

# THE SOCIETY OF FLAVOR CHEMISTS

## Testing Protocol

The following describes how one may earn membership under The Society of Flavor Chemists' (SFC) guidelines, and compliance with its by-laws shall be upheld through the actions of The Society of Flavor Chemists 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 inquiries 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 are generally administered at an SFC Meeting
  - 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 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 sufficient knowledge of raw materials, compounding techniques, flavor formulations, production processes, flavor applications, and regulations to be able to proceed to an independent mode of creativity.
  - b. Certified candidates must demonstrate working knowledge of the flavor industry, including raw materials, laboratory practices, production procedures, legal/regulatory considerations, and the economics involved in the creation, production, and utilization of flavors.

5. **The SFCMC shall determine if the candidate should be recommended for the level of membership to which the candidate had applied.**
  - a. For the written test:
    - i. Apprentice candidates shall be allowed no more than 20% incorrect or incomplete responses
    - ii. Certified candidates shall be allowed no more than 10% incorrect or incomplete responses
    - iii. If the number of incorrect responses exceeds the allowed percentage, the SFCMC reserves the right to not proceed to the verbal interview. Candidates who fail to pass the written exam will be notified by the Membership Chair of the “no pass” result.
  - b. Candidates recommended for membership shall be presented to the SFC membership for a vote at the first possible business meeting following the candidate’s interview
  - c. 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. Should additional information be needed, the Membership Chair can be contacted at [membership@flavorchemist.org](mailto:membership@flavorchemist.org).**

### **Commitment to Society of Flavor Chemists 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 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 inquiries.

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 role is to ensure that the highest standards of protocol are practiced to maintain the 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 the flavor industry, namely, 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 (FCC)
14. Industry Periodicals including:
  - Perfumer & Flavorist
  - Journal of Agriculture and Food Chemistry
  - Food Technology
  - Food Processing
  - Cereal Food World
  - Prepared Foods
  - Food Chemical News
  - Food Product Design
  - Beverage World

# The Society of Flavor Chemists Syllabus

## I. ORGANIC & ANALYTICAL CHEMISTRY

### Chemical Compound Classes

Alcohols	Phenols	Amines	Thiols, Dithiols
Aldehydes	Lactones	Pyrrroles	Sulfides, Disulfides
Carboxylic Acids	Furans	Pyrazines	Thioesters
Esters	Pyrans	Pyridines	Thiazoles
Ketones, Diketones	Terpenes, Terpenoids	Amino Acids	Isothiocyanates
Acetals	Sesquiterpenes	Reducing Sugars	
Ethers	Macrocyclic Compounds	Isomers - Structural, Stereochemical	

**Expected working knowledge including but not limited to:**

- General substituent groups, their structure, functionality, reactivity and stability.
- IUPAC and common names
- Understanding of structural & functional grouping – Aliphatic, Terpene, Aromatic and Heterocyclic
- Understanding the relationship between carbon chain length progression and aroma and physical properties for the aliphatic compounds
- Understanding the organoleptic changes throughout an oxidation sequence (alcohol to aldehyde to acid, etc.)
- Understanding the differences between saturated and unsaturated compounds of same carbon chain length within a functional group (for example Hexyl alcohol versus cis-3-Hexenol)

**Reactions and Processes**

**Primary:**

Acetal Formation	Recrystallization	Volatilization	Oxidation
Esterification	Precipitation	Enzymolysis	Fermentation
Schiff Base	Polymerization		
Maillard Reaction – Schiff Base, Strecker Degradation, Amadori & Heyns Rearrangement, Aldol Condensation			

**Secondary:** General knowledge is expected to support cross functional teams

Chelation	Reduction	Microbial Degradation	Macronutrient Interactions
Cross Esterification	Condensation	Salting Out	Trans-Esterification
Deamination	Cyclization	Sedimentation	Neutralization
Interesterification	Saponification	Separation	Metal-Ion Complexation

**Expected working knowledge including but not limited to:**

- Chemical groups involved and conditions required
- Factors accelerating or inhibiting the reactions, and considerations during formulation
- Examples of each reaction or process
- Understanding how these reactions/processes impact aging of a flavor and shelf life

**Instruments / Methods**

**Primary:**

Refractometer/Refractive Index/Brix	Water Activity Meter
Density Meter/Densitometer	Gas Chromatography, GC-O, Flame Ionization Detector
pH Meter	Mass Spectrometry
Flash Point Tester	Liquid Chromatography
Karl Fischer Titration, Moisture Analyzer	Particle Size Analysis
Spectrophotometer/Colorimeter	SPME, SPDE

**Secondary:**

Turbidity Meter	Polarimeter	Titrateable acidity
FTIR Spectroscopy	NMR	Salt analysis
Viscometer		

**Expected working knowledge including but not limited to:**

- Theory, function, and reporting of each
- Relevance to the flavor industry
- Advantages and limitations of each method

**II. CATEGORIES OF FLAVORING SUBSTANCES**

**Explain physical form, method of production, organoleptic characteristics and solubility of:**

Absolutes, Concretes	Enzyme Modified Cheeses
Essential Oils	Spices
Oleoresins	Aroma Molecules (Natural & Synthetic - Organoleptic only)
Resins, Resinoids, Balsams	Yeast, AYE, HVP
Extracts: Fluid & Solid Extracts, Tinctures, CO <sub>2</sub>	Vegetable and Animal derived fats/oils
Distillates: Fruit, Cocoa, Coffee, Tea	Animal Broths, Stocks, Powders
Fruit & Vegetable Juice Concentrates	Smoke Condensates
Vanilla	Citrus
○ Varietals and growing regions (organoleptic profiles)	○ Derivatives and varietals
○ Methods of production (pollination, harvesting, curing, extraction)	○ Methods of production
○ Extract folds and concentrates	○ Citrus oil folding
	○ Citrus greening

**Identify the part(s) of the plant used, derivatives, organoleptic characteristics, and the major chemical component(s) which characterizes the aroma/flavor of each natural flavoring items including but not limited to:**

Allspice	Cassia	Fennel	Lemon	Patchouli
Almond	Cedarwood	Fenugreek	Lemongrass	Pennyroyal
Anise	Celery Seed	Galbanum	Lime	Peppermint
Asafetida	Chamomile	Garlic	Lovage	Petitgrain
Balsam Peru	Chicory	Gentian	Mace	Rose
Balsam Tolu	Cinnamon	Geranium	Mandarin	Rosemary
Basil	Citronella	Ginger	Marjoram	Sage
Bergamot	Clove	Grapefruit	Mustard	Spearmint
Black Pepper	Cognac	Ho	Neroli	St. John's Bread
Bois de Rose	Coriander	Hops	Nutmeg	Sweet Birch
Boronia	Cornmint	Horseradish	Onion	Tarragon
Buchu	Cumin	Jasmine	Orange	Tea Tree
Capsicum	Davana	Juniper Berry	Oregano	Thyme
Caraway	Dill	Labdanum	Orris	Vetiver
Cardamom	Elemi	Laurel	Osmanthus	Violet Leaf
Carrot Seed	Eucalyptus	Lavender	Parsley	Wintergreen

### III. FLAVOR REGULATIONS

Specific CFR citations are included for reference purposes only

#### Food and Drug Administration (FDA)

- Flavor declarations: CFR 21, Part 101, Subpart 101.22
- Food Safety Modernization Act (FSMA) 2011
- Nutritional Labeling and Education Act 1990

#### United States Department of Agriculture (USDA)

- USDA Organic, NOP – National Organic Program CFR 7, Part 205
  - Categories of Organic
  - 2019 NOP Amendment – implications to organic formulation; CAF (Commercial Availability Form)
  - Natural Flavor Questionnaire
  - Certifying agencies, process for certification
- Animal Products in Flavors - CFR 9, Part 319 and 381, Food Standards and Labeling Policy book (references related to flavor only)
  - Relevance to savory flavors, labeling of meat-containing flavors, amenability

#### Alcohol, Tobacco, Tax & Trade Bureau (TTB)

- CFR 27, Part 17 – Drawback on Taxpaid Distilled Spirits Used in Manufacturing Nonbeverage Products
- Formulas online / COLA
- TTB Form 5154.1 Formula and Process for Nonbeverage Product
- FIDS (Flavor Ingredient Data Sheet)
  - Filing status (drawback vs. no action)
  - TTB flavor classifications
  - Limited ingredients
- Unfitness for Beverage Purposes
  - Mitigating ingredients
  - Unfitness worksheet
  - Potability - organoleptic testing

#### Vanilla

- 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 ice cream categories - formulation considerations

#### Genetically Engineered Ingredients

- National Bioengineered Food Disclosure Standard as defined in CFR 7, Part 66
- Non-GMO Project Verified

#### Allergens – major allergens in the below mentioned geographical regions

- United States
- Canada
- European Union

**Flavor and Extract Manufacturers Association (FEMA)**

- Expert Panel
- GRAS Lists
- Category Max use level
- FMP sensory testing

**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**

- Flavor chemicals subject to DEA regulations
- Shipping considerations for DEA regulated materials

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

- HAZCOM - Hazardous Communication Standard

**International Considerations – basic understanding and its relevance to flavor formulations**

- European Union - Regulation (EC) No 1334/2008
  - Solvent limitations
  - Flavouring Preparations, Flavouring Substances, Natural Flavouring Substances
  - Flavouring labeling
- Canada
  - Canadian Organic Standards (CAN/CGSB-32.310-2020, CAN/CGSB-32.311-2020)
  - CFIA amenability (meat containing attestation, exemptions as noted in Section 3.(1)(i) of the Meat Inspection Regulations 1990)
  - Canadian Food Compositional Standards (CFCS) document: Volume 9 - Flavouring Preparations
  - Flavour labeling

**Other Considerations – understanding of the limitations and its relevance to flavor formulations**

- Proposition 65
- Kosher Certification - Pareve, Dairy, Meat, Passover
- Halal
- Vegan, Vegetarian
- Palm free
- Gluten free
- Keto

## IV. NON-FLAVOR INGREDIENTS

### Solvents

- Types: water soluble, oil soluble

### Preservatives

- Antimicrobial
- Antioxidant

### Emulsifiers and Weighting Agents

### Carriers

- Gums
- Starches
- Maltodextrins
- Salts
- Sugars
- Fibers

### Colors

- Certified colors: FD&C dyes, lakes
- Exempt colors:
  - Stability
  - Sources
  - Caramel color

### Processing Aids

- Flow Agents
- Filter aids
- Anti-dusting agents
- Anti-foam

### Acidulants and Buffers

### Expected working knowledge including but not limited to:

- Labeling
  - Flavor vs. finished product
  - Incidental additives
- Functionality
- Appropriate use
  - Application dependent
  - Potential interactions
- Advantages/disadvantages of each

## V. FLAVOR FORMS

Describe the formulation, production, troubleshooting, applications, stability considerations, and advantages/disadvantages of each form.

### Liquid

Water soluble - compound; washed extracts	Process flavors
Oil soluble	Pastes
Emulsions - beverage, bakery	

### Dry

Powder blend	Vacuum drying	Drum drying
Plated	Fluid bed drying	Spray chilling
Spray drying	Freeze drying	Coacervation
Glass encapsulation	Agglomeration	

## 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 flavor profiles can be created and/or developed, including but not limited to:

Citrus	Meat/Seafood	Spirits
Floral	Spice/Herb	FMPs/Taste Modulation
Fruit	Mint	Sensates
Dairy	Brown Flavors	Vegetable

Modifications are also a large part of a Flavorist's profession. Candidates should be prepared to discuss flavor materials that may be used to contribute specific attributes, including but not limited to:

Ripe	Jammy	Floral	Umami
Fresh	Brown	Green	Mouthfeel
Juicy	Sweet	Candy	Fatty
Meaty	Tropical	Herbal	Earthy
Creamy	Pulpy	Spicy	
Cooking processes (e.g. smoked, grilled, toasted, etc.)			

## VII. FLAVOR ORGANIZATIONS, CERTIFICATIONS AND DOCUMENTATION

**International Organizations and Standards – expected to know basic scope of work**

- Joint Expert Committee of Food Additives (JECFA)
- European Food Safety Authority (EFSA); European Commission
- United Nations (UN) / World Health Organization (WHO)
- Codex Alimentarius (CA)
- Global Harmonization System (GHS)
- Health Canada; Canadian Food Inspection Agency (CFIA)
- International Organization of the Flavor Industry (IOFI)
  - Guidelines for the Production of Thermal Process Flavorings (Code of Practice, Ch. 14)

**Quality Assurance/Control**

- Hazard Analysis and Critical Control Points (HACCP)
- Safety Data Sheets (SDS)
- Specifications
- Certificate of Analysis
- Good Manufacturing Practices (GMPs)
- Natural Certification/Continuing Letter of Guarantee
- Food safety considerations -  $a_w$ , pH, etc.

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

- American Institute of Baking Certification (AIB)
- Food Safety System Certification (FSSC)
- ISO Certification

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- Global Food Safety Initiative (GFSI)
- Safe Quality Food (SQF)
- National Sanitation Foundation (NSF)
- Roundtable on Sustainable Palm Oil (RSPO)

### **Industry Relevant Organizations**

- British Society of Flavor Chemists (BSF)
- Chemical Sources Association (CSA)
- European Flavour Association (EFFA)
- Food Chemicals Codex (FCC)
- National Association of Flavors & Food-Ingredient Systems (NAFFS)
- United States Pharmacopoeia (USP)
- American Spice Trade Association (ASTA)
- Institute of Food Technologists (IFT)
- Research Chefs Association (RCA)
- International Fragrance Association (IFRA)
- International Federation of Essential Oils and Aroma Trades (IFEAT)