Challenges and Approaches for Food Classification in the US

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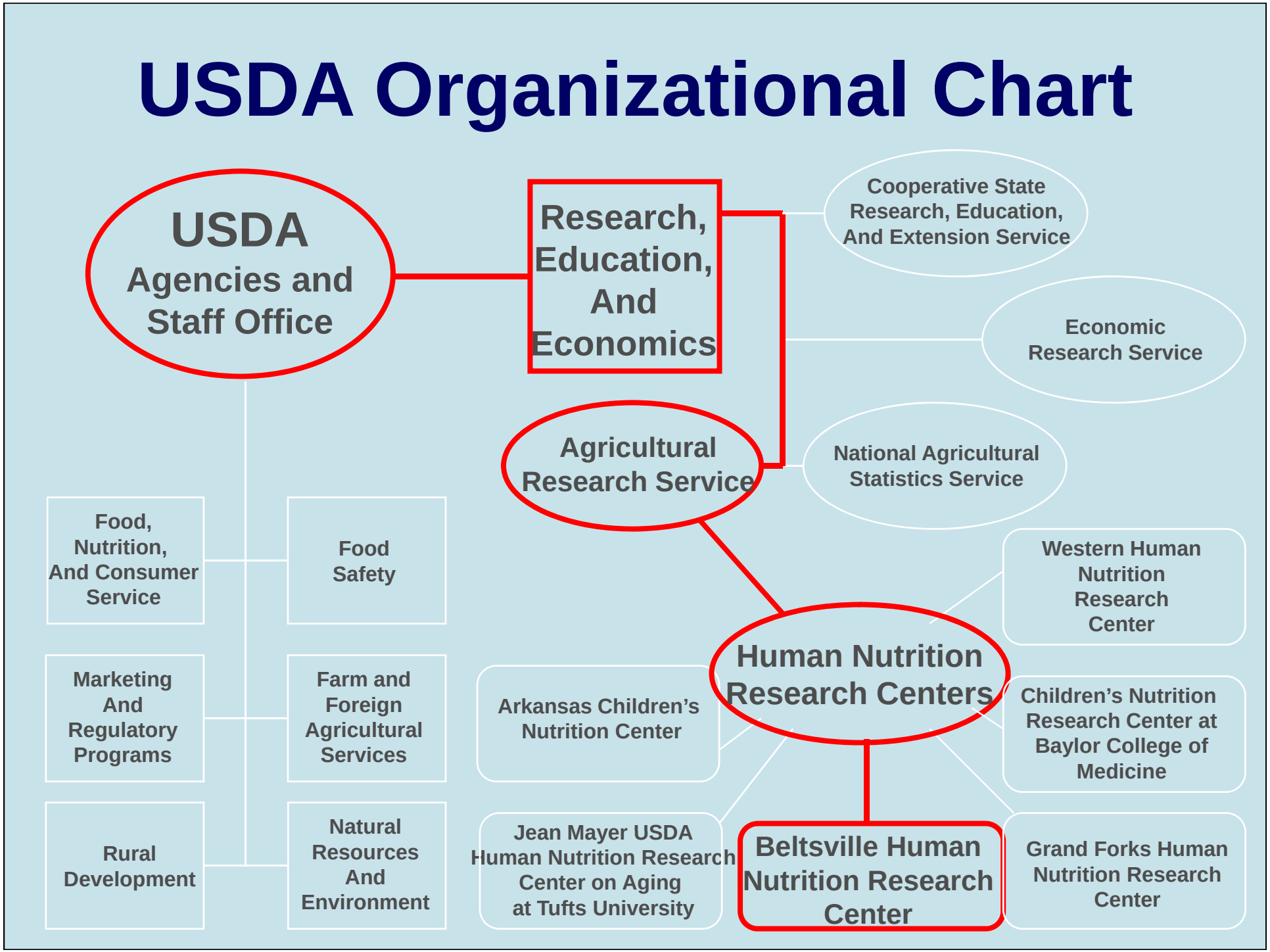
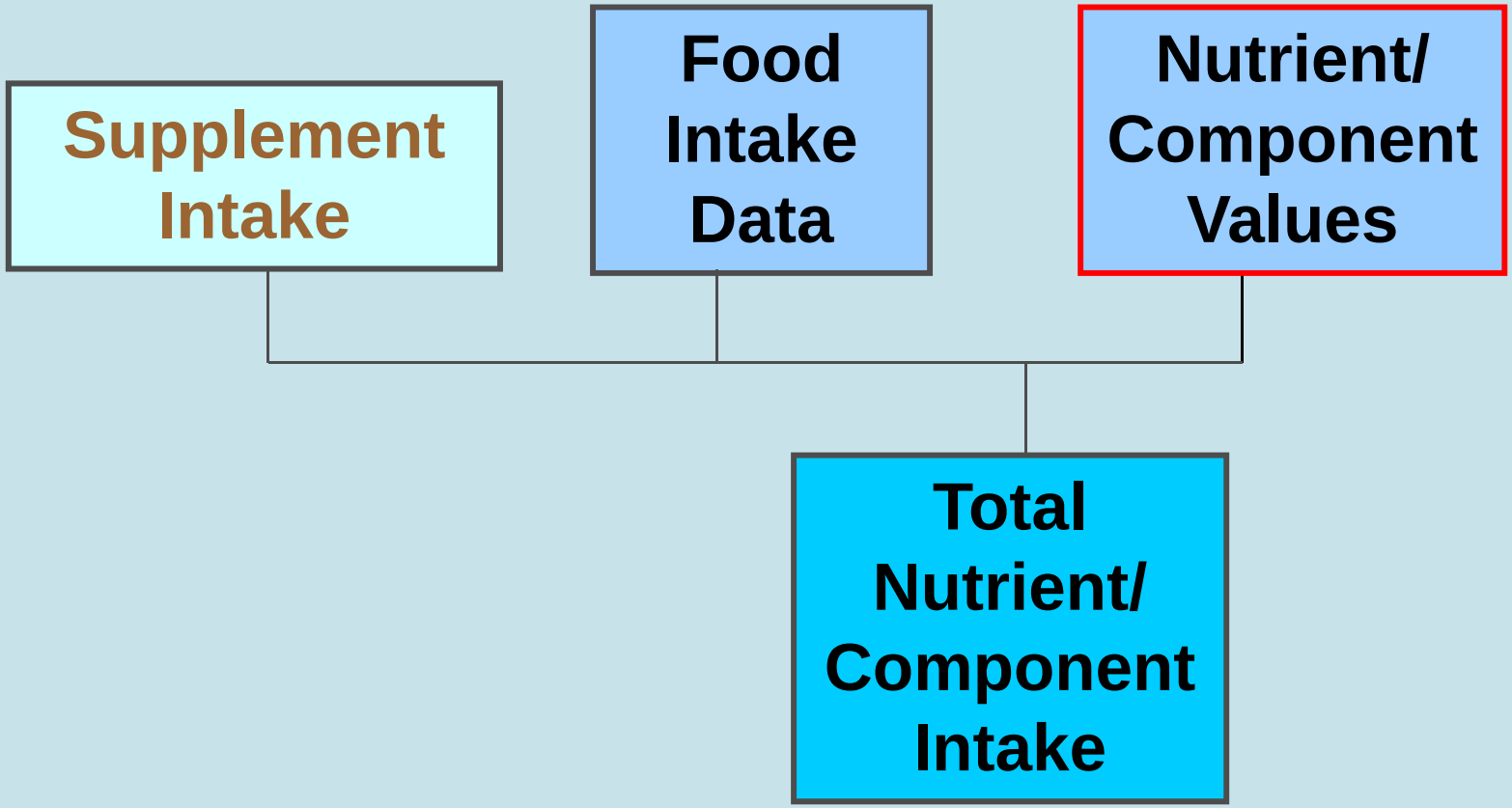
USDA Organizational Chart



My Objectives

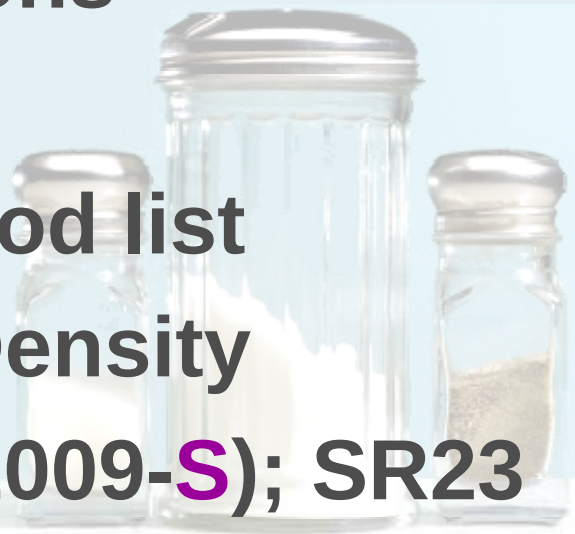
- **Present the current USDA food description system**
- **Discuss how USDA, US-FDA, and EPA are working together to optimize the U.S. food information network to address Agency specific issues**
- **Propose ways national food authorities can exchange information about food in their markets and jurisdictions**

USDA's Intake Assessment of Dietary Components

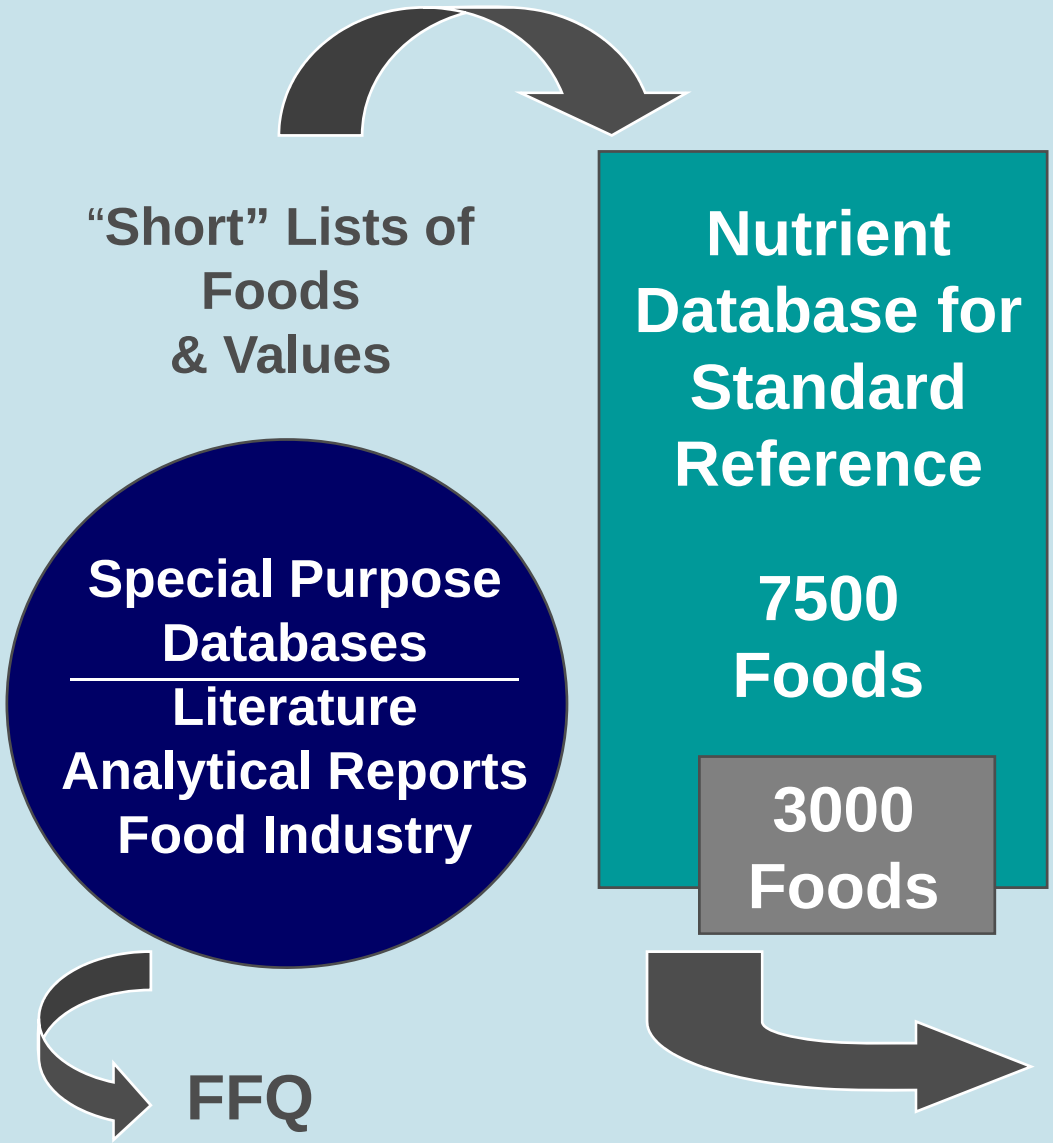


USDA National Nutrient Database for Standard Reference (SR)

- >7500 Foods with Nutrient Values
- Up to 140 Food Components
- Generic and brand name foods
- Systematic Food Descriptions
- 5-digit codes
- LanguaL factoring of the food list
- Food Weights, Measures, Density
- Annual Releases – SR22 (2009-S); SR23 (2010)



Nutrient Database for NHANES:WWEIA



FNDDS: Survey Nutrient Database

- 7000 Foods reported by participants
- 65 Components
- 7-digit codes
- Food yield &nutrient retention factors
- All Cells Filled

USDA's Historical Description of Food Entries

- Oranges, raw, all commercial varieties
- Oranges, raw, California, Valencias
- Oranges, raw, Florida
- Oranges, raw, Navels
- Oranges, raw, with peel

USDA Description of Meat Products

Meat and poultry products

- **Species descriptor; (e.g., cattle, swine, sheep); scientific name**
- **Skeletal meat cuts vs. organ meats**
- **Specific names of meat cuts for species, e.g., rib**
- **Fat content terms for species: Lean vs. lean and fat**
- **Grade of meat, where relevant**
- **Cooking method or raw**

Fluid Milk Types

- **Milk, whole, 3.25% milk fat, with added vitamin D**
- **Milk, reduced fat, 2% milk fat, with added vitamin A and vitamin D**
- **Milk, low fat, 1% milk fat, with added vitamin A and vitamin D**
- **Milk, nonfat, with added vitamin A and vitamin D (fat free or skim)**

Industry Innovation is Fast-Paced!

- Customization/globalization of basic foods
  - Hundreds of fruit and vegetable cultivars
  - Finfish/ shellfish farms overtake wild sources
  - Meat and poultry products to meet consumer demands for taste and convenience
- Explosion in processed foods
  - Thousands of new food products are introduced world wide each year
- Trends toward more restaurant meals and prepared dishes

Names Are Not Enough!

- **What are these products?**
  - **Fudge**
  - **Corn dogs**
  - **Bangers and Mash**
  - **Chicken Fricassee**

- **What are the ingredients? What was added?**
- **What is the source of the food? How was it prepared?**
- **What is the nutritional value of the food? What contamination may be present?**
- **What allergies might be triggered by the food?**

US Databases and LanguaL

- **USDA databases for composition and consumption are used to create a list of commonly consumed (generic) products.**
- **The LanguaL controlled vocabulary provides a common definition of foods with diverse facets**
- **Manufacturers can use the vocabulary to create a specific catalog of descriptors for their products**
- **Agencies, vendors and consumers can:**
  - **Access the data they need**
  - **Retrieve foods and products information to address challenges (e.g., allergies) within the food network**

USDA Customers

Environmental Protection Agency: Perspective

- Descriptions of foods and commodities for integration with pesticide and contaminant analysis and estimation

LanguaL, EPA and potential contamination

WHO GEMS

Global Environment Monitoring System - Food Contamination Monitoring and Assessment Program studied:

Food description	LanguaL facet term codes (FTCs)
Apples, raw, with skin	A0143 A0669 B1245 C0137 E0150 F0003 G0003 H0003 J0001 K0003 M0001 N0001 P0024
Banana, raw	A0143 A0673 B1266 C0167 E0150 F0003 G0003 H0003 J0001 K0003 M0001 N0001 P0024
Tomato, raw	A0152 A0677 B1276 C0140 E0150 F0003 G0003 H0003 J0001 K0003 M0001 N0001 P0024
Milk, whole, fluid	A0148 A0719 B1201 C0235 E0123 F0001 G0003 H0003 J0001 K0003 M0001 N0001 P0024

WHO GEMS CCPR Total Diet Study

The GEMS Codex Committee on Pesticide Residues (CCPR) analyzed the occurrence of the following contaminants in the LanguaL-coded foods:

Examples of pesticides	Examples of heavy metals	Examples of industrial chemicals	Byproduct by Cooking
Aldrin/dieldrin DDT (complex) Endosulfan	Cadmium Lead Mercury	Polychlorinated biphenyls Polybrominated diphenyls Dioxins	Acrylamide

FDA Food/Analyte Matrix from FDA Total Diet Study

The FDA Total Diet Study also used LanguaL to measure the occurrence of the following contaminants:

Food description	LanguaL	MRMs	CPA	Phen	Carb	ETU	Benz	VOC	Merc
Apples, raw, with skin	FTCs above	x		x	x	x	x	x	
Banana, raw		x		x	x	x	x	x	x
Tomato, raw		x			x	x	x	x	x
Milk, whole, fluid		x	x					x	x

Abbreviations for the analytes listed in the food/analyte matrix are:

FTCs: (LanguaL) Facet Term Codes	Phen: phenylureas	Benz: benzimidazoles
MRMs: multi-residue methods for pesticides	Carb: carbamates	VOC: volatile organic compound
CPA: chlorophenoxy acids	ETU: ethylenethiourea	Merc: mercury

FDA Perspective

- Needs a method to describe changes to food as it moves – from farm to fork – thru the food chain, and the means to locate the source of food borne illness

LanguaL, FDA and traceability

- Lot-level information to trace food borne illness to its origin

GS1 GTIN

GS1 GPC Brick code

Brick attribute values

Brick equivalence *set* of LanguaL facet terms

An extensive but incomplete data record

- *Member* of the Brick equivalence *set* of LanguaL facet terms.
- Additional LanguaL facet terms.

- Nutrient data base ID
- Nutrients values for a nutrition fact panel

Production Input
- Supplier ID
- Supplier Lot Number
- Food ID
- Food description
- Expiration date

Production Output
- Output Lot Number
- Food ID
- Food description
- Expiration date

Additional data to complete a single record

Unified food packaging, description, nutrition and trace data

Full Ingredient Indexing: Cheeseburger

Food description	LanguaL
Beef, ground, patties, frozen, cooked, broiled	A - Z Facet Term Codes
Cheese, cheddar	
Lettuce, iceberg, raw	
Tomato, raw	
Onions, raw	
Tomato catsup	
Pickles, cucumber, sweet	
Bread, white, enriched	

Nutrient	Units	Values		Nutrient	Units	Values
Proximates				***Lipids***		
Water	g	127.13		Fatty acids, total saturated	g	21.125
Energy	kcal	726		Fatty acids, total monounsaturated	g	18.870
Protein	g	39.50		Fatty acids, total polyunsaturated	g	3.851
Total lipid (fat)	g	48.18		Cholesterol	mg	122
Minerals				***Vitamins***		
Calcium, Ca	mg	302		Vitamin C, total ascorbic acid	mg	7.4
Sodium, Na	mg	1712		Vitamin B-6	mg	0.381
Copper, Cu	mg	0.246		Folic acid	mcg	28
Manganese, Mn	mg	0.373		Folate, food	mcg	51
Selenium, Se	mcg	32.5		Folate, DFE	mcg_DFE	99
... etc						

Full Ingredient Indexing Description of a Cheeseburger

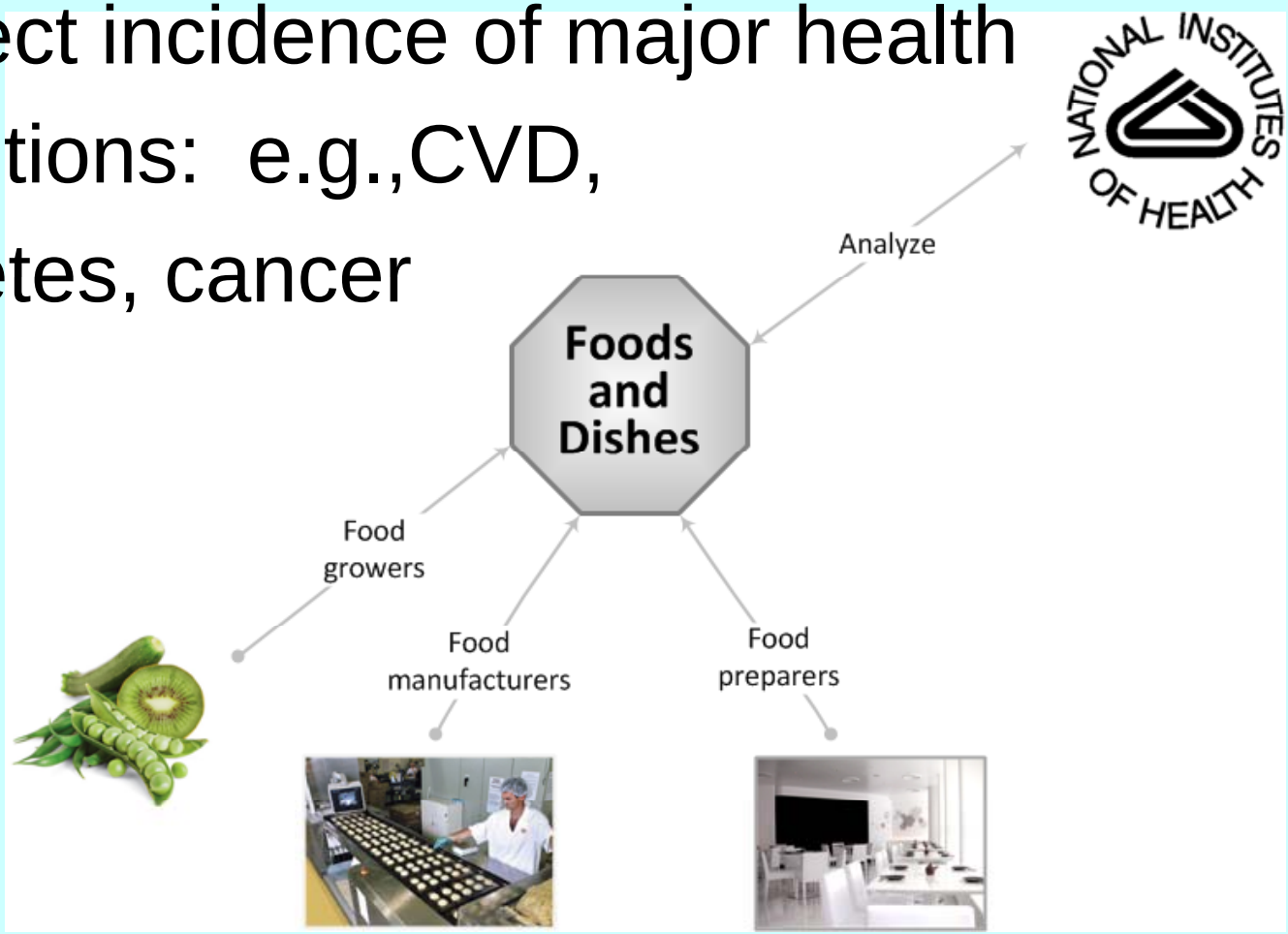
- LanguaL Facet Codes and Nutrient Values

Food description	LanguaL facet term codes (FTCs)
Beef, ground, patties, frozen, cooked, broiled	A0150 A1283 B1161 C0269 E0140 F0014 G0006 H0241 J0001 K0003 M0001 N0001 P0024 Z0018 Z0019
Cheese, cheddar	A0186 A1271 B1201 C0245 E0151 F0001 G0003 H0253 H0328 J0001 K0003 M0001 N0001 P0024
Lettuce, iceberg, raw	A0152 A1281 B1390 C0151 E0150 F0003 G0003 H0003 J0001 K0003 M0001 N0001 P0024
Tomato, raw	A0152 A1281 B1276 C0140 E0150 F0003 G0003 H0003 J0001 K0003 M0001 N0001 P0024
Onions, raw	A0152 A1281 B1300 C0240 E0150 F0003 G0003 H0003 J0001 K0003 M0001 N0001 P0024
Tomato catsup	A0179 A1281 B1276 C0140 E0135 F0014 G0003 H0123 H0136 H0200 H0227 J0001 K0003 M0001 N0001 P0024
Pickles, cucumber, sweet	A0271 A1281 B1404 C0140 E0150 F0022 G0003 H0136 H0190 H0200 H0227 H0253 J0001 K0001 M0001 N0001 P0024
Bread, white, enriched	A0178 B1418 C0208 E0151 F0014 G0003 H0256 H0194 H0248 H0181 H0216 H0136 J0001 K0003 M0001 N0001 P0024

Selected nutrient	Units	Values		Selected nutrient	Units	Values
Proximates						
Energy	kcal	726				
Protein	g	39.50				
Minerals				**Lipids**		
Calcium, Ca	mg	302		Fatty acids, total saturated	g	21.125
Iron, Fe	mg	5.03		Fatty acids, total monounsaturated	g	18.870
Amino acids				**Vitamins**		
Tryptophan	g	0.498		Vitamin C, total ascorbic acid	mg	7.4
Threonine	g	1.516		Thiamin	mg	0.533

Dietary Intake and the Health Perspective of the NIH

- How does dietary intake of components affect incidence of major health conditions: e.g.,CVD, diabetes, cancer

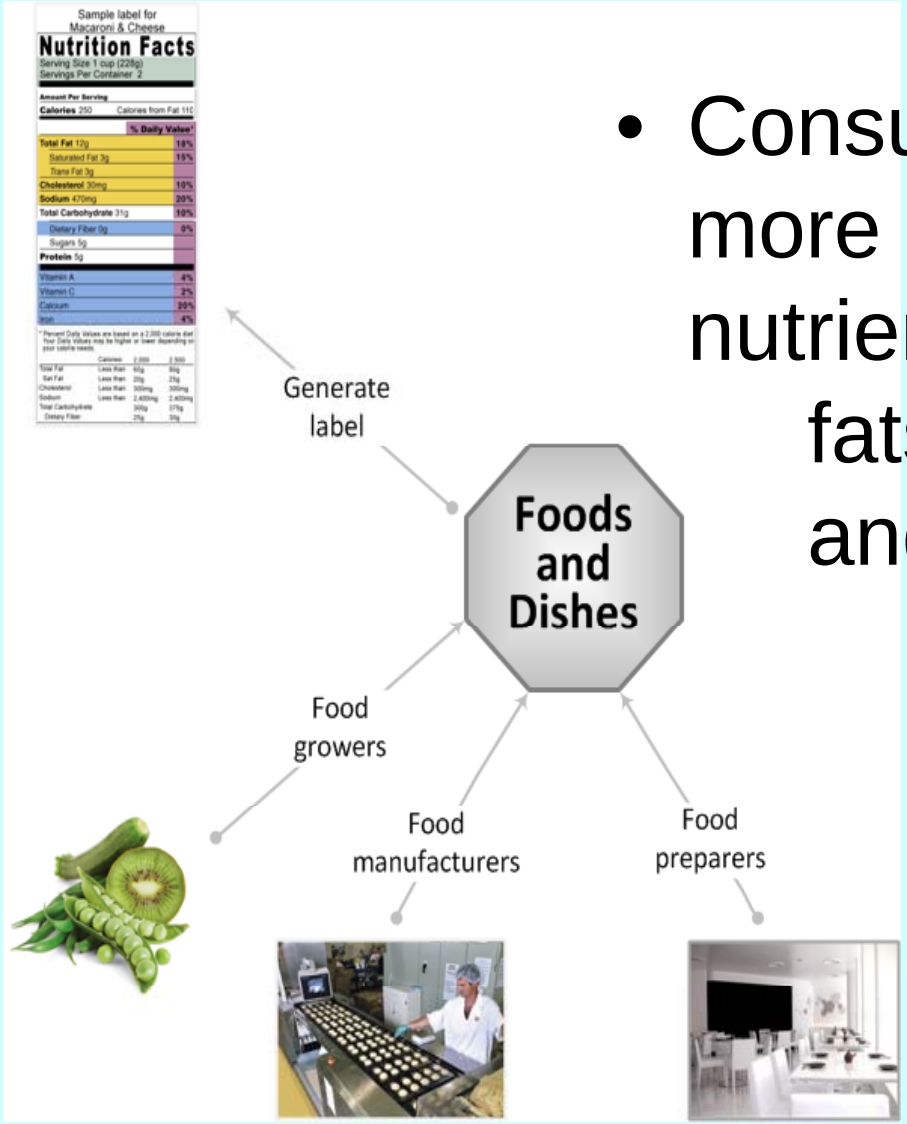


Food Pyramid Perspective

- Need for specific information about popular food choices

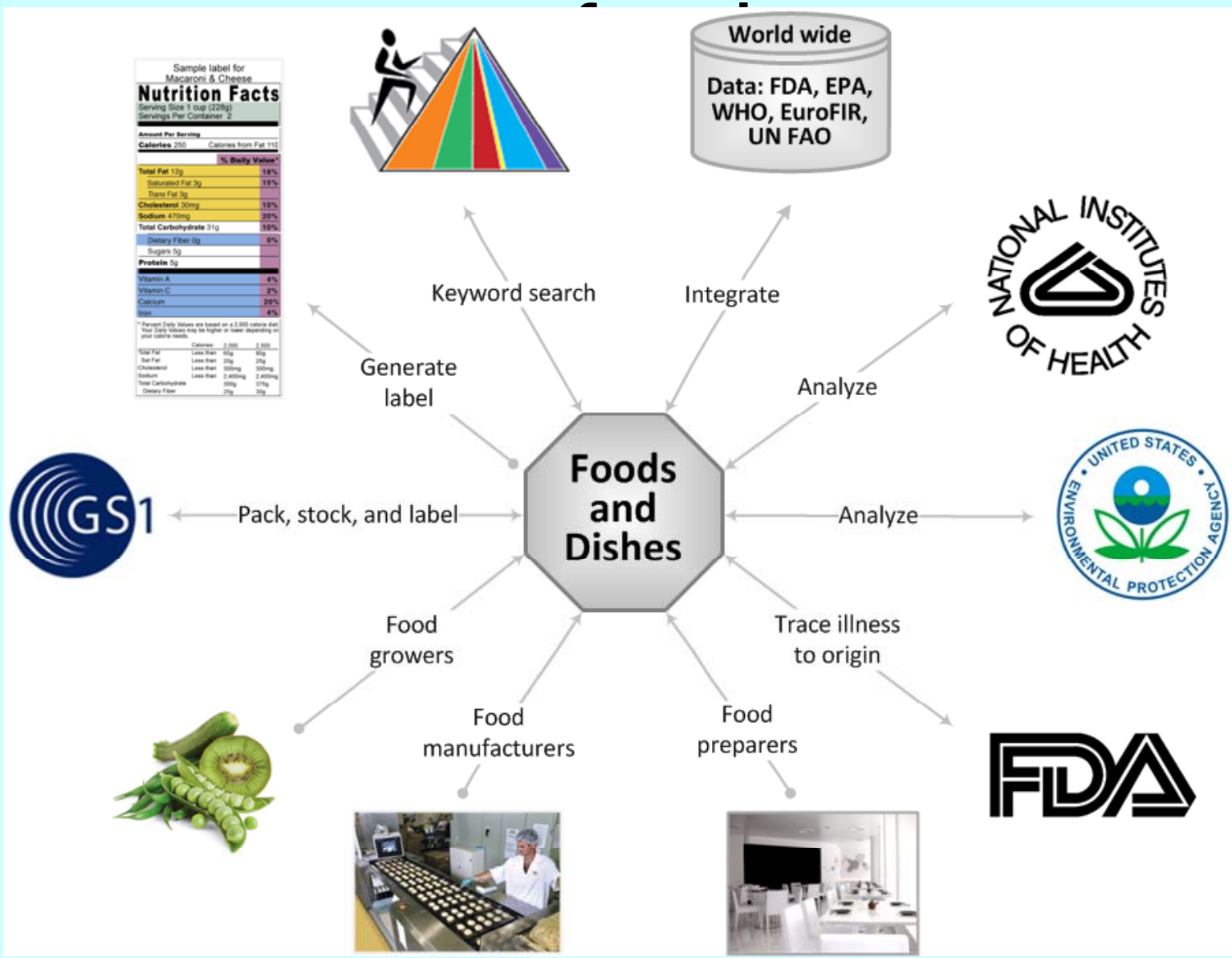
- US Dietary Guidelines and Food Pyramid provide consumers with guidance for choosing a healthy diet

Consumer Groups Have a Voice



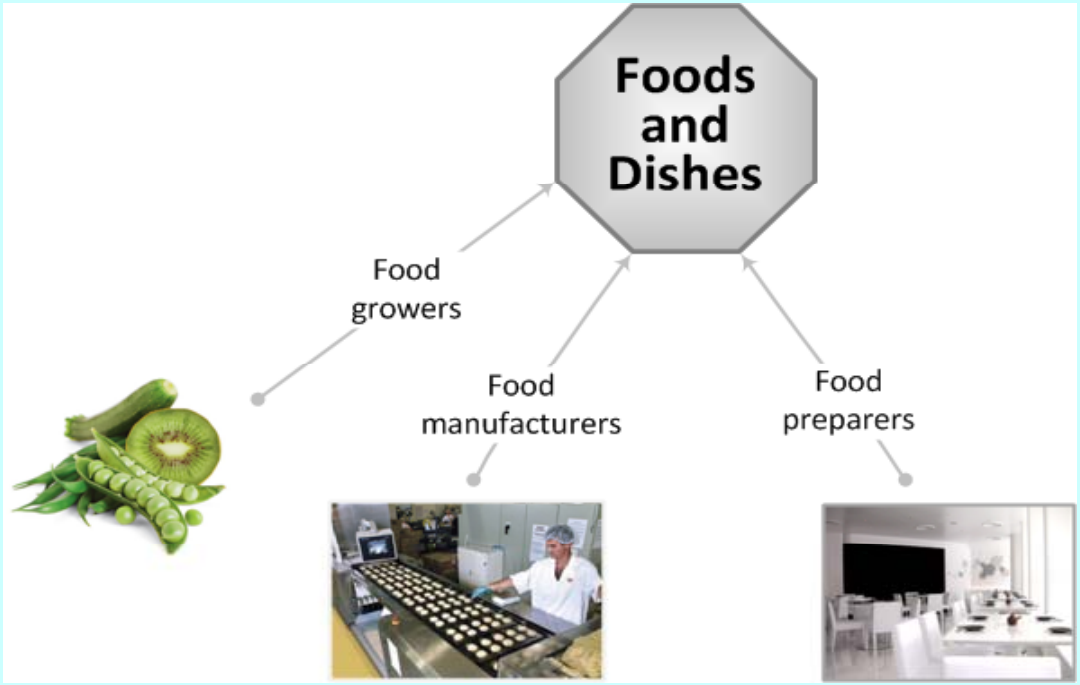
- Consumer groups want more information about nutrients (e.g., omega-3 fats), food additives and sustainable food values (origin, growing methods)

An integrated US Perspective



How to Stay Current with Reformulation and Innovation?

- Every vendor differentiates their products
- Food authorities need to help them register and document their “differentials”
- Make it easy!



A Global Food Supply Requires Global Integration of Food Information Systems

- Food safety and traceability
- Nutrient content and intake studies
- Trade and food regulation

Foods Information Interchange

	International	Jurisdiction	Vendor	Registration	Tarrifs/Trade	Description	Distribution Traceability	Nutrition	Contamination
1	LanguaL Facets B - Z					International			
2	Nutrient tags							INFOODS	
3	Contaminant tags								EPA
4	Vendor ID			GS1 GTIN			GS1 GTIN		
5	Product ID			GS1 GTIN			GS1 GTIN		
6	LanguaL Facet A			Constituents					
7	Methods, nutrients			USDA					
8	Baseline, generic Facet Term Codes					USDA			
9	Baseline, generic food nutrients					USDA			
10	Food ID			USDA	USITC		FDA		
11	Methods, contaminants								EPA
12	Baseline, contaminant tolerances								EPA
13	Contaminant ID			EPA					
14	Output food ID				Vendor		Vendor		
15	Values, specific Facet Term Codes				Vendor	Vendor			
16	Values, specific food nutrients							Vendor	
17	Values, specific food contaminants								Vendor

Conclusion

- **USDA, US-FDA and EPA seek a common language for food information integration**
- **Controlled vocabulary provides the basis for a food classification system**
- **Multiple hierarchical approach can include diverse facets about foods and DS**
- **Clear definition of the elements is driven by science, the regulations, and the accepted conventions of the food systems**
- **“State of the art” approach to indexing and retrieval is critical**

Acknowledgements

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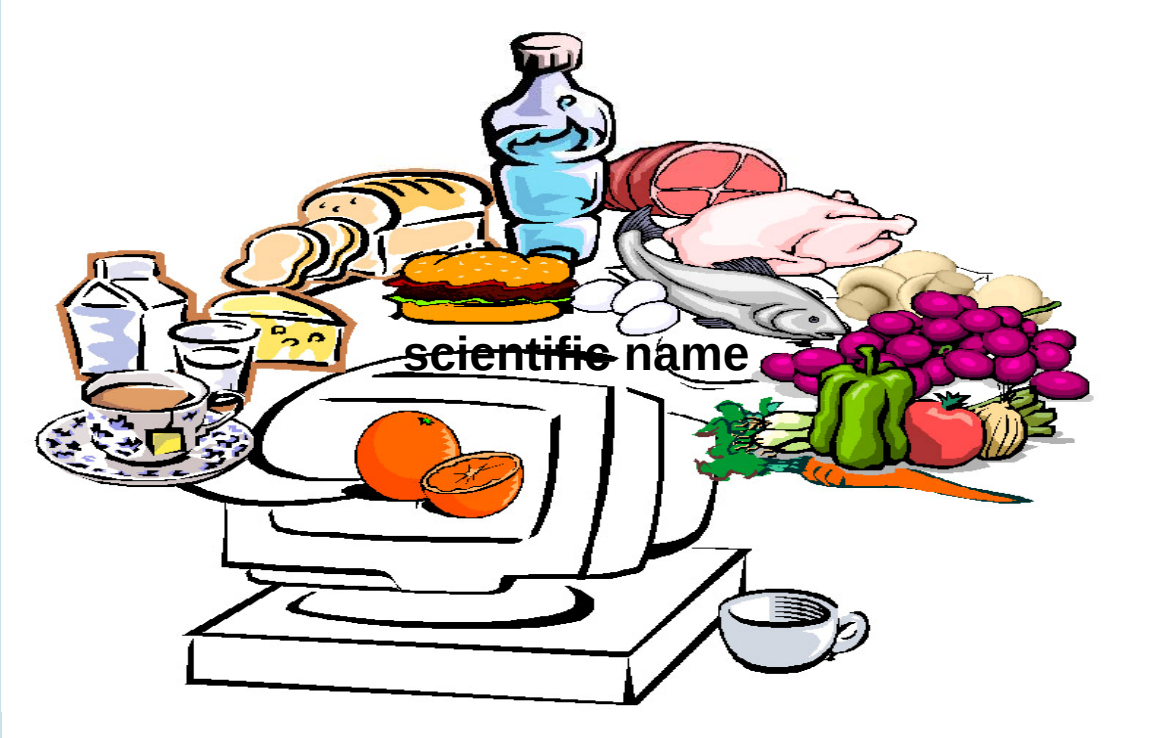

Web Site:
http://www.ars.usda.gov/nutrientdata