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Chemoreception & Tobacco

Centers for Disease Control and Prevention

October 6, 2014

Aspects of Oral Perception

- Taste (Gustation)
- Aroma (Olfaction)
- Mouthfeel
- Thermal & Chemesthetic (e.g. Trigeminal)

Cooling Ingredients

- Menthol Production
- Menthol & Perception
- Other Cooling Ingredients

Tobacco & Flavoring

- The Old Cigarette Companies
- The Changing Cigarette
- Filters - Lower Tar & Nicotine
- Smoke pH, Ammonia & DAP
- Tobacco Flavors

E-Cigarettes & Flavors

- The New Wild West

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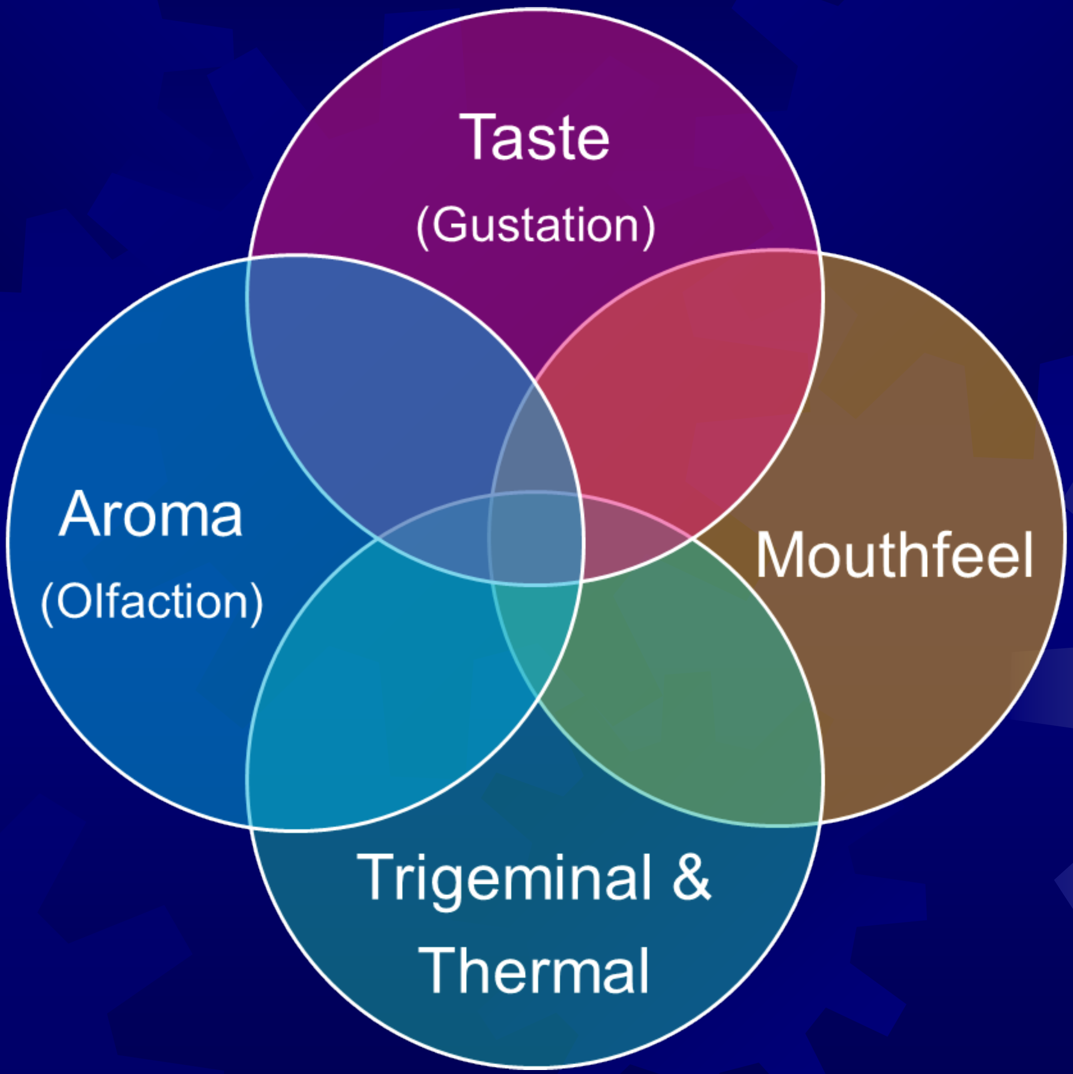
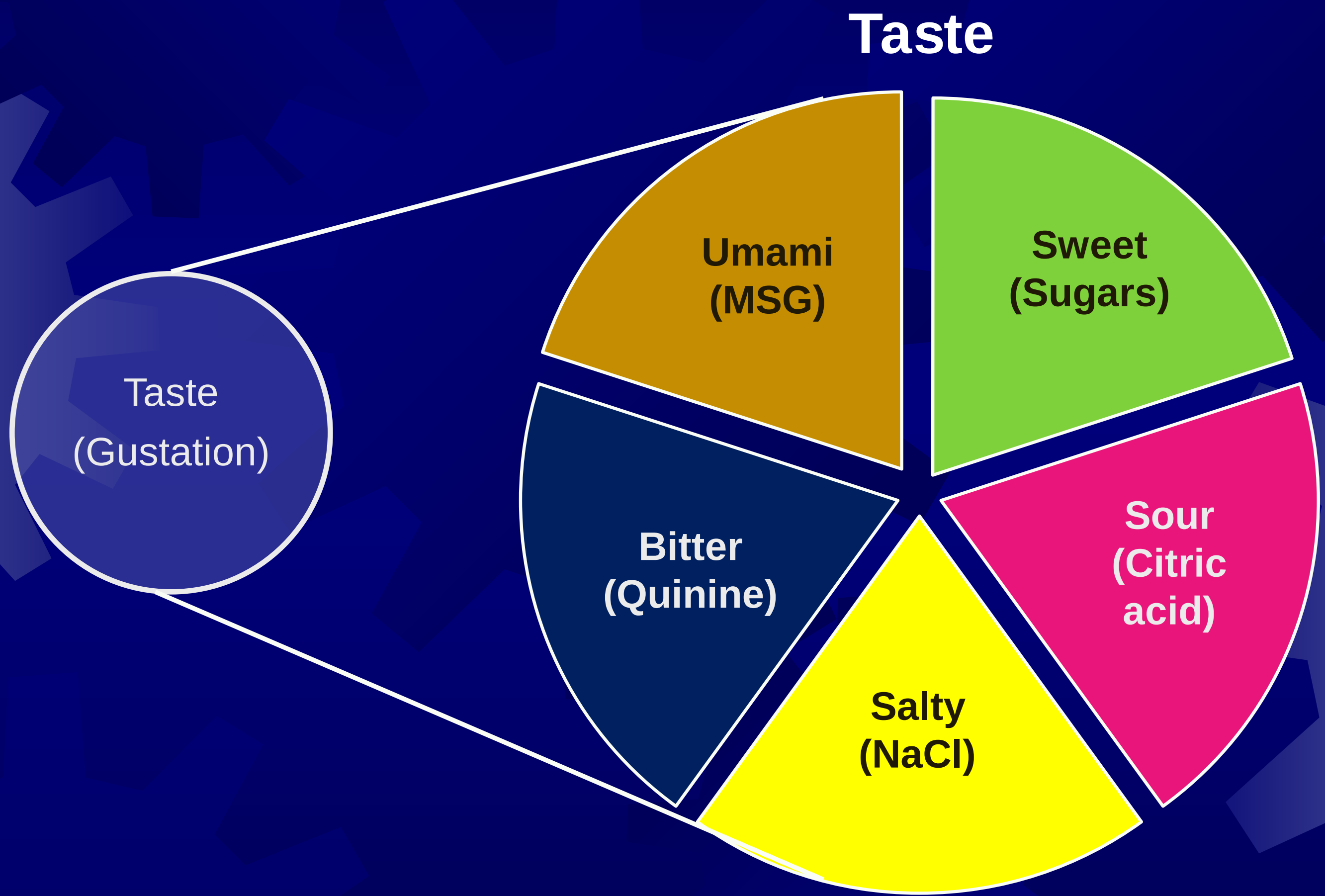
ASPECTS OF ORAL PERCEPTION

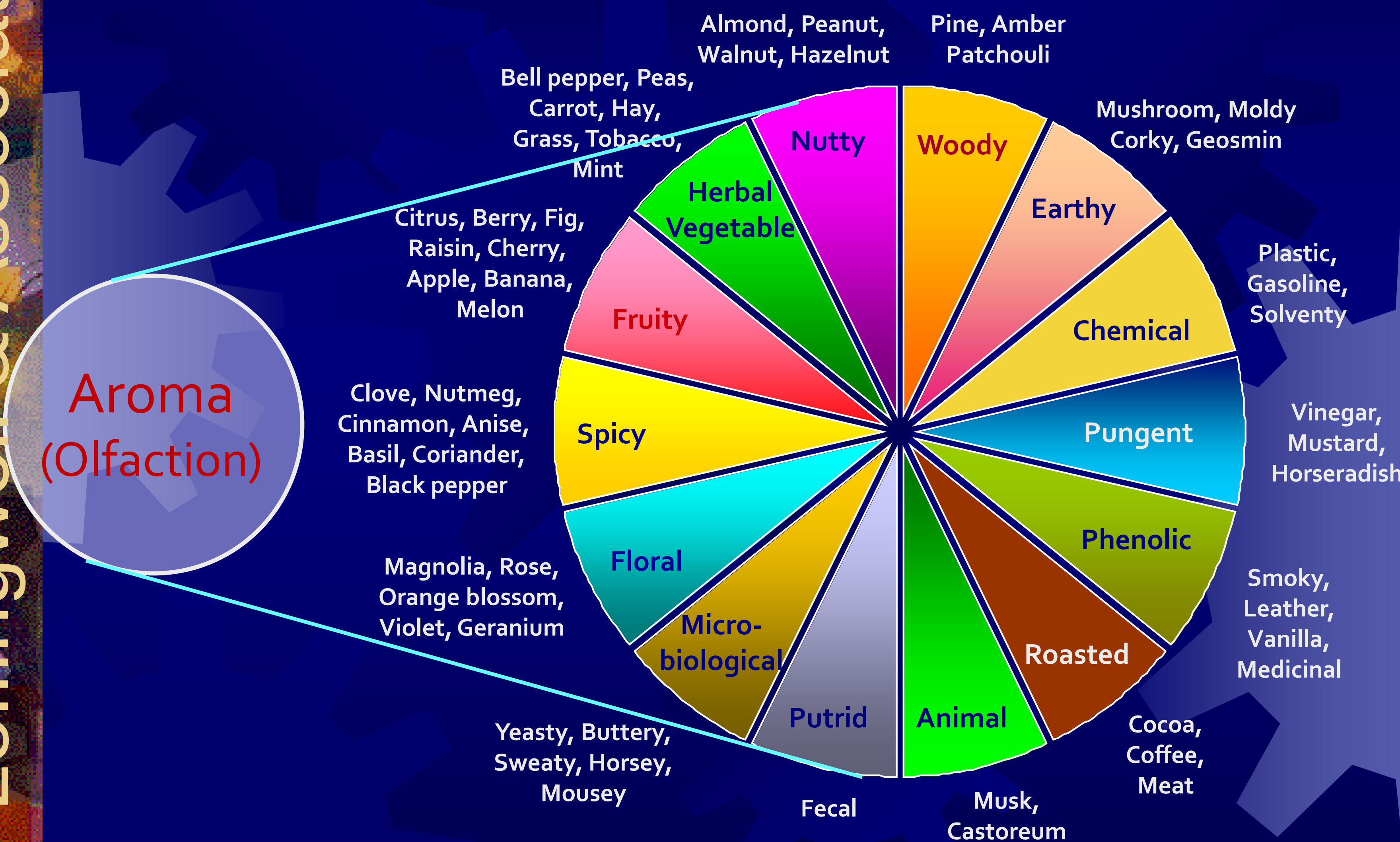


ASPECTS OF ORAL PERCEPTION



And is "Kokumi" the sixth taste?

ASPECTS OF ORAL PERCEPTION



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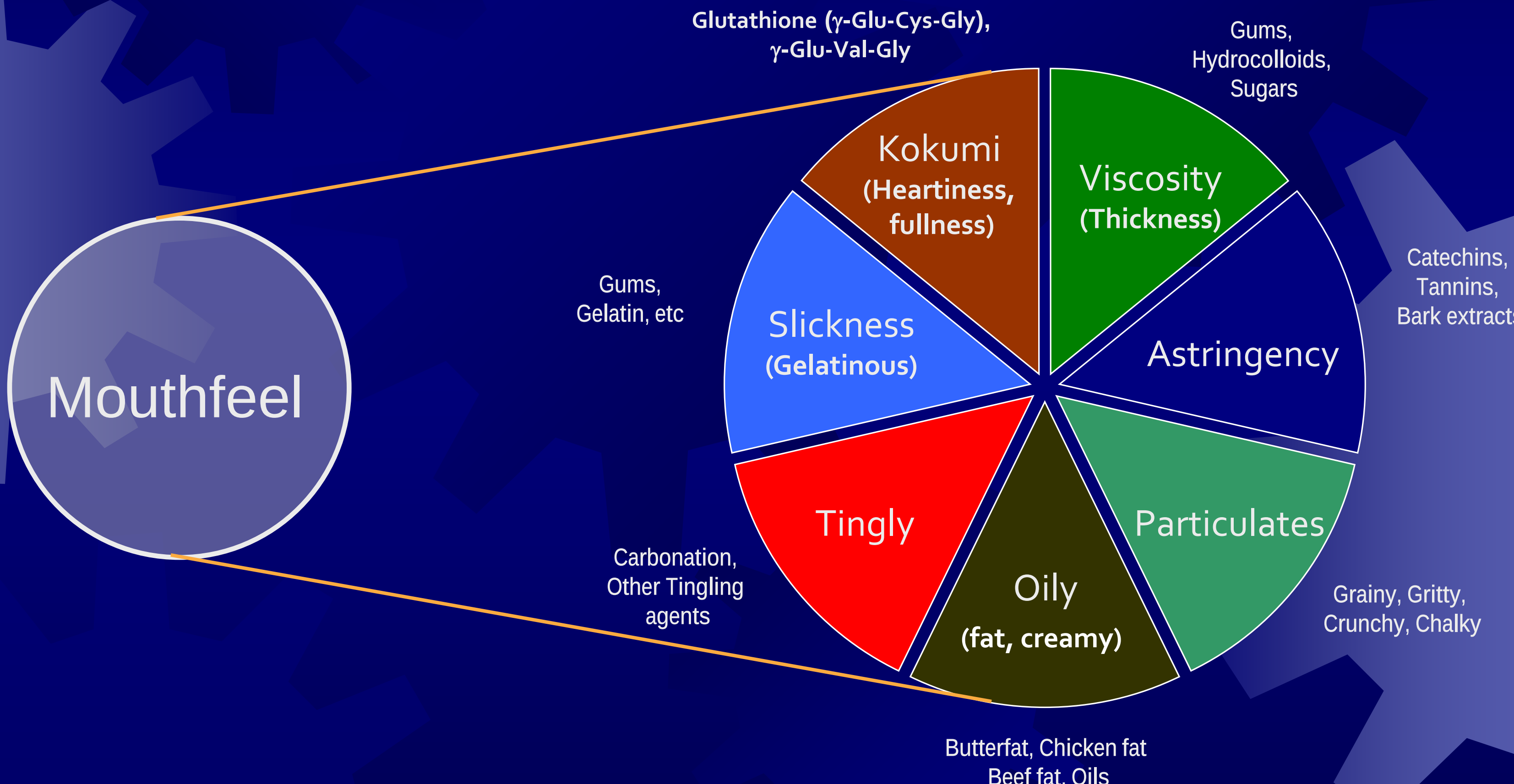
ASPECTS OF ORAL PERCEPTION

Major Mouthfeel Attributes



ASPECTS OF ORAL PERCEPTION

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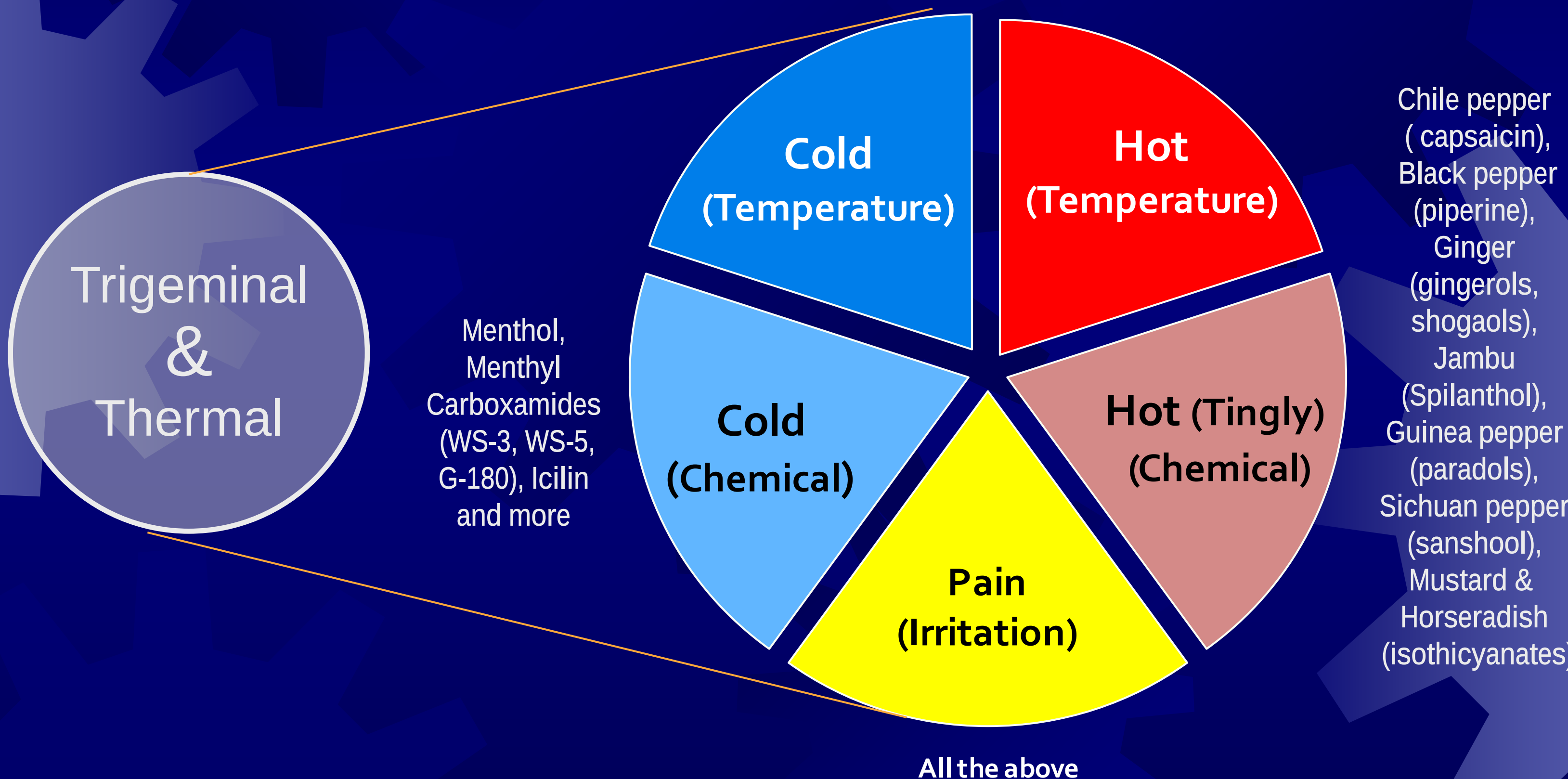
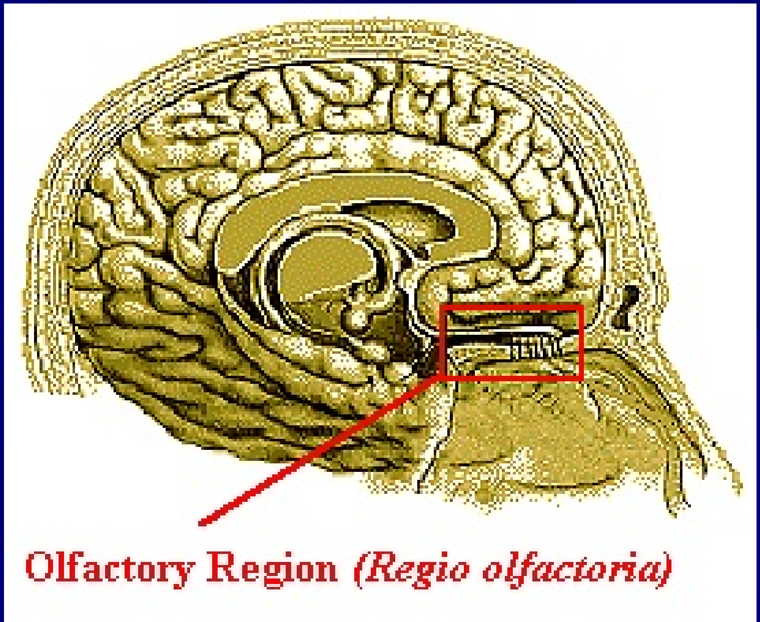
Major Thermal & Chemesthetic (e.g. Trigeminal) Attributes



Understanding Scent



Odorants are volatile chemicals carried by air to the Regio olfactoria (olfactory epithelium) located in the roof of the two nasal cavities of the human nose, just below and between the eyes.
The olfactory region of each of the two nasal passages in humans is a small area of about 2.5 square centimeters containing in total approximately 50 million primary sensory receptor cells.

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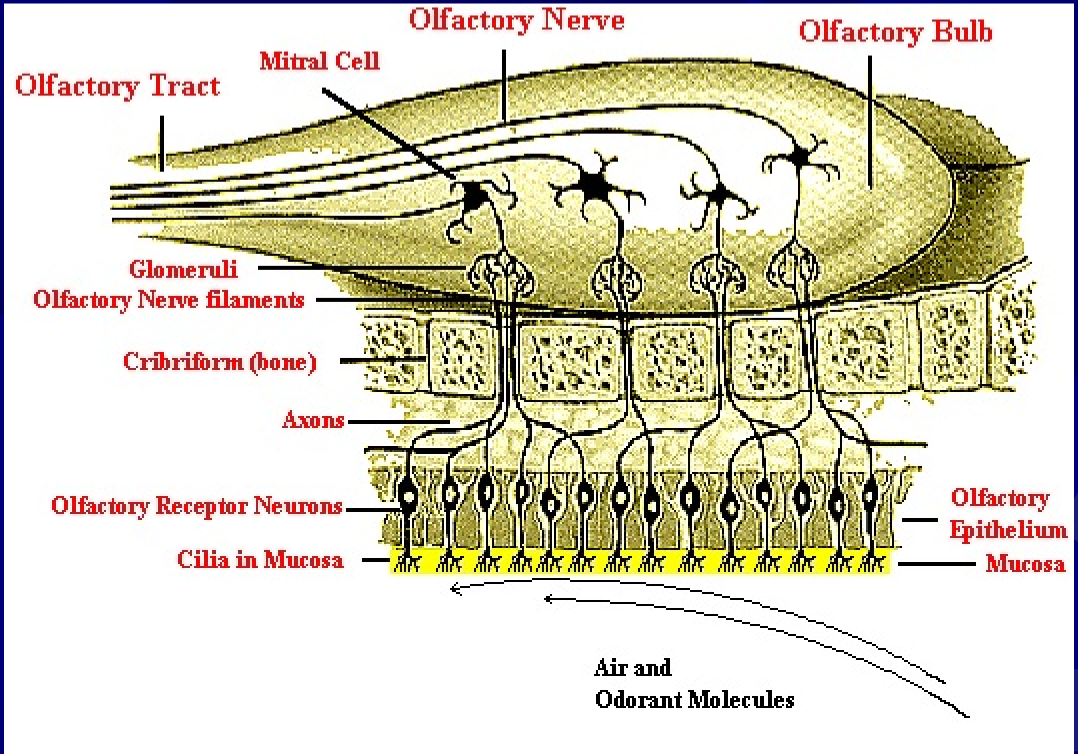
Understanding Scent



The olfactory region consists of cilia projecting down out of the olfactory epithelium. The olfactory cilia are the sites where molecular reception with the odorant occurs and sensory transduction (i.e., transmission) starts.

Odorants can reach the receptors either though the nostrils (orthonasal) or via the mouth cavity (retronasal).

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Olfactory Receptors – Nobel Prize (2004)

October 4, 2004 - Richard Axel and Linda Buck honored with the 2004 Nobel Prize in Physiology or Medicine for pioneering studies that clarify how the olfactory system works

Linda Buck & Richard Axel, Cell 1991;65:175-87.

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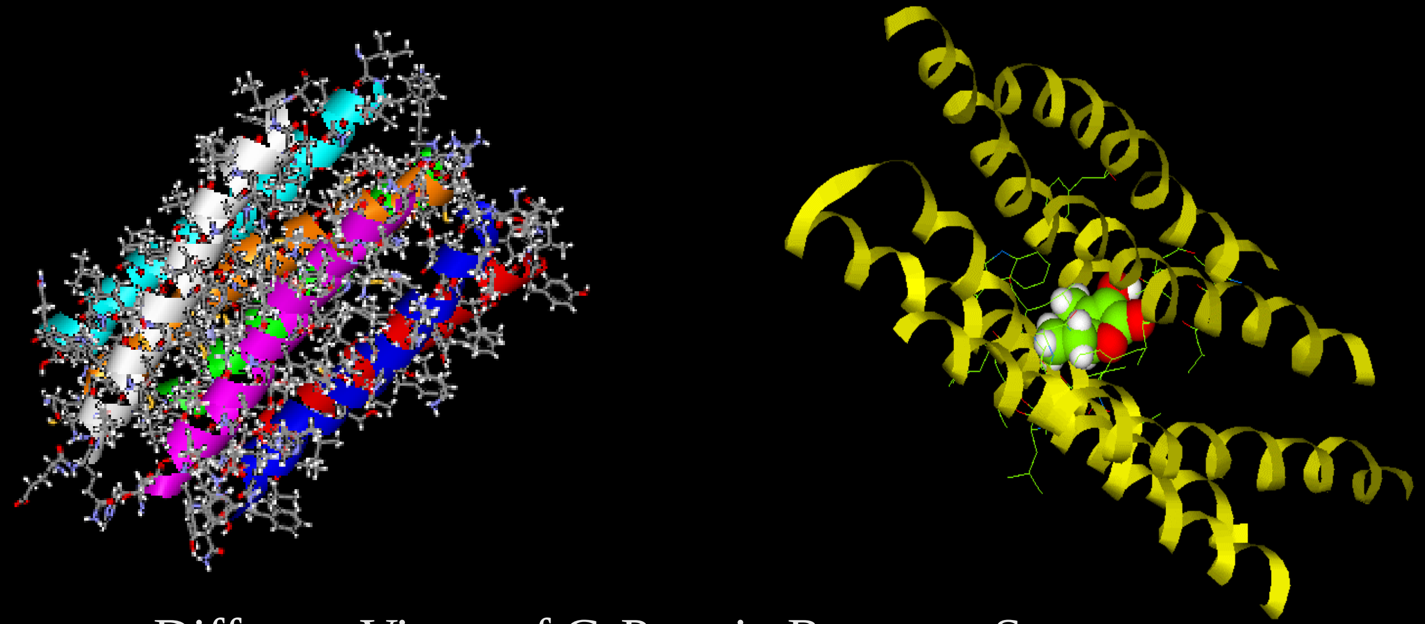
Understanding Scent

Elucidation of Olfactory G-Protein Receptor Structures - a result of Genome Data mining Research



Different Views of G-Protein Receptor Structures

900+ Human Olfactory Receptor Genes – Lancet (2000)
& Zozulya (2001) ~560 Pseudogenes + ~350 Intact Genes

Cooling Ingredients

- Menthol Production
- Menthol & Perception
- Other Cooling Ingredients

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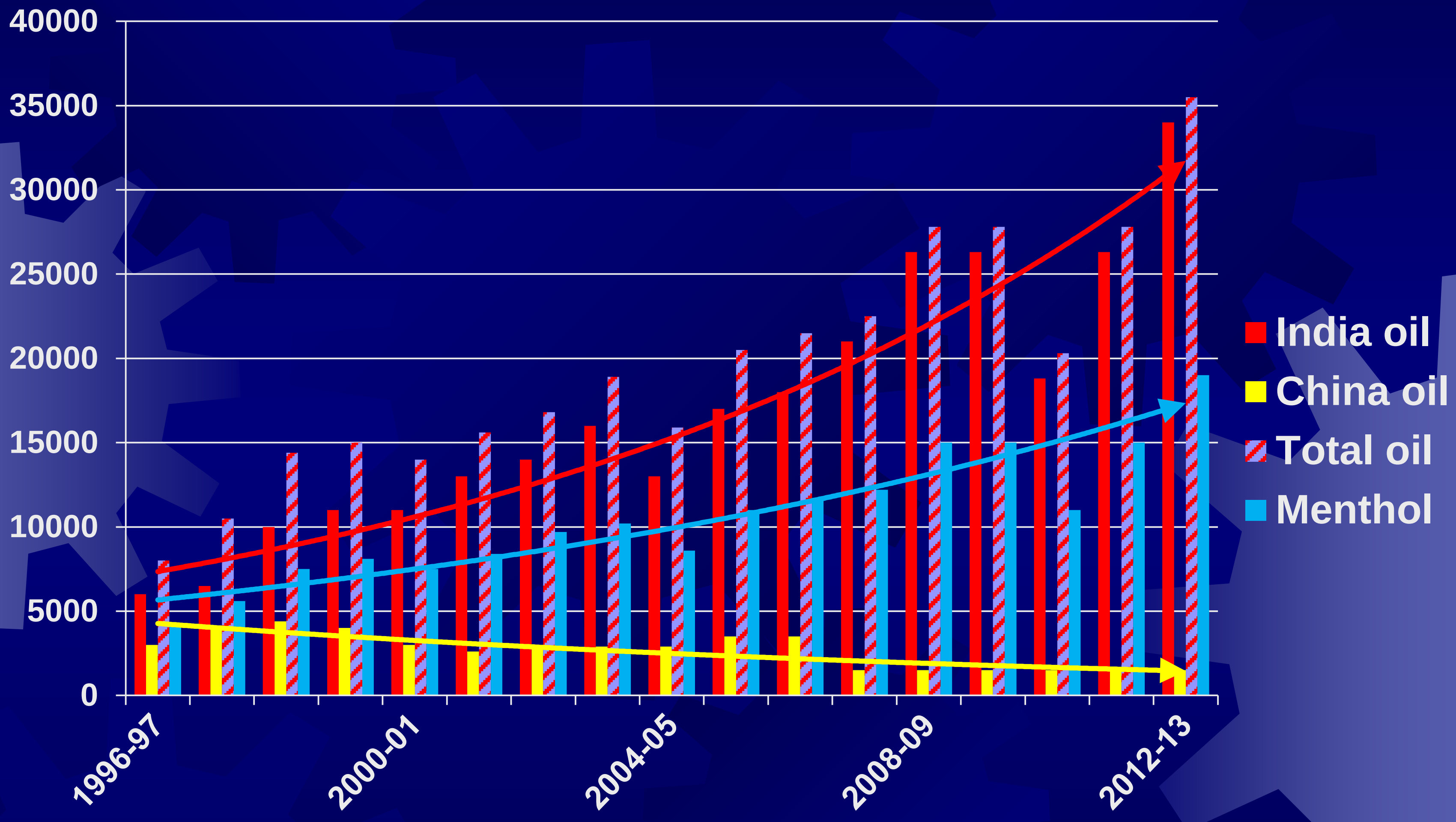
Production of Mentha arvensis Oil in India & China & Menthol Derived



Source: 1996-2006 - G.S. Clark, Perfumer & Flavorist, Vol. 32, 38-47 (2007)
Source: 2007-2010 - India Spice Board & Karvy Comtrade Ltd (July 2011) & Sushil Global Commodities
Source: 2011-2012 - Commodity Online India & MCX India

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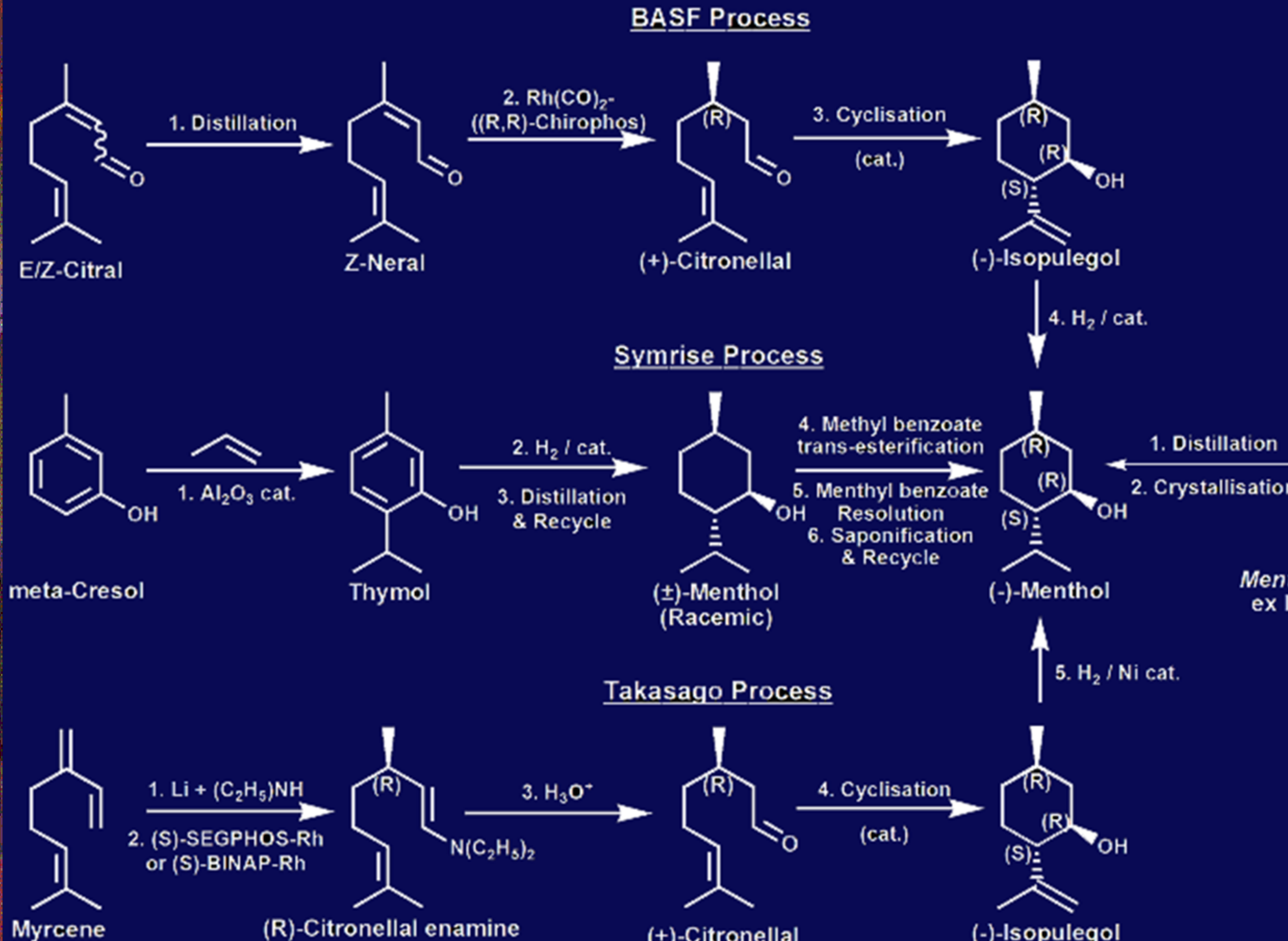
Major Commercial Routes to (-)-Menthol



Mentha arvensis ex India/China

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Worldwide Estimated L-Menthol Production (Metric tons)

Year	2007	2012
India (natural)	9,700	13,000
China (natural)*	2,120	4,000
Symrise (synthetic)	3,600	5,500
Takasago (synthetic)	1,500	2,000
BASF	0	1,000
Other synthetic	1,200	2,000
Brazil (natural)*	450	300
Taiwan (natural)*	300	300
Japan (natural)*	300	300
Total	19,170	28,400

*Primarily produced from crude menthol and/or Mentha arvensis oil from India

Source: 2007 – G.S. Clark, Perfumer & Flavorist, Vol. 32, 38-47 (2007)
Source: 2012 – J.C. Leffingwell estimate

Assuming a menthol price of US $25/kilo = ~$700 million Market
In 2011 USA Menthol Cigarettes used ~ 252 tons of Menthol

Thermo TRP Receptors & Agonists

Thermoreceptor Agonists

Chemical agonist (botanical source)	ThermoTRP
Capsaicin (hot chilli peppers, e.g., Tabasco)	TRPV1
Piperine (black pepper corns)	TRPV1
Allicin (fresh garlic)	TRPV1, TRPA1
Camphor (Cinnamomum camphora)	TRPV3, TRPV1
D-9-Tetrahydrocannabinol (Cannabis sativa)	TRPV2, TRPA1
Cannabidiol (Cannabis sativa)	TRPV2
Thymol (thyme)	TRPV3
(-)-Menthol (peppermint)	TRMP8, TRPA1, TRPV3
1,8-Cineole, eucalyptol (eucalyptus)	TRPM8, TRPV3
WS-3 (synthetic)	TRPM8, TRPA1
Icilin (synthetic)	TRPM8, TRPA1
WS-12 (synthetic)	TRPM8
Eugenol (clove)	TRPV3, TRPA1, TRPV1
Cinnamaldehyde (cinnamon, cassia)	TRPA1, TRPV3
Allyl isothiocyanate (mustard, horseradish)	TRPA1
Phenethyl isothiocyanate (mustard, horseradish)	TRPA1
Nicotine (Tobacco)	TRPA1

Thermoreceptors belong to the class of transient receptor potential (TRP) channels

Leffingwell, Perfumer & Flavorist, Vol. 39, No. 3, 2014, 34-43; Gravina et al., U.S. Patent 7541055 (2009) (IFF); Schreiner et al., European journal of pharmacology 728 (2014): 48-58

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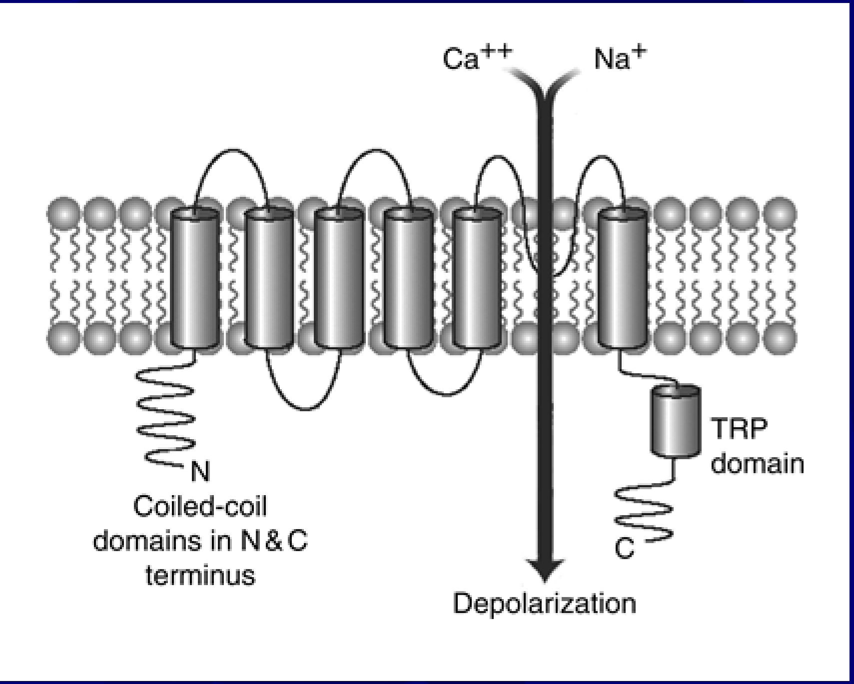
Thermo TRP Receptors



ThermoTRPs are gated Ca++ channels consisting of six transmembrane domains (TM1–TM6) flanked by large N- and C-terminal cytoplasmic domains. The schematic representation is shown with the putative ion channel between TM5–TM6 in TRPM8, which is activated by menthol and other cold stimuli. TRP channels modulate the calcium ion gating processes resulting in the stimulus signal.

Much of the knowledge gained on TRP activation by chemical stimuli has been derived by genetic expression of putative receptor domains and measurement of Ca++ flux intensity by fluorometric imaging assays.

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Wilkinson Sword Design of Non-Menthol Cooling Agents
(late '60's – early 70's)

Used Pharmaceutical Approach

A - Examined cooling activity of over 1200compounds
B - Developed Structure Activity Relationships for predicting cooling

The Wilkinson-Sword model lists four requirements for cooling compounds:

1 - A hydrogen bonding group.
2 - A compact hydrocarbon skeleton.
3 - A log*P* between 1.0 and 5.0 (solubility coefficient in octanol/water)
4 - A molecular weight between 150 and 350

* - Chirality can play a major role when present

Although refined over the years, these factors are still valid.

Today, the major approach to discovery of new coolants (and other tastants) utilizes the genetic approach of receptor expression and calcium fluorometric imaging assays to measure binding intensity.

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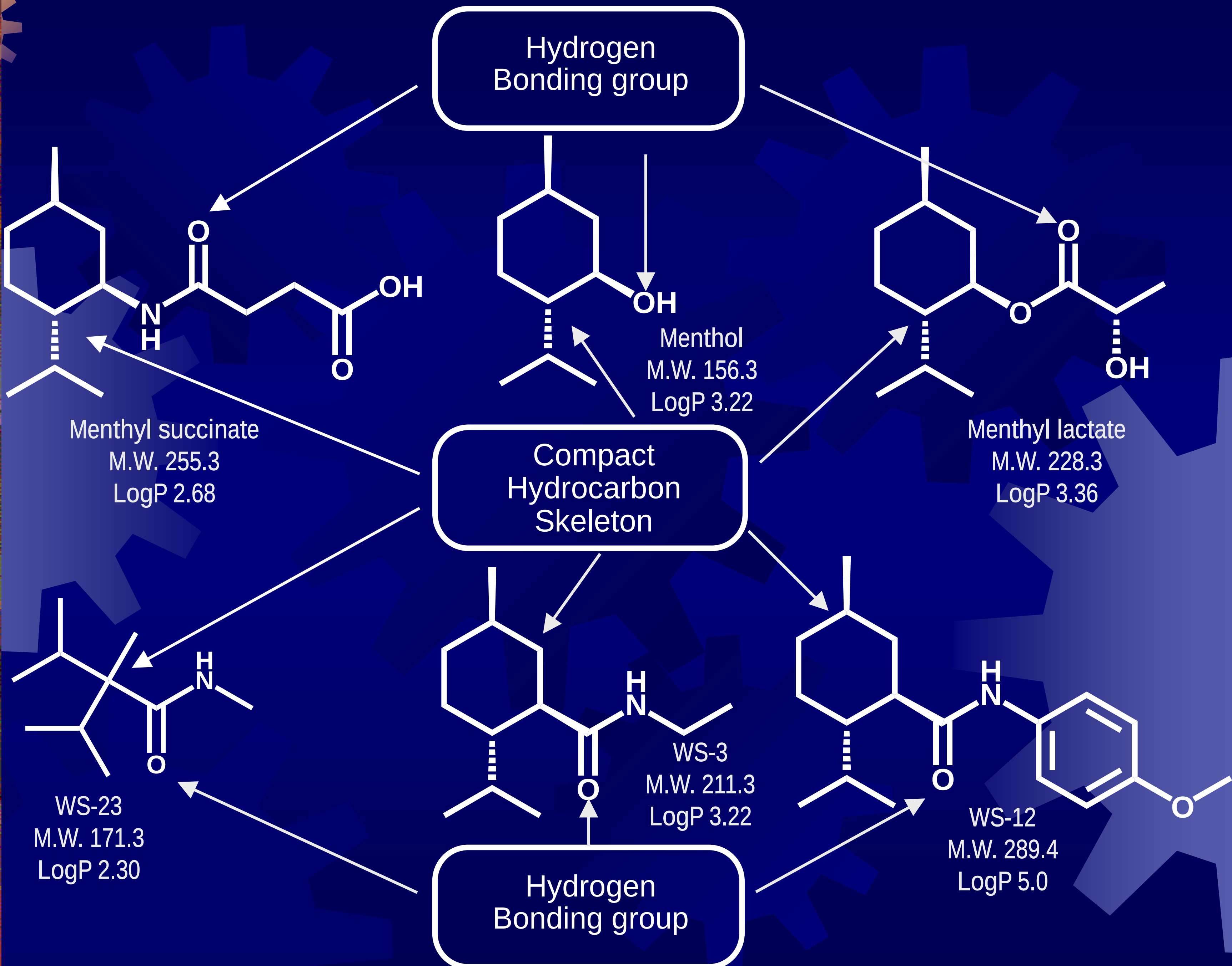

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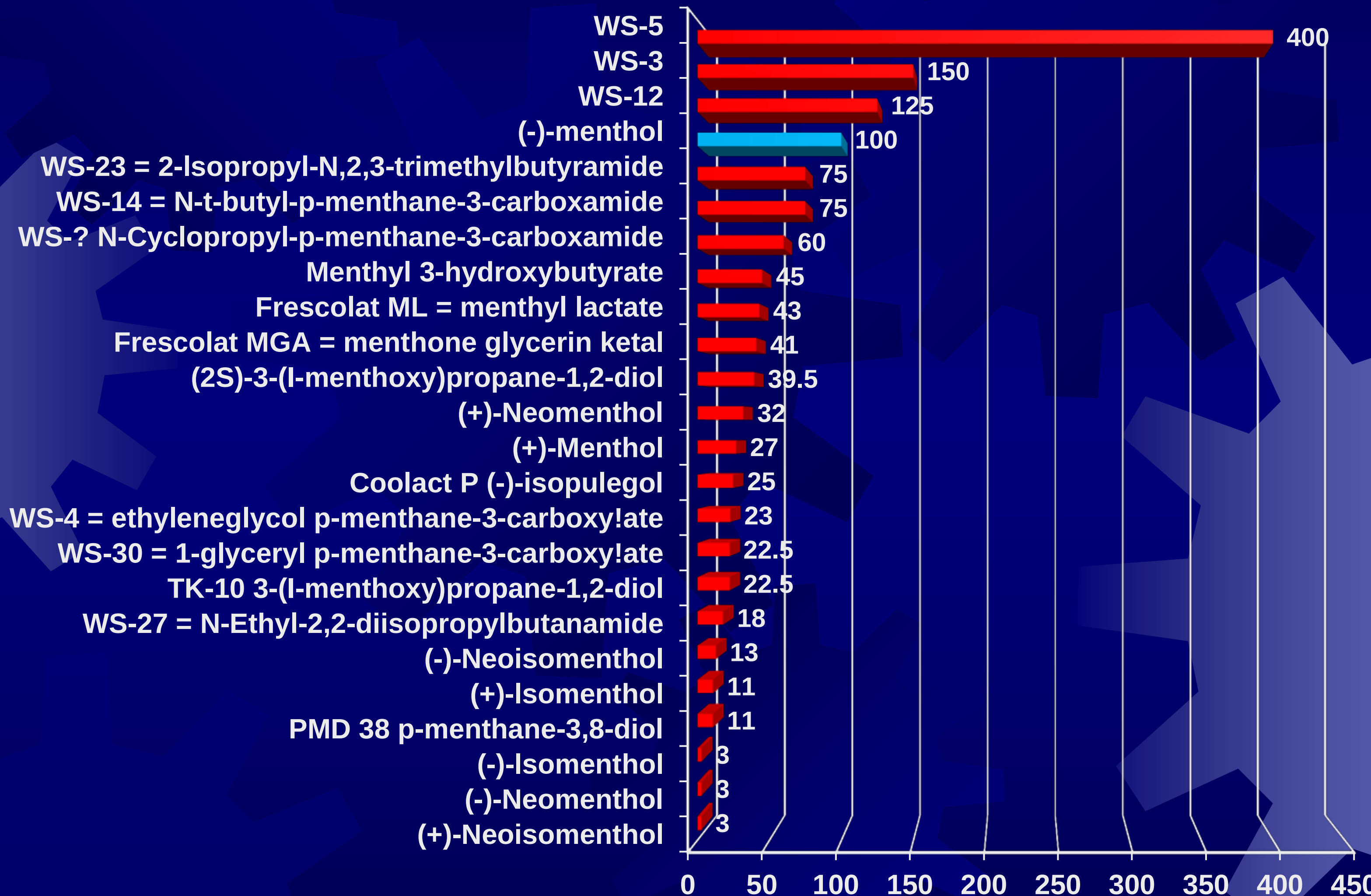
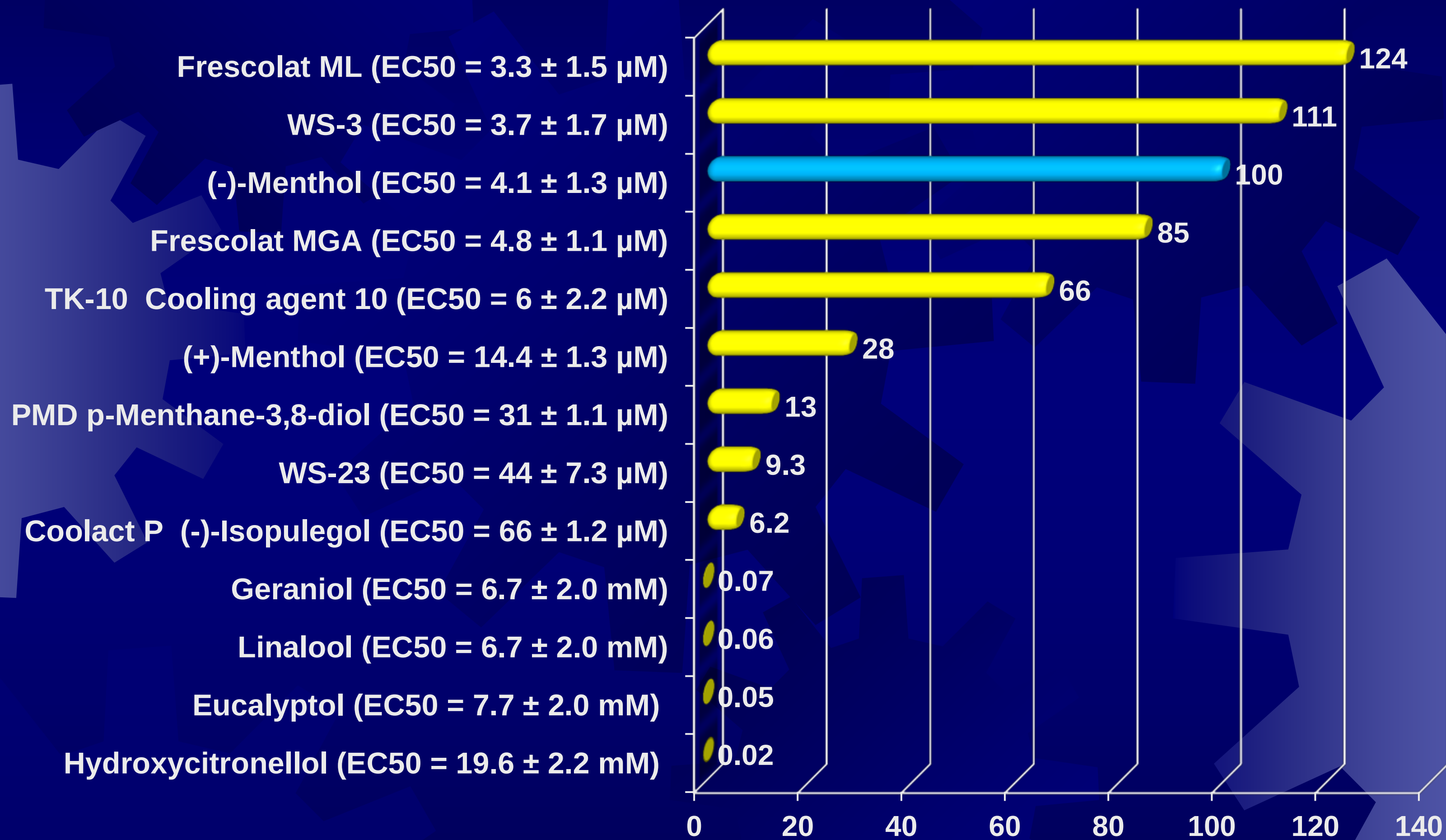
Approximate Relative Cooling Strengths vs Menthol (as 100)



Note – WS-30, WS-4 & WS-14 are not GRAS as of 2014

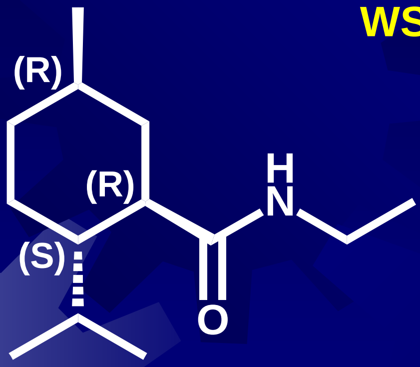
Relative Potency of TRPM8 agonists based on EC_{50} values (mean) with (-)-Menthol = 100



Adapted from Behrendt et al., Characterization of the mouse cold-menthol receptor TRPM8 and vanilloid receptor type-1 VR1 using a fluorometric imaging plate reader (FLIPR) assay, Brit J Pharm 2004; 141(4):737–745.

Wilkinson Sword Coolants

WS-3 = N-Ethyl-p-menthane-3-carboxamide

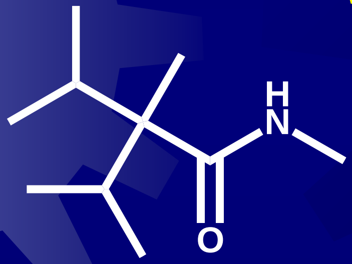


FEMA 3455 (1975)
FLAVIS 16.013

Approximate cooling intensity
vs. L-Menthol (as 100)

150
= 1.5X menthol

WS-23 = N,2,3-trimethyl-2-Isopropylbutyramide

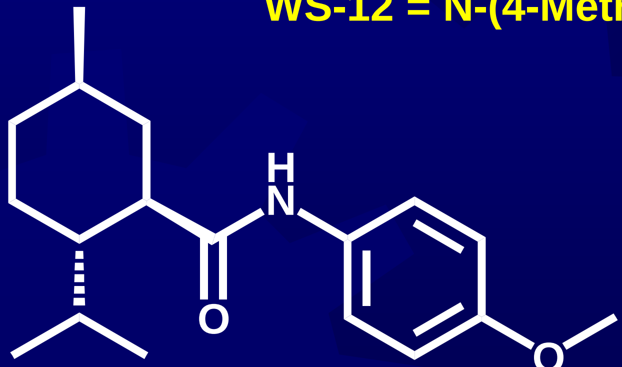


FEMA 3804 (1996)
FLAVIS 16.013

Approximate cooling intensity
vs. L-Menthol (as 100)

75
= 0.75X menthol

WS-12 = N-(4-Methoxyphenyl)-p-menthane-3-carboxamide



FEMA 4681 (2011)
FLAVIS --

Approximate cooling intensity
vs. L-Menthol (as 100)

~100 – 150
= ~1.0-1.5X menthol

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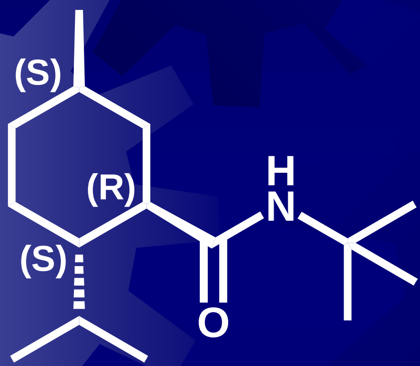
Wilkinson Sword Coolants

WS-14 = N-t-Butyl-p-menthane-3-carboxamide
(NOT GRAS)



Approximate cooling intensity vs. L-Menthol (as 100)

75
= 0.75X menthol

Investigated by both RJRT and Philip Morris for a "Cool without Menthol" concept. Considered the best of the WS non-menthol coolants by both companies.

Introduced into test market by PM in 1981 – rather rapidly withdrawn! Was that because of market acceptance OR because of legal concerns?

Tobacco & Flavoring

- The Old Cigarette Companies
- The Changing Cigarette
- Filters - Lower Tar & Nicotine
- Smoke pH, Ammonia & DAP
- Tobacco Flavors

The Old Cigarette Companies

- At the beginning of 1911, J.B. Duke's American Tobacco Co. controlled 92% of the world's tobacco business. But the trust is broken up as violation of the 1890 Sherman Antitrust Act. The major companies to emerge were: American Tobacco Co., R.J. Reynolds, Liggett & Myers Tobacco Company, Lorillard and BAT.
- Liggett & Myers got about 28% of the cigarette market
- P. Lorillard received 15% of the cigarette business
- American Tobacco retained 37 per cent of the market
- R. J. Reynolds received no cigarette line but was awarded 20 per cent of the plug chewing trade

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The Old Cigarette Companies

1912: RJR Introduces Red Kamel ... a blend of Turkish & Virginia Tobaccos AND
Prepares the Introduction of another cigarette

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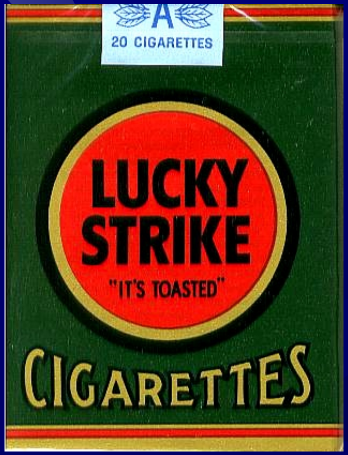
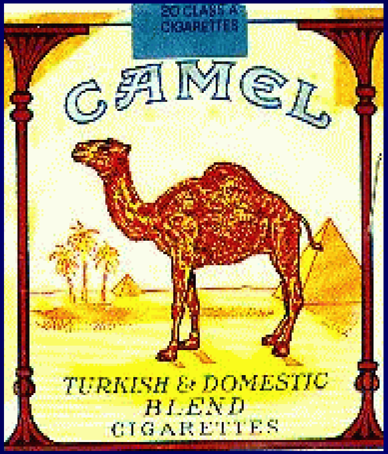
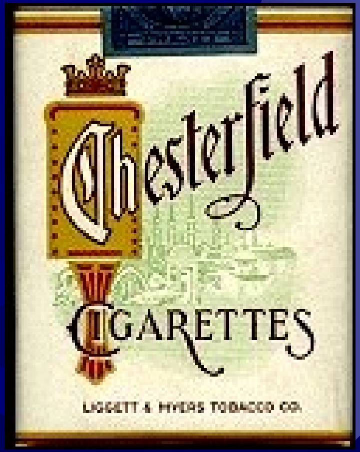
The Old Cigarette Companies

1913: Birth of the "modern" cigarette: R.J. Reynolds introduces Camel, the first “American Blend” cigarette - made of a blend of Virginia, Burley and Oriental tobaccos.

1917: There are now 3 standard brands of cigarettes on the US market: Camel, Lucky Strike and Chesterfield.





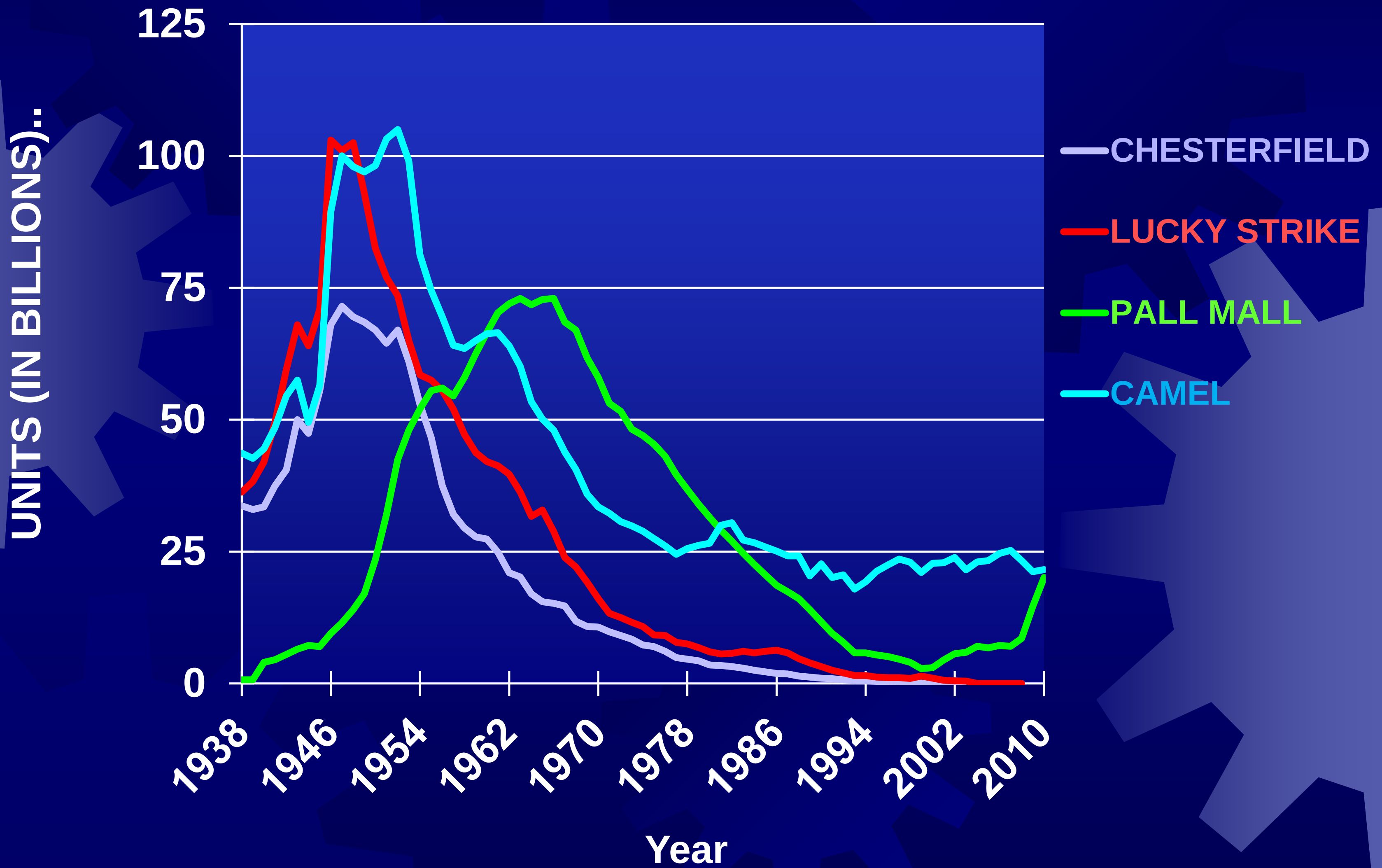


The Old Cigarette Companies

1926: Lloyd (Spud) Hughes' menthol Spud Brand and recipe sold to Axton-Fisher Tobacco Co., which markets it nationally.

1932: B&W introduces "Kool" cigarettes to compete with Axton-Fisher's *Spud,* the only other mentholated brand.

The Old "Original" Major Brands U.S. Sales 1938-2010



Source: RAI 2010-2013; Maxwell Reports 1983-2009; Philip Morris USA 1938-81

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The Changing Cigarette

Filter Cigarettes:

1951 - Filters are 0.8% of sales

1952 – B&W's 70mm Viceroy with the new cellulose acetate filter is introduced.

1952: Lorillard introduces Kent cigarettes with the "Micronite Filter"; but the filter contains asbestos.

1954: RJR's Winston filter tips go on sale. The first blockbuster success for a filter cigarette.

1955 - Filters are 19.6% of sales

1956: P. Lorillard discontinues use of "Micronite" filter (with asbestos) in its Kent cigarettes. With a conventional cellulose acetate filter Kent sales increase by 33 billion units between 1956-1958.

1960 - Filters are 52.5% of sales

The Changing Cigarette

Reconstituted Tobacco:

Early 1950's - RJR constructs plant to produce reconstituted tobacco and incorporates low levels (i.e., 1%) into cigarettes in 1954. This utilizes Tobacco waste & stems in a classic paper making process.

By the late 1950’s all manufacturers were utilizing reconstituted tobacco.

1964 –1965: Philip Morris implements a new “hot belt” or “band cast” recon process, with improved flavor, using diammonium phosphate to solubilize the tobacco pectins. Immediately, sales of Marlboro sky rocketed. In the next 10 years Marlboro volume in the U.S. increased by 64.4 billion units at an average annual growth of 14.5%/year.

By 1969 -1970 – Competitors were investigating “why?”. And the possibility of “Free-Base” nicotine was being discussed.

The Changing Cigarette

Cigarette Paper Porosity:
1956 - 1964: The use of more porous cigarette paper allows the industry to reduce average tar & nicotine levels by nearly 50%.

Expanded Tobacco:
1967: an eccentric chemist buried in the RJR labs proposes a method of expanding tobacco by impregnating tobacco with a volatile solvent and heating it.

Circa 1970 - the first expanded tobacco quietly is introduced into RJR cigarettes; the volatile solvent utilized commercially for expansion was Freon.

Expanded tobacco would play an important role in product cost reduction and also become important in designing “low tar” cigarettes.

The Changing Cigarette

Expanded Tobacco:

mid-70's: Philip Morris begins using an expansion process utilizing ammonium carbonate that circumvents the RJR patents.

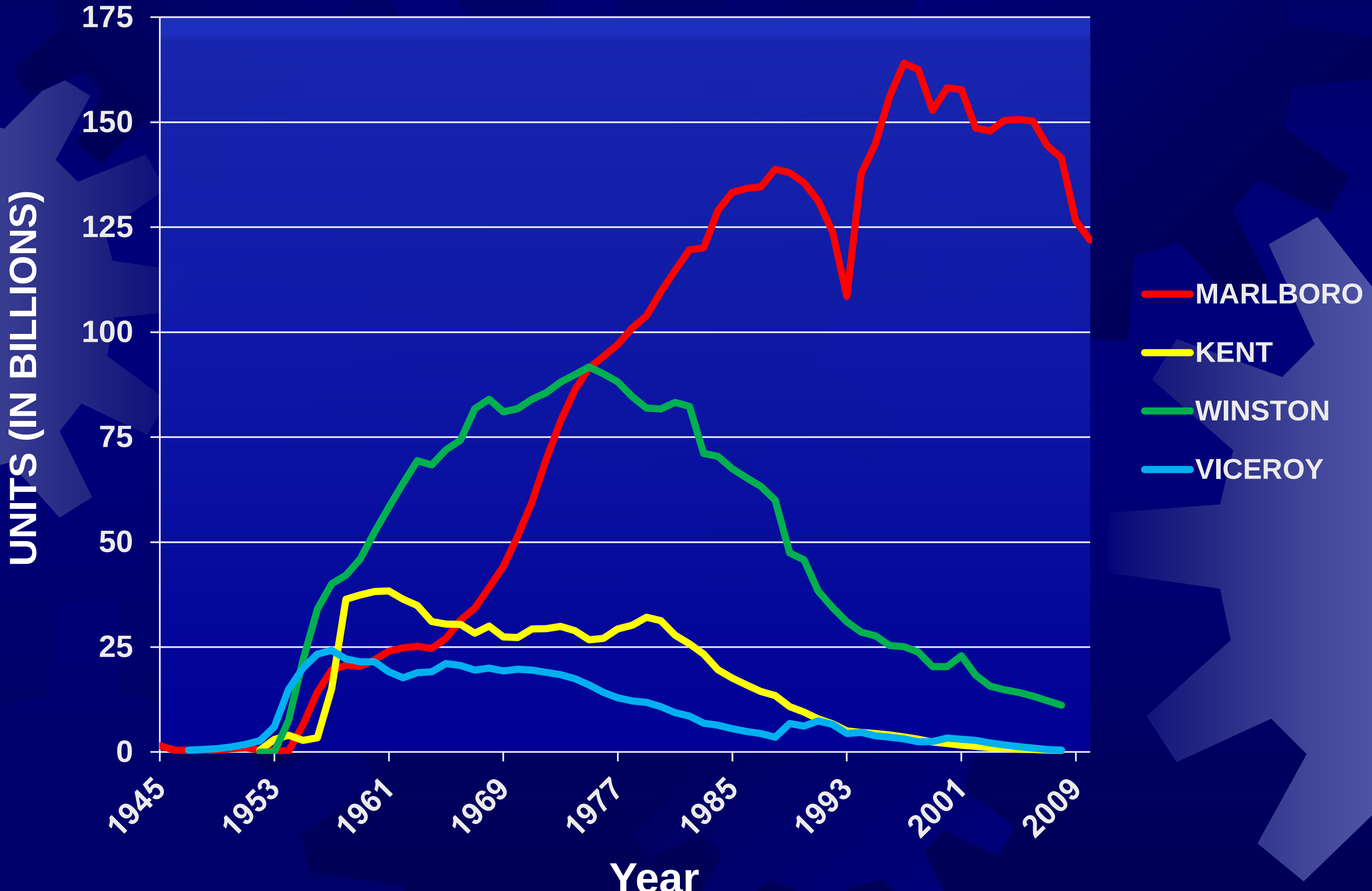
1979: A Philip Morris / Airco process now known as DIET utilizing carbon dioxide in a pressurized vessel followed. This process gave a superior tasting product as compared to using ammonium carbonate.

Late 70's: concern over Freon's effect on the ozone layer becomes an issue to face RJR.

1980's: RJR develops a propane expansion process, but only built a pilot plant.

1990's: RJR implements DIET expansion.

The New Filter Brands of the 50's U.S. Sales 1945-2010



Source: Altria 2009-2013; Maxwell Reports 1983-2009; Philip Morris USA 1938-81

The Major Menthol Brands U.S. Sales 1938-2010

Source: Lorillard 2010-2013; Maxwell Reports 1983-2009; Philip Morris USA 1938-81

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The Changing Cigarette

1951 - Filters are 0.8% of sales

1955 - Filters are 19.6% of sales

1960 - Filters are 52.5% of sales

1970 - Filters are 79.4% of sales

1980 - Filters are 91.7% of sales

1990 - Filters are 96.0% of sales

2000 - Filters are 98.2% of sales

2010 - Filters are 99.5% of sales

Source: Maxwell Reports; FTC

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The Changed Cigarette

Prior to 1950:

Less than 1% with filter, No Porous cigarette paper

No reconstituted or Expanded tobacco

Most were 70 mm in length;

Tobacco wt. per cigarette ~1000-1200 mg.

Less than 1% were mentholated

Todays Cigarette:

99.6% with filter, all with Porous cigarette paper,

15-29% Reconstituted tobacco

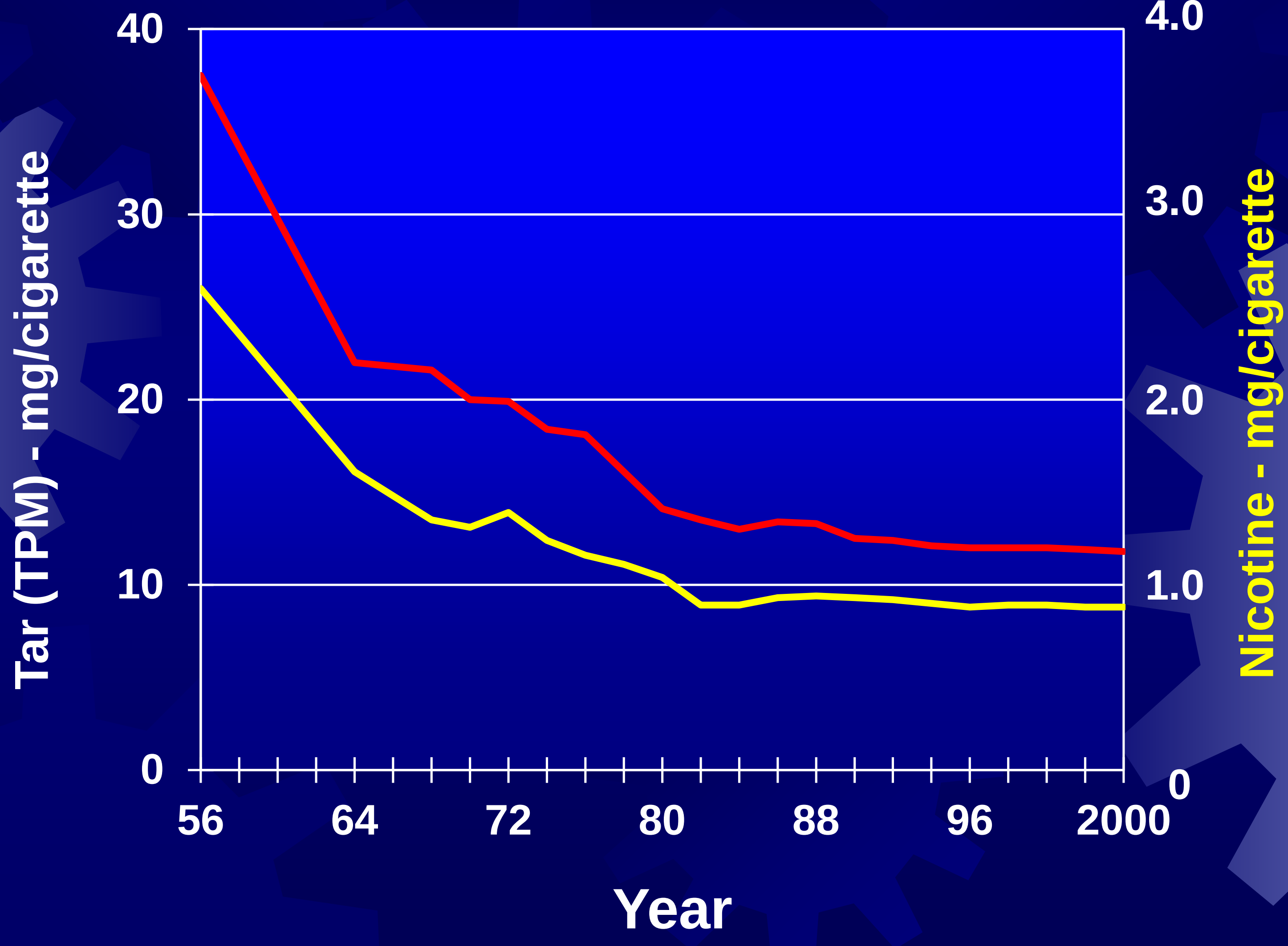
15-29% Expanded tobacco

Most 85 mm in length

Tobacco wt. per cigarette ~725 mg.

32+% are mentholated

Sales Weighted Average Tar & Smoke Nicotine USA



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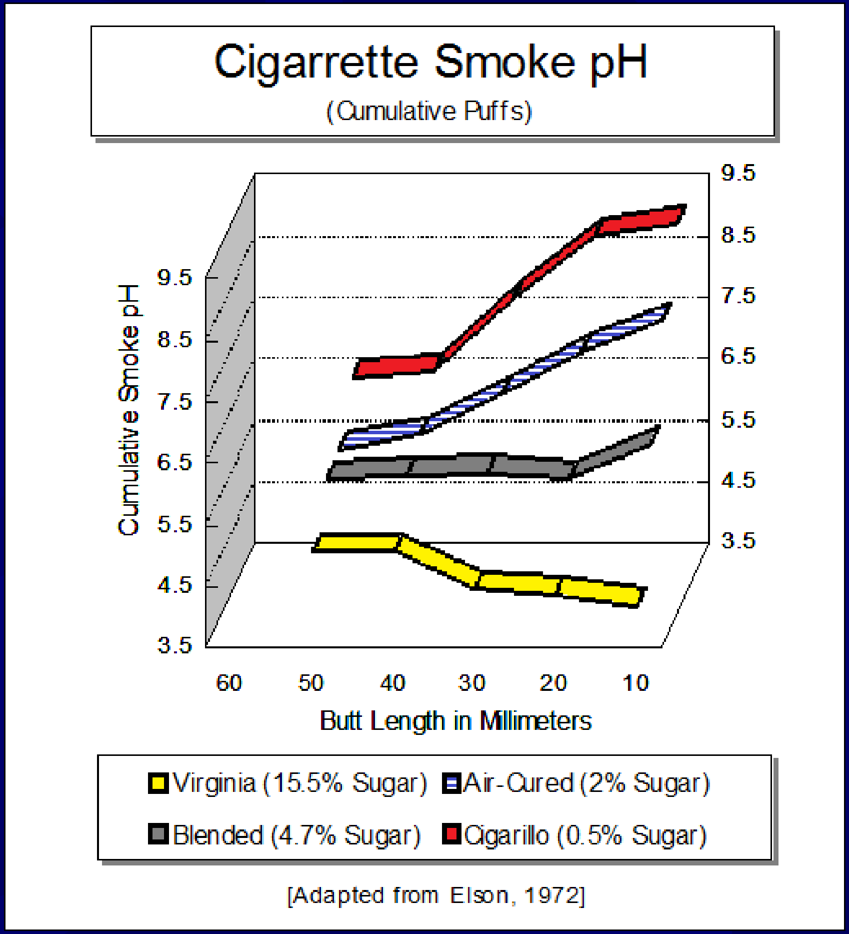
Smoke pH, Ammonia & DAP

Alkalinity of Smoke – Air-Cured vs. Flue-Cured



J.C. Leffingwell, Leaf Chemistry in Tobacco: Production, Chemistry, And Technology, D. Layten Davis and Mark T. Nielson, Eds., Blackwell Science (Pub.), 1999; pp 270-273

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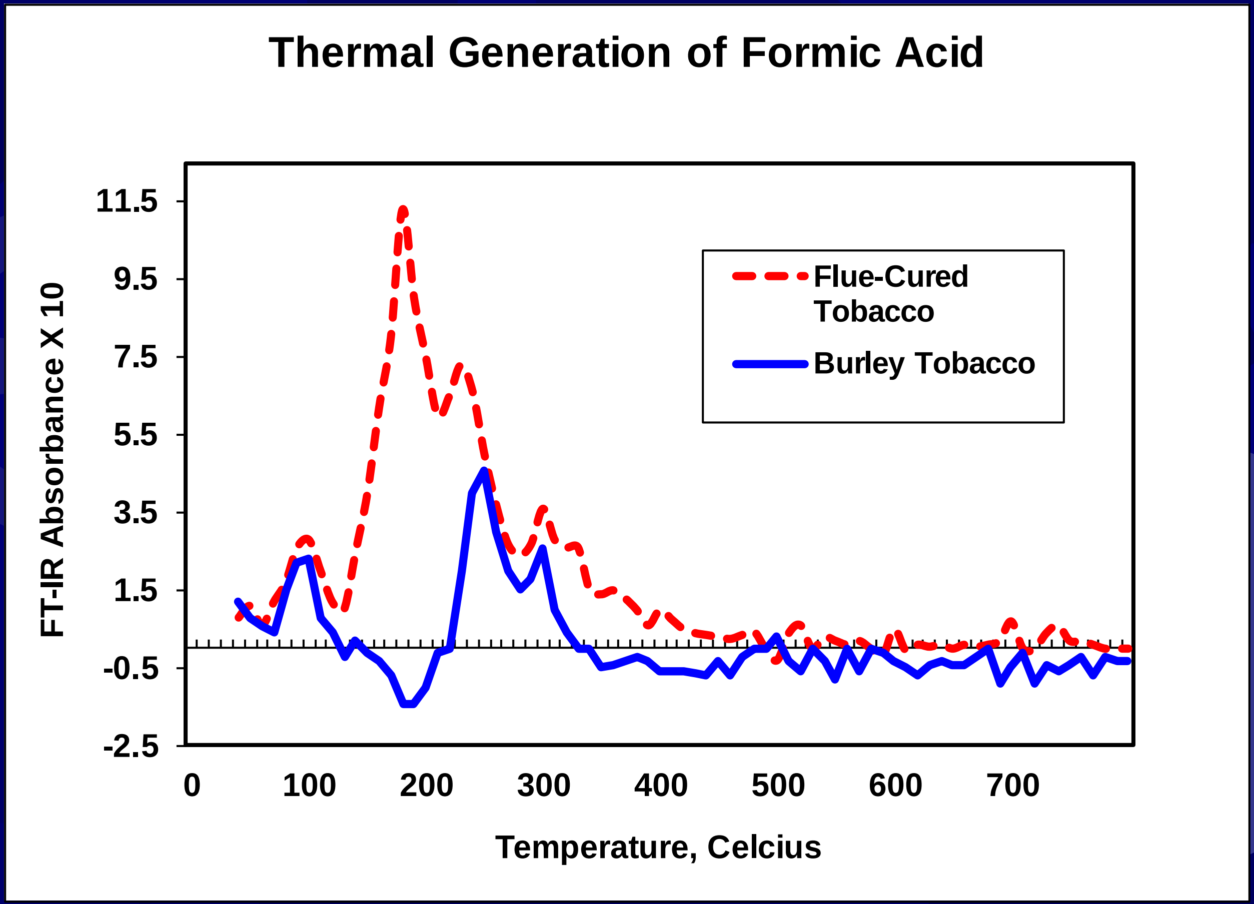
Smoke pH, Ammonia & DAP

Thermal Generation of Formic Acid – Burley vs. Flue-Cured



Adapted from Fenner, TCRC, 1988

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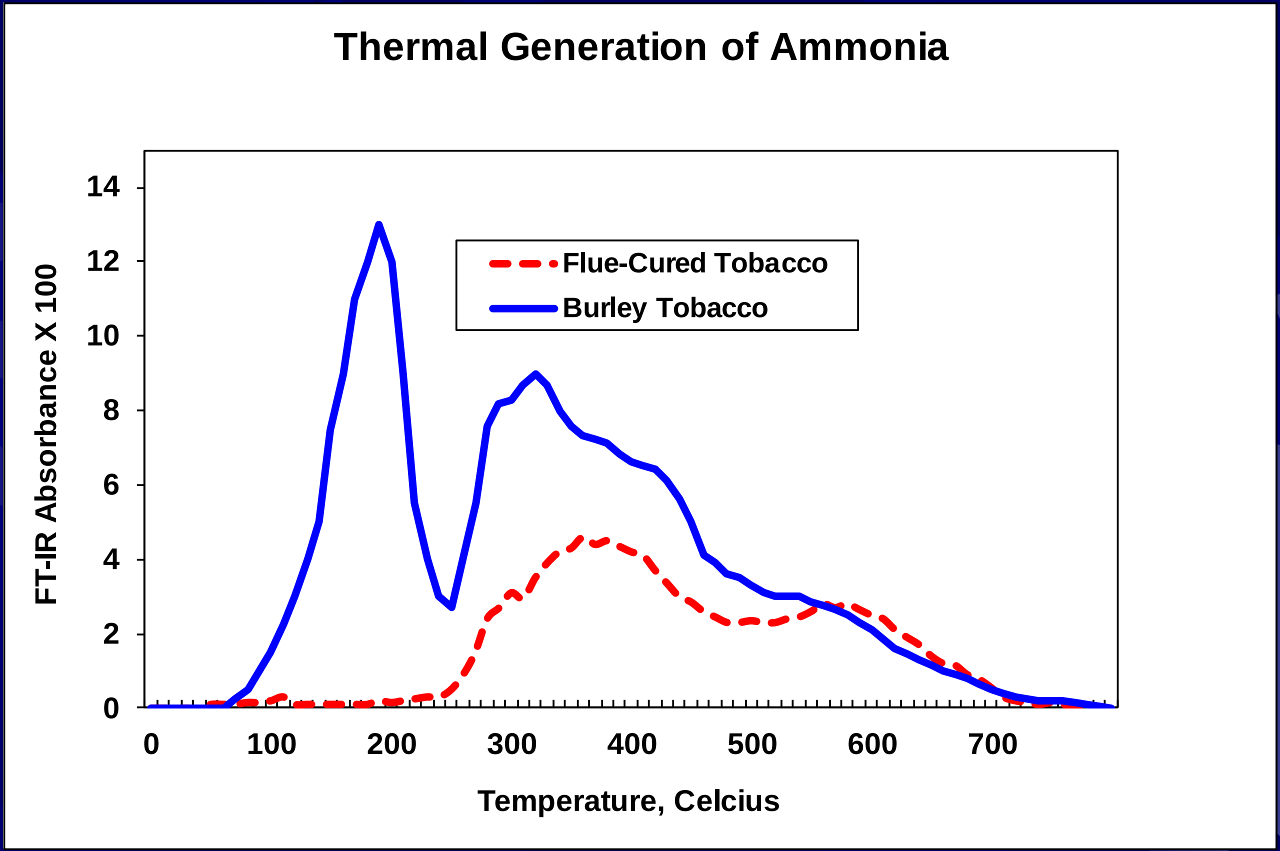
Smoke pH, Ammonia & DAP

Thermal Generation of Ammonia – Burley vs. Flue-Cured



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Smoke pH, Ammonia & DAP

Since pH of smoke in air-cured tobacco is more alkaline than flue-cured or Oriental, the ratio of nicotine base to nicotine salts increases. This causes the sensory and physiological perception of increased nicotine strength (and harshness) on inhalation. Accordingly, the increased alkalinity of straight air-cured cigarettes renders them virtually unacceptable to nearly all smokers as the higher smoke pH imparts an alkaloid harshness (nicotine “impact” or “kick’) with a flavor distortion which can be extremely unpleasant. Conversely, many smokers find the “acidic” smoke of straight Virginia cigarettes to be unbalanced.

The addition of sugars to air-cured tobacco mitigates the alkaloid harshness.

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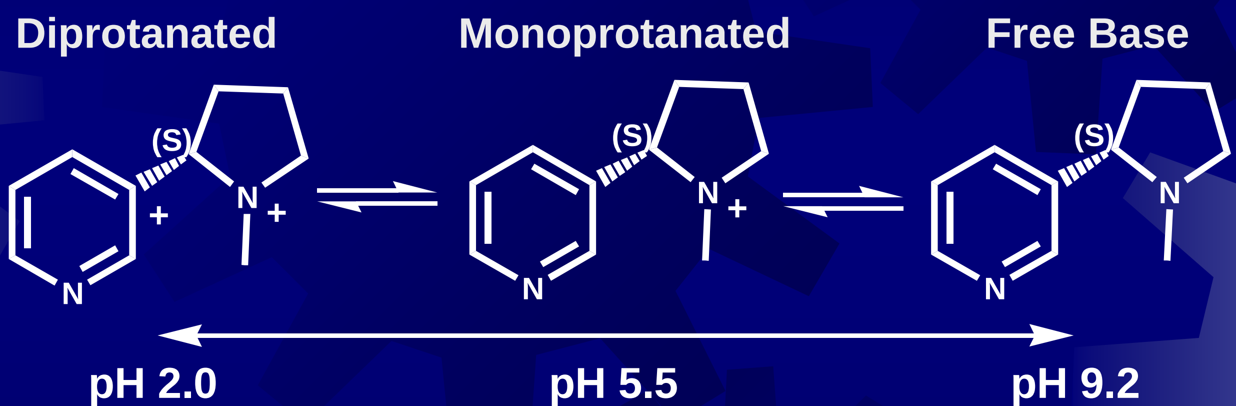
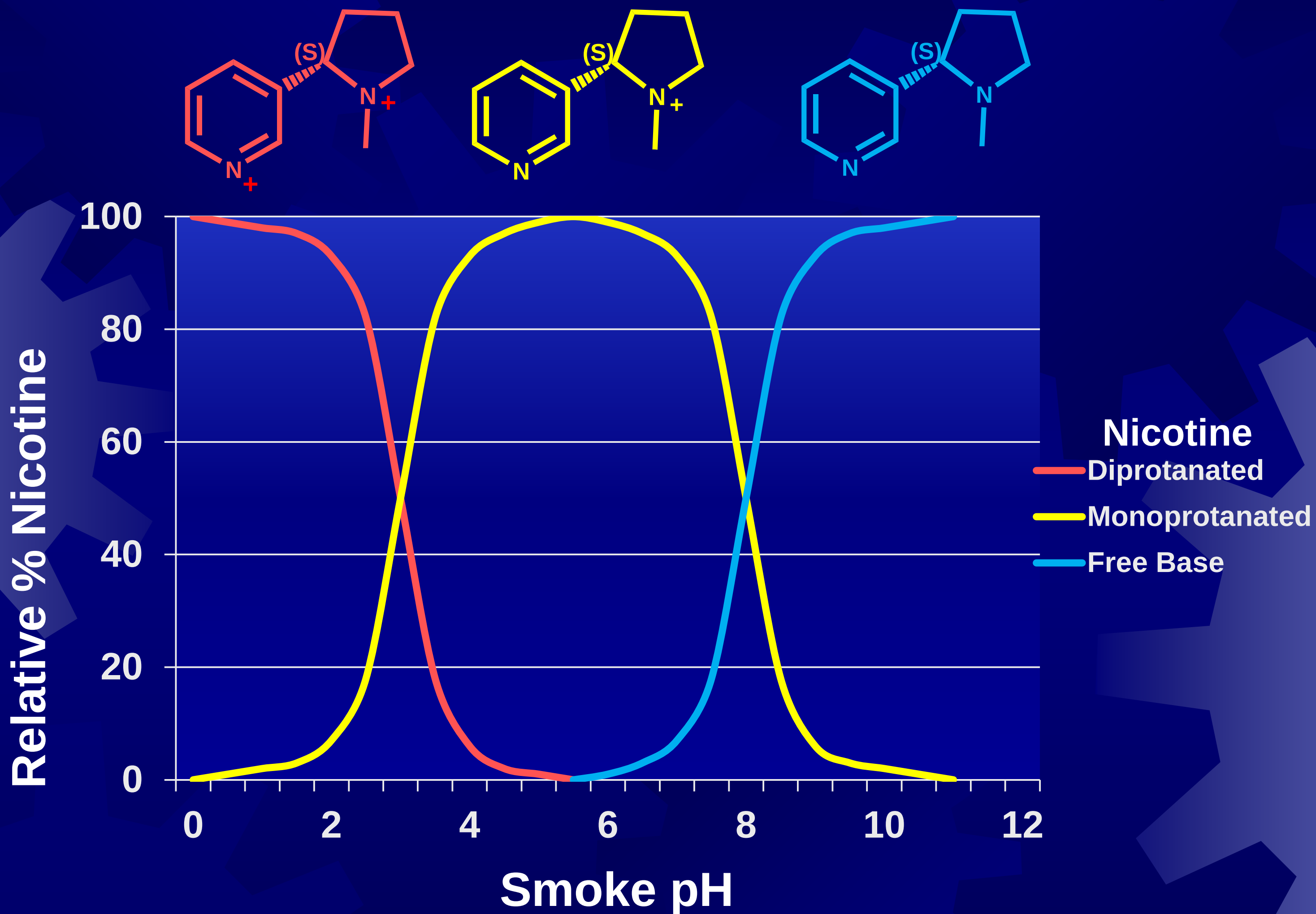
Smoke pH, Ammonia & DAP

Nicotine



See Jeffrey I. Seeman, Possible Role of Ammonia on the Deposition, Retention, and Absorption of Nicotine in Humans while Smoking, Chem. Res. Toxicol., 2007, 20 (3), pp 326–343

Smoke pH, Ammonia & DAP



Morie, G.P., "Fraction of protonated and unprotonated nicotine in tobacco smoke at various pH values." Tob. Sci 16 (1972): 167; Hoffmann, D. & I. Hoffmann, "The changing cigarette, 1950-1995." Journal of Toxicology and Environmental Health Part A 50, no. 4 (1997): 307-364.

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Smoke pH, Ammonia & DAP

Tobacco Smoke	"Smoke pH"	Free nicotine (calc.)
Flue-cured	5.0 – 6.0	0 – 1%
American blend	5.5 – 6.5	0.3 – 3%
Dark-air cured	7.0 – 7.5	9 – 25%
Cigar	8.0 – 8.5	50 – 80%
Recon Tob.	5.9 – 6.0	~1%
Recon Tob. (NH_3)	6.0 – 6.2	~1 – 2%
Recon Tob. (DAP)*	6.0 – 6.5	~2 – 3%

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* DAP = $(NH_4)2HPO_4$ = Diammonium phosphate

Rodgman, A., Smoke pH: A Review, Beiträge zur Tabakforschung Int., Volume 19, No. 3, 2000, pp.128-131

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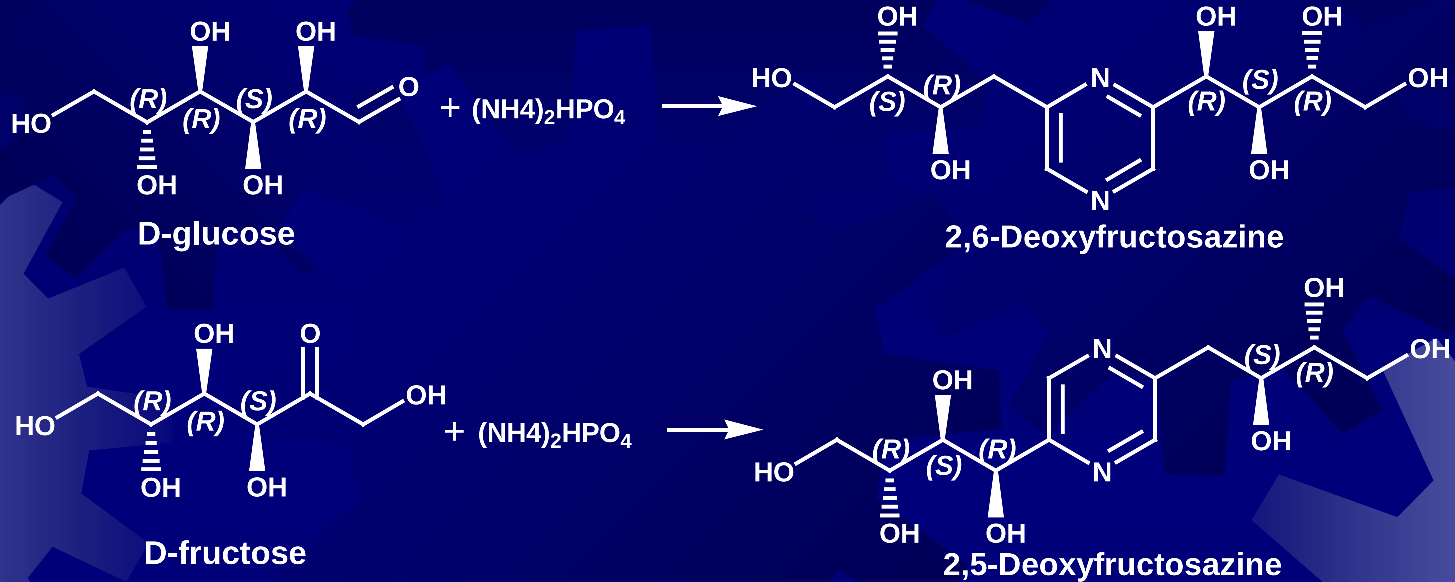
Ammoniaton of Sugars

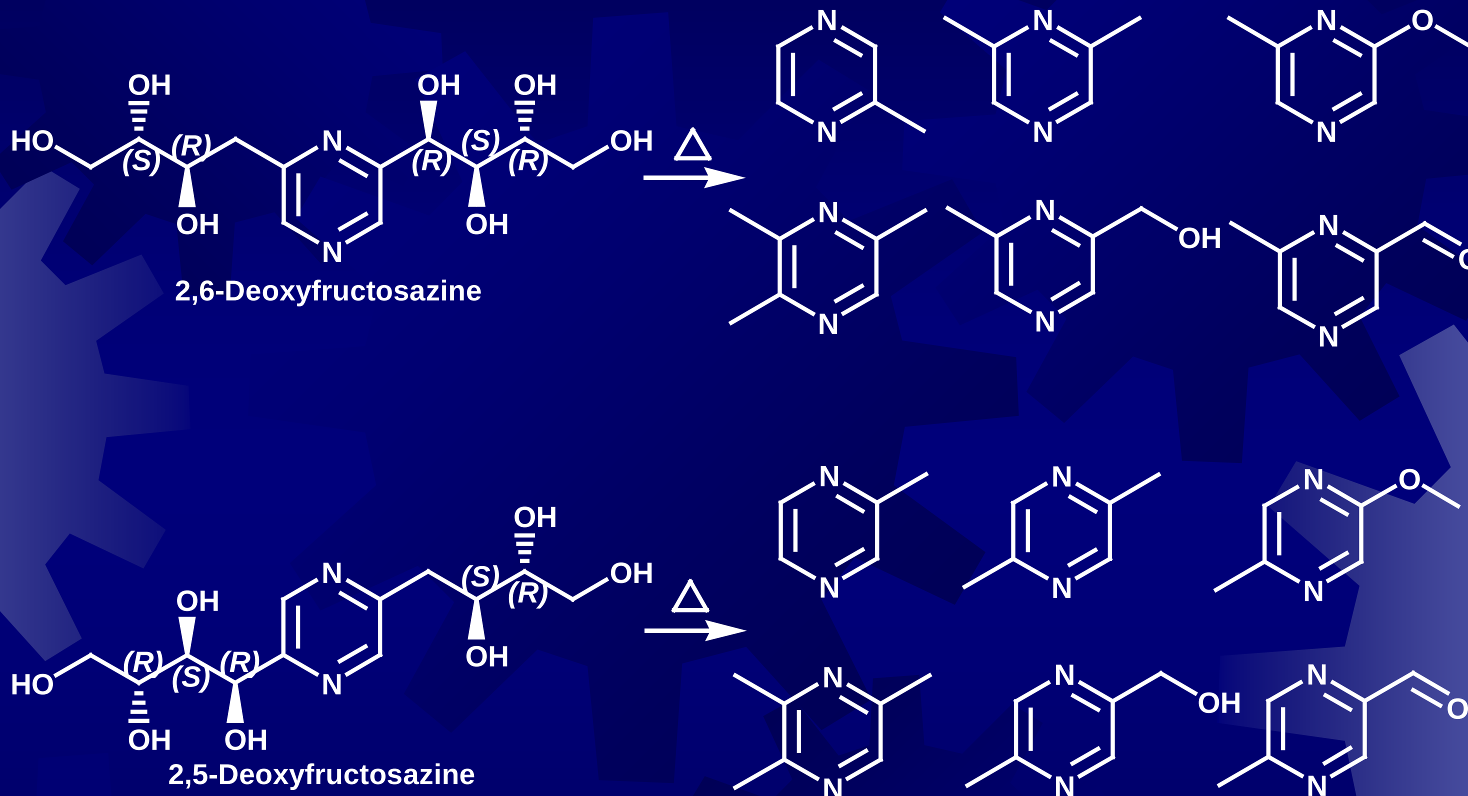


Cigarette	2,6-DF (µg/g)	2,5-DF (µg/g)	Glucosamine (µg/g)
Newport*?	225.24	355.05	1093.27
Marlboro Red*	167.22	286.32	1008.97
Camel*	140.99	227.51	992.83
Am. Blend Reference 2R4F	117.58	174.74	882.07
Flue-cured (avg. 6 Samples)	57.97	66.13	420.67
Izmir (Oriental)	36.97	35.10	255.03
Burley (avg. 6 Samples)	0.76	18.87	145.83

* Ammoniated Recon

Moldoveanu et al., Beiträge zur Tabakforschung Int., Volume 24, No. 5, 2011. p 239

Pyrolysis of Deoxyfructosazines



Moldoveanu, S.C. & Alford, E.D., Thermal Decomposition of Deoxyfructosazine G and Deoxyfructosazine F in Nitrogen and Air, Brown & Williamson File Note, June 20, 1988; Accessed from http://legacy.library.ucsf.edu/tid/pvm31f00/pdf on Sept. 18, 2014.

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Tobacco Flavors

Evolution of American Blend Cigarette Flavors

(The American Tobacco Trust - Dissolved in 1911)

Emerging U.S. Companies were:
American Tobacco
R.J. Reynolds Tobacco
Lorrilard Tobacco
Liggett & Myers Tobacco

All of these companies used the same types of master flavor formulas developed by the American Tobacco Trust for Pipe tobaccos such as Prince Albert, Dukes Mixture and Bull Durham - all were based on Nutmeg or Mace, Cardamom and Coriander.

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Tobacco Flavors

Alcoholic extracts (Lucky Strike Type) - Historical

(Merory, Food Flavorings, 1960)

	PARTS
Tonka beans	125
Coriander seed	125
Cardamom seed	8
Mace	1.2
Alcohol	357
Water	773

Casing of sugar, maple, licorice, cocoa
with Balsam Peru, Balsam Tolu and Styrax

Tobacco Flavors

Alcoholic extracts (Camel Type) - Historical

(Merory, Food Flavorings, 1960)

	PARTS
Deer tongue	125
Tonka beans	125
Coriander seed	125
Angelica root	64
Cardamom seed	8
Mace	16
Alcohol	390
Water	840

Casing of sugar, maple, licorice, cocoa

Tobacco Flavors

Typical Components of American Blend Flavors

(Philip Morris - Marlboro Type circa 1960 - 1998)

Chocolate Flavor (pre-1960 type) supplied originally by Fritzsche-D&O (now Givaudan)

Anise extract or oil	(~2-5 ppm anethole)
Menthol	(~25 ppm)
Valerian oil	(probably oil at low level)

Casing of sucrose, invert sugar, licorice, cocoa, chocolate liquor & Benzoin resinoid

Originally contained coumarin until ~1970 (after 1954 FDA food ban)

Notes were predominantly chocolate, some vanilla with a fruity pack aroma

In the late 1990's PM reformulated the Marlboro Flavor to remove anethole – it now has an anisic aldehyde, acetanisole, chocolate, vanilla type flavor.

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Tobacco Flavors

Typical Components of American Blend Flavors

(RJR – Old Camel / Winston Types)

Nutmeg oil	(~2-5 ppm)
Cardamom Oil	(~1 ppm)
Coriander Oil	(~0.5 ppm)
Vanillin	(~10 ppm) (optional)

Casing of invert sugar, licorice, cocoa.

Originally contained coumarin until ~1965 (after 1954 FDA food ban)
(Still used in some low-tar brands until early 1980’s)

Note: By 1972 Camel Filter was modified to mimic Marlboro

Note – some companies have removed Nutmeg & Mace oils for potential regulatory reasons (e.g. myristicin)

Tobacco Flavors

Typical Components of American Blend Flavors

(Old Kent Types)

Nutmeg or Mace oil
Cardamom Oil
Chamomile Oil ?

Casing of invert sugar, corn syrup, licorice, cocoa, Balsam Tolu, Balsam Peru, Styrax.

Originally contained coumarin until ~1974 (after 1954 FDA food ban)

Tobacco Flavors

Key Tobacco Flavoring Materials

COUMARIN NOTES:
VANILLIN
HELIOTROPIN
C-18 ALDEHYDE
IMMORTELLE ABSOLUTE
OAKMOSS ABSOLUTE
OCTALACTONES
HEPTALACTONE
METHYL HEPTADIENONE
CHAMOMILE EXTRACT
ANISYL ALCOHOL
ANISE ALDEHYDE
ACETANISOLE
BENZALDEHYDE GLYCERIN ACETAL

BURNT SUGAR NOTES:
MAPLE FURANONE
STRAWBERRY FURANONE
SOTOLON
MALTOL
ETHYL MALTOL
CYCLOTENE

NUTTY NOTES
ACETYLPYRAZINE
METHOXYMETHYLPYRAZINE

Tobacco Flavors

Key Tobacco Flavoring Materials

HONEY:
PHENYLACETIC ACID
ETHYL PHENYL ACETATE
METHYL PHENYL ACETATE

BUTTER:
DIACETYL
ACETYL VALERYL
ACETYL PROPIONYL
DELTA-DODECALACTONE
DELTA-DECALACTONE

SMOOTHING AGENTS:
PHENYLACETIC ACID
LACTIC ACID

VANILLA NOTES:
VANILLIN
ETHYL VANILLIN
HELIOTROPIN
PROPENYL GUAETHOL
GUAIACOL

SWEET SMOKEY:
GUAIACOL
4-METHYL GUAIACOL

Tobacco Flavors

Key Tobacco Flavoring Materials

FLORAL (ROSE):
PHENYL ETHYL ALCOHOL
PHENYL ACETALDEHYDE
BULGARIAN ROSE OIL

SWEET/FLORAL:
LINALOOL
METHYL DIHYDROJASMONATE
ISOAMYL SALICYLATE
CORIANDER OIL

CHOCOLATE
ISOBUTYRALDEHYDE
ISOVALERALDEHYDE
VANILLIN
TRIMETHYL PYRAZINE
TETRAMETHYL PYRAZINE
DIMETHYL PYRAZINES
TRIMETHYL THIAZOLE
ETHYL DIMETHYL PYRAZINE
BUTYRIC ACID
CAROB EXTRACTS

Tobacco Flavors

Key Tobacco Flavoring Materials – Tobacco-Like

KETO ISOPHORONE
BETA-DAMASCONE
4-ETHYL GUAIACOL
NUTMEG OIL
CIS-3-HEXENYL BENZOATE
PHENYLACETIC ACID
GERMAN CHAMOMILE
MATE ABSOLUTE
OAKMOSS ABSOLUTE
2,3-DIETHYL PYRAZINE
TRIMETHYL PYRAZINE
TETRAMETHYL PYRAZINE
IMMORTELLE ABSOLUTE
3-ETHYL PYRIDINE
2,6-DIMETHYL PYRIDINE
CAPROIC ACID
ISOVALERIC ACID
VALERIAN OIL and/or EXTRACT

DAMASCENONE
MACE OIL
CARDAMOM OIL
2.5-DIMETHYL PYRAZINE
2.6-DIMETHYLPYRAZINE
ISOVALERALDEHYDE
ISOBUTYRALDEHYDE
OCTALACTONES
HEXALACTONE
CAROB EXTRACT
MALTOL
SOTOLON
ETHYL ISOVALERATE
VALERIAN OIL
PHENYLACETALDEHYDE
ACETIC ACID
FENUGREEK EXTRACTS
4-METHYLGUAIACOL

E-Cigarettes & Flavors

- The New Wild West

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Electronic Cigarettes

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Electronic Cigarettes
Flavors

Manufacturers of e-cigarettes, including the major tobacco companies, such as RAI, Altria, PMI and Imperial are "not experts" in designing the many types and varieties of flavors being sold.

For this, flavor companies are being used – many of which are simply adapting existing "food flavors" which may contain flavor ingredients never used previously in tobacco products or other inhalation devices. In fact, only about 5% of available GRAS flavor additives are currently used in conventional tobacco products.

Electronic Cigarettes
Flavors

In the case of conventional cigarettes & cigarillos, while one can add flavor to the tobacco which imparts a characteristic aroma (to the tobacco) – when smoked, the flavor/taste is rarely perceived in the same manner due to the tobacco combustion products.

In contrast, since e-cigarettes simply “vaporize” the e-liquid, a truer “flavor” impression can be experienced.

Thus flavors like strawberry, coffee, cream soda, cola, walnut, pineapple and many more are available.

Electronic Cigarettes
Flavors

The Flavor Manufacturers Association (FEMA) states:

1. There is no apparent direct regulatory authority in the United States to use flavors in e-cigarettes.

2. None of the primary safety assessment programs for flavors, including the GRAS program sponsored by the Flavor and Extract Manufacturers Association of the United States (FEMA), evaluate flavor ingredients for use in products other than human food. FEMA GRAS™ status for the uses of a flavor ingredient in food does not provide regulatory authority to use the flavor ingredient in e-cigarettes in the U.S.

The FEMA Expert Panel does not evaluate flavor ingredients for use in tobacco products including e-cigarettes.

Electronic Cigarettes
Flavors

I liken this to the "Wild, Wild West" of old! – An opportunity for a great and possibly very useful alternative to smoking and for smoking cessation – but without a sheriff in site (yet).

The American Heart Association states: "As of early 2014, there were 466 brands and 7764 unique flavors of e-cigarette products in the marketplace".

There are about 42 million smokers in the U.S., of which more than 50% have made attempts to quit (CDC). And e-cigarettes may be one of the best solutions.

Obviously, adequate scientific assessments & regulations are needed. This should ultimately include levels of Nicotine delivery and "inhalation toxicological" assessment of the many flavor additives used in this new type of inhalation device (e.g. LSRO).