

THE SOCIETY OF FLAVOR CHEMIST SYLLABUS

The following describes how one may earn membership under the Society of Flavor Chemist (SFC) guidelines, and in compliance with its' by-laws, shall be upheld through the actions of the Society of Flavor Chemist Membership Committee (SFCMC). Candidates for membership should ensure validity of their candidacy as outlined in the SFC by-laws before submitting an application for membership. The SFC Membership Committee Chair will review the candidate applications to confirm compliance with the requirements stated in the by-laws. The SFC Syllabus acts as a guide for expected knowledge content of a candidate and for development of written and verbal enquiries for the SFCMC interview process.

SFC Candidate for Membership Interview Process

- 1. Candidates for SFC Membership will be asked to complete a written test followed by a verbal interview. Sufficient time will be allowed for both the testing and interview process:**
 - a. Both written responses and verbal interviews will be administered either at a SFC meeting or via remote testing
 - b. An hour for written responses followed by an hour for verbal interview is a usual time allowance
 - c. Additional time of approximately 15 minutes shall be available should the candidate show steady and thorough advancement in the process

- 2. A written test consisting of 25-30 free response questions shall be presented to the membership candidate:**
 - a. Short written responses should be communicated in order to display candidate's knowledge to the membership committee
 - b. Aroma chemical identification exercises, via samples of flavoring item solutions, shall be included as part of the 25-30 questions
 - c. All questions stem from knowledge content areas stated in the SFC syllabus
 - d. If during the verbal interview process, it is determined that an Apprentice candidate has enough qualifications, e.g., time, experience, qualified responses, to be raised to the level of Certified a recommendation may be made that the candidate be voted straight to Certified

- 3. The written response test will be reviewed by members of the SFC Membership Committee (SFCMC):**
 - a. The SFCMC Committee members shall agree with criteria set by the SFC by-laws Article II Sections 1c and 2c and as restated in this document section 4 (below)
 - b. The written response test shall act as an indicator to the interview team of the expertise and limitations of the candidate
 - c. SFCMC members who have a history of mentorship or camaraderie with a candidate shall voluntarily omit themselves from the candidate's interview evaluation process

- 4. The candidate shall be verbally interviewed by the SFCMC members who have proficiently reviewed the candidate's application for membership and written responses:**
 - a. Apprentice candidates should exhibit a sufficient knowledge of raw materials, compounding techniques, flavor formulation/production processes, regulatory and flavor applications to be able to proceed to an independent mode of creativity
 - b. Certified candidates must exhibit working knowledge of the flavor industry, namely raw materials, laboratory practices, production procedures, legal/regulatory consideration, and the economics involved in the creation, production and utilization of flavors

SFC Candidate for Membership Interview Process (cont'd)

5. The SFCMC shall determine if the candidate should be recommended for the level of membership to which the candidate had applied. For the written test:

- a. Apprentice candidates shall be allowed no more than 20% incorrect or incomplete responses
- b. Certified candidates shall be allowed no more than 10% incorrect or incomplete responses
- c. An SFCMC recommendation for membership shall be presented to the SFC membership for a vote at the first possible business meeting following the candidate's interview
- d. If the SFCMC recommends a "no pass", the options shall be privately discussed with the candidate. The candidate's name shall remain confidential
 - i. Should the candidate have already earned Apprentice membership, and is in good standing with the by-laws, they will retain the level of Apprentice until they either time out or upgrade successfully.

6. The SFC by-laws for membership should be consulted for queries regarding sponsorship and years of training needed to be considered for membership. The Membership Chair can be contacted at membership@flavorchemist.org should additional information be needed.

Commitment to Society of Flavor Chemist Membership Standards

The syllabus is intended to provide support and guidance to training programs and is the expected knowledge from which the SFCMC draws interview queries.

No attempt has been made to divide the subject matter into Certified and Apprentice SFC membership categories. Apprentice candidates should be prepared to present a solid understanding of aspects of flavor creation, with the presumption that the candidate may not yet have successfully and independently applied the practice. Certified candidates should be prepared to share a broad and deep knowledge, demonstrative of successful independent and original flavor creation skills. It is not likely, nor is it expected, that each candidate will know every aspect of flavor creation.

For the sake of objectivity, no single aspect of the membership interview process shall be more significant than the other. However, the verbal questions will reflect a weighting dependent upon the candidate's personal job experience. The expectation is that candidates sufficiently fulfill the allotted correct or complete answers on the combination of written and verbal enquiries.

The SFCMC is aware that people test differently (written versus verbal) and shall act to ensure each candidate is treated with fairness and equality. The committee's position is to ensure that the highest standards of protocol are practiced perpetuating professionalism of the organization.

This document is a reiteration and elaboration of article II, 2,c of the SFC by-laws, which states that applicants for Certified Membership "must exhibit a working knowledge of...raw materials, laboratory procedures, production processes, legal/regulatory considerations, and the economics involved in the creation, production, and utilization of flavors."

Reference Information

Since there are no formal courses in Flavor Chemistry, most of a candidate's knowledge and training comes from work experience, trial and error and the counsel of more experienced practitioners of the art. Most candidates for SFC membership will find it useful or necessary to supplement their experience by consulting various published sources of information.

1. Steffen Arctander, *Perfume and Flavor Chemicals, Perfume and Flavor Materials of Natural Origin*
2. Burdock, *Fenaroli's Handbook of Flavor Ingredients*
3. Dolf DeRovira, *The Dictionary of Flavors*
4. Ernest Guenther, *The Essential Oils*
5. Dr. Brian Lawrence, *Essential Oils*
6. Earl Merwin, *Flavor History*
7. Morrison and Boyd, *Organic Chemistry*
8. Gerard Mosciano, *Successful Flavors*
9. Gary Reineccius, *Flavor Chemistry and Technology, Source Book of Flavors*
10. John Wright, *Flavor Creation*
11. Allured Publishing, *Flavor and Fragrance Materials*
12. Code of Federal Regulations (CFR)
13. Food Chemical Codex
14. Industry periodicals including:

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- Perfumer & Flavorist
 - Journal of Agricultural & Food Chemistry
 - Food Technology
 - Food Processing
 - Cereal Food World
 - Prepared Foods
 - Food Chemical News
 - Food Product Design
 - Beverage World

The Syllabus

I. BASIC ORGANIC CHEMISTRY

Chemical Groups - Working Knowledge –

- **Basic generic structure** component responsible for reaction/functionality/stability
- Refer to chemical group classification as in John Wright's – Flavor Creation
- Understanding of structural grouping – aliphatic (straight chain), Terpene, Aromatic and Heterocyclic
- Understanding functional grouping – Alcohols, Aldehydes, Acids, Esters, Ketones, Lactones, Phenols, Sulfur compounds, nitrogen compounds, etc.
- Understanding the co-relation (for the most part) between carbon chain length progression and aroma/stability especially on aldehydes, alcohols, acids, and esters
- Understanding the co-relation (for the most part) between structure/function and odor/aroma properties especially on aldehydes, alcohols, acids, and esters
- Understanding the difference between saturated and unsaturated compounds of same carbon chain length within a functional group (for example Hexyl alcohol versus cis-3-Hexenol)

- Examples

Carboxylic Acids (R-COOH)

Aldehydes (R-C=O-H)

Alcohols (R-OH)

Esters (R-C=O-OR')

Ketones, diketones

Lactones – heterocyclic, aromatic

Phenols

Macrocyclic compounds

Sulfur compounds – thiols, Dithiols, Thioesters, terpene sulfur compounds, aromatic

Nitrogen compounds – amines, isothiocyanates, aromatic

Furans – non-sulfur and sulfur

Pyrans -

Terpenes – terpene derivatives (aldehydes, alcohols, esters, ketones), terpenoids

Sesquiterpenes

Isomers – cis/trans, dextro/laevo, racemic

Amino acids

Ethers

Pyrroles

Pyrazines

Thiazoles

Pyridines

Reactions and Shelf Life/Formulation Considerations – chemical groups involved, conditions required, and the factors accelerating or inhibiting the reactions, with examples of each

Primary:

Acetal Formation

Esterification

Maillard Reaction – Schiff's Base, Strecker Degradation, Amadori Rearrangement, Aldol Condensation

Polymerization

Recrystallization

Volatilization

Aging – Impact on shelf life

Fermentation

Oxidation

Precipitation

Schiff Base

Enzymolysis

Secondary: General Knowledge is expected – To support the knowledge of the cross functional counter parts and or teams.

Chelation

Cross Esterification

Deaminazation

Interaction?

Metal-Ion Complexation

Reduction

Condensation

Cyclization

Saponification

Interesterification

Microbial Degradation

Salting Out

Sedimentation

Separation

Trans Esterification

Neutralization

Instruments / Methods

The following are instruments that are used in the industry. A general knowledge of these is expected. The discussion will revolve around quality assurance, accuracy and general descriptions of the tests.

Primary:

Refractometer Refractive Index/Brix Density Meter/Densitometer
 pH Meter
 Flash Point Tester
 Karl Fischer Titration or Moisture Analyzer Spectrophotometer/Colorimeter
 Water Activity Meter
 Gas Chromatograph / Mass Spectrometry
 Particle Size Analysis
 Liquid Chromatography

Secondary:

Turbidity Meter
 FTIR Spectroscopy
 Flame Ionization Detector
 Viscometer

II. CATEGORIES OF FLAVORING SUBSTANCES

Explain physical form, method of production, Organoleptic characteristics and solubility of:

Absolutes, Concrete	Spices & Their Extracts
Fruit Juice Concentrates	CO2 Extracts
Distillates: Fruit, cocoa, coffee, tea	*Aroma Molecules
Enzymatic Modified Cheeses	(Natural & Synthetic -
Essential Oils	Organoleptic only)
Botanical Extracts	Citrus products, Citrus
Fluid & Solid Extracts, Tinctures	Oil, Types, & Varietals
Vanilla - Varietals, differences & similarities,	Citrus oil folding
Vanilla Extract Folding	Oleo-resins/Resinoids

Identify major chemical component which characterizes aroma/flavor of natural flavoring items including but not limited to:

Almond	Carrot Seed	Cumin	Jasmin Absolute	Osmanthus
Anise	Celery	Davana	Juniper Berry	Parsley Leaf
Asafetida	Cedarwood	Dill Seed	Labdanum	Parsley Seed
Balsam Peru	Chamomile, Blue	Dill Weed	Lavender	Peppermint
Balsam Tolu	Chamomile, Roman	Elemi	Lemon	Petitgrain
Basil	Cinnamon Bark	Eucalyptus	Lemongrass	Rose
Bergamot	Cinnamon Leaf	Fennel	Lime	Rosemary
Birch Oil, Sweet	Citronella	Galbanum	Mace	Sandalwood

Black Pepper Oil	Clove Bud	Garlic	Mandarin	Spearmint
Bois de Rose	Clove Leaf	Geranium	Mustard	Tangerine
Boronia Absolute	Clove Stem	Ginger	Neroli	Tagette
Bucchu	Cognac, Green	Grapefruit	Nutmeg	Tea Tree
Capsicum	Cognac, White	Ho	Onion	Violet
Caraway	Coriander	Hop	Orange	Wintergreen
Cardamom	Corn Mint	Horse Radish	Orris	

III. FLAVOR LABELING

“Intent of the specific CFR citations are just for the reference purpose only to find”

FDA Flavor Declaration – CFR 21, Part 101.22

- Artificial
- Natural Flavor Type
- Natural and Artificial
- Natural / FTNF
- Natural WONF

USDA Labeling – CFR 7, part 205.605

- USDA Organic/Natural requirements – Definition of:
- Categories of Organic – 100%, Organic (95/5), Made with Organic (70%), Less than 70% - implications of the different levels to finished product labeling and certification
- Organic flavor formulation considerations, and exclusions
- Organic Compliance, NFQ – importance and purpose in an organic formula
- 2019 NOP Amendment – implications to organic formulation; CAF (Commercial Availability Form),
- Few examples of Certifying Agencies

TTB Labeling - <https://www.ttb.gov/scientific-services-division/nonbeverage-drawback-alcohol>

- Non-beverage drawback alcohol
- Limited Ingredients – ppm thresholds in finished beverage
- FIDS sheet
- TTB Form 5154.1 – Drawback/TTB approval form
- What is potability test and how to do it?
- Unfitness for Beverage Purposes – what makes a product unfit, how to make product unfit
- TTB flavor labeling guidelines, 0.1% Artificial top notes – Reference – Drawback Tutorial on ttb.gov
- Artificial versus Natural Vanillin
- Acids as flavoring chemicals – how they are labeled (nice to know)

Standard of Identity

- Vanilla extract as defined in CFR 21, Part 169.175
- Folded Vanilla extracts and vanilla flavoring – as defined by CFR 21, Part 169.176-169.178
- Vanilla powder – CFR 21, Part 169.179
- Vanilla products other than pure vanilla extract – CFR 21, Part 169.180-169.182
- Vanilla Oleoresin, Vanilla Absolute
- Vanilla extract/Vanilla flavors for ice cream – categories

Genetically Engineered Ingredients/GMO

- National Bioengineered Food Disclosure Standard
- Definition of Bioengineered Food/s
- Non-GMO Project Verified

Allergens – major allergens in the below mentioned geographical regions

- United States
- Canada
- European Union

IV. NON-FLAVOR INGREDIENTS (Labeling / How is it used)

Solvents

Types:

Water soluble

Oil soluble

Appropriate uses in flavor design and application (When to Use and Why/ What happens when the wrong solvent is used)

Discuss advantages/disadvantages of each such as shelf-life stability.

Acidulants and Buffers (purposes/types of products used in)

Carriers (purposes/types of products used in)

Gums

Salts

Starches

Sugars

Maltodextrins

Colors

FD&C, Lakes (differences and usages)

Caramel color (classes),

Naturally Derived (stability/origins)

Preservatives / Antioxidants (examples: types of flavors used in. Naturals and synthetics)

Antimicrobial

Antioxidant

V. FLAVOR FORMS

Describe processes, applications, and differences between processes & parameters

Liquid: Water soluble (solvents & applications) – liquid compound, washed extracts

Oil Soluble (solvents & applications)

Emulsions (types & applications) – beverage (weighting agents), bakery

Dry: Drum Drying
Powder Blend

Fluid Bed Drying
Vacuum Drying
Plating
Spray Drying
Freeze Drying

Pastes: Enzyme Modified Products (organoleptic and process, applications)

VI. FLAVOR CREATION:

The creation of flavor is at the center of our profession and candidates will be expected to discuss their creative thought process and approach to original flavor creation. Many correct responses to describing one's creative inclinations exist and candidates should be comfortable with explaining how the following flavor types can be created and or developed

Citrus	Savory – Meat/Seafood	Encapsulated Flavors
Add Back Flavors	Savory – Spice/Vegetable	FMP's/Taste Modulation
Fruit Flavors	Mint Flavors	Sensates
Dairy Flavors	Brown Flavors	

Modifications of existing flavorings are also a large part of a Flavorist's profession. Candidates should be prepared to discuss flavoring items that shall be used to create versions of existing flavors that vary, at minimum, in the following taste descriptors:

Ripe	Jammy	Floral
Fresh	Brown	Green
Juicy	Sweet	Candy
Meaty	Tropical	
Creamy	Pulpy	

VII. REGULATORY ORGANIZATIONS AND CERTIFICATIONS

The candidate should have a general knowledge of these as it relates to the regulation of flavors worldwide

Alcohol, Tobacco, Tax and Trade Bureau (TTB)

- CFR 27, Part 17 – Drawback on Taxpaid Distilled Spirits Used in Manufacturing Non Beverage Products
- Formulas online / COLA
- FIDS (Flavor Ingredient Data Sheet)
- Fit versus Unfit
- Potability
- Drawback
- Reference - <https://www.ttb.gov/scientific-services-division/drawback-tutorial>

United States Department of Agriculture (USDA)

- Food and Drug Act 1906 / Meat Inspection Act: Basics, relevance to savory flavors
- Organic, NOP – National Organic Program CFR 7, Part 205
- Subpart 205.301 to 205.305 – Product Composition, calculating percentages, 100% organic, Made with Organic, Less than 70% organic

Food and Drug Administration (FDA) – a basic understanding of the following is expected – purpose of the act/document?

- CFR 21, Part 101, Subpart 101.22
- Prop 65
- Food Safety Modernization Act (FSMA) 2011
- Nutritional Labeling and Education Act 1990
- Specifications: Ingredient statement, physical and chemical properties, COA
- Natural Certification/Continuing Letter of Guarantee
- Good Manufacturing Practices (GMPs)

Flavor and Extract Manufacturers Association (FEMA) – a basic knowledge/definition is expected to be known, and their purpose.

- Expert Panel
- GRAS Lists
- Category Max use level

Certifications – basic knowledge of what it stands for and where it is used in the industry is expected

- American Institute of Baking Certification (AIB)
- Food Safety System Certification (FSSC)
- ISO Certification
- Global Food Safety Initiative (GFSI)
- Safe Quality Food (SQF)
- Organic certification
- NGP Verified/Verification
- National Sanitation Foundation (NSF)
- Responsibly Sourced Palm Oil certified (RSPO)

Foreign Regulatory Organizations – expected to know basic area of scope of work

- Joint Expert Committee of Food Additives (JECFA)
- European Food Safety Authority (EFSA)-
- United Nations (UN)/ World Health Organization (WHO)
- Hazard Analysis and Critical Control Points (HACCP)
- Codex Alimentarius (CA)
- Global Harmonization System (GHS)
- International Organization of the Flavor Industry (IOFI)

Department of Transportation (DOT) –its relevance to flavor industry

- Flash Point, and shipping consideration
- HAZMAT – Hazardous Material Identification System (HMIS)

Drug Enforcement Administration (DEA) - its relevance to flavor industry

- Examples of flavor raw materials considered under DEA and their thresholds in flavors
- Shipping consideration for the DEA regulated materials

Occupational Safety and Health Administration (OSHA) - its relevance to flavor industry

- Safety Data Sheets (SDS)
- HAZCOM 2012 – Hazardous Material Identification System (HMIS)

Dietary Considerations – understanding of the limitations and allowances is essential, and its relevance to flavor formulation

Halal	Vegan	Vegetarian
Gluten Free	Palm Free	Keto
Kosher Certification – Pareve, Dairy, Meat, Passover		