact on other styles is significant
- Evolution will largely be fueled by new hop varieties, hop products, and new hopping techniques