LECTURE # 3

Please review the images of the next lecture and of any past lecture at:

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The World, its Resources, and Humankind. Topics of Study

FOOD

"Civilization, as it is known today, could not have evolved, nor can it survive, without an adequate food supply"

Norman Borlaug

(1914-2009)

"Food is the moral right of all who are born in this world"

Norman Borlaug
(1914-2009)

Plan of Discussion

1. Timeline of Foods
2. Nutrition
3. Digestion
4. Types of Food
5. Alcoholic beverages

TIMELINE OF FOOD

Timeline of Food

Prehistoric Times

2,000,000 BC - Consumption of meat

250,000 BC - Hearths appear – **Invention of cooking**

40,000 BC - Fish consumption – East Asia

30,000 BC - **Earliest flour**

25,000 BC - **Earliest fish hook**

12,000 BC - **Oldest domesticated rice** – China

9,000 BC - Figs – Jordan valley

8,500 BC - **First agricultural revolution – Middle East**

8,000 BC - Squash – Mexico

8,000 - 5,000 BC – Banana cultivation – Papua

8,000 - 5,000 BC – Domestication of potato South America

Major Formative Events in the Neolithic Era (Mesopotamia, Nile's banks, Indus River valley, and major rivers of China)

By 10,000 BC humans colonized all ice-free parts of the globe.

Future of humankind was molded by:

- **Domestication of animals and plants**
- **Agriculture - developed - c. 8000 - 5000 BC**. ⇨ Man settled becoming a farmer
- The **wheel** - invented - 6500 - 4500 BC in Mesopotamia ⇨ facilitated transportation
- **Navigation –** from rivers to the sea. **Trading resources and ideas**
- ⇨ **Discovering** ⇨ **Conquering**

Major Formative Events in the Neolithic Era (cont'd)

- Agriculture and the wheel make the greatest human
- progress
- Accounting became necessary
-
- **Writing invented -** 3500 BC ⇨ Accounting
  ⇨ Communication

- **Grains in excess of the need**

- Social classes ensued ⇨ **"Haves"** and **"have-nots"**
- Creation of **city-states** and military for defense
- **"Have nots"** revolts *or* **Outsiders'** invasions

- **<u>Destruction and rebuilding became the norm</u>**

Timeline of Food (I)
Neolithic Times

~7,000 BC – **Cereal production** – Syria. Rice and millet in China

Wheat and barley in Pakistan

~7,000 BC – Brewing fermented alcoholic beverage. Wine in Georgia

~7,000 BC – Sheep domesticated – China

~6,800 BC – **Rice domesticated in SE Asia**

~6,140 - 4530 BC – Fish processing and storage – Israel

~6,000 BC – Granary in Mehrgarh (Pakistan)

~5,500 BC – Cheese making – Poland

~5,000 BC – Cattle domesticated – Mesopotamia

Timeline of Food (2)
Neolithic Times

~5,000 BC – Beans cultivated – Americas

~4,000 BC – First use of **wooden ploughs** in Mesopotamia

~4,000 BC – **Leavened bread** – Egypt (yeast used)

~4,500 - 3,500 BC – Olive domestication and **olive oil** extraction

~4,000 BC – **Agriculture reaches NE Europe**

~4,000 BC – Citron seeds – Mesopotamia

~3,900 BC – Early evidence of **beer from barley** – Mesopotamia - **oldest surviving beer recipe**

~3,600 – **Aquaculture** – China

Timeline of Food (3)
Antiquity (I)

~3,000 BC – Grapes for wine – Fertile Crescent

~3000 BC – Sugar produced in India

~3,000 – **Sunflower** – N. America

~3,000 BC – Turmeric, cardamom, pepper, mustard – Harappa (Indus valley)

~3,000 BC – Beer in Europe by Germanic and Slavic tribes

~2,500 BC – Domestic pigs from wild boars – Hungary

~2,000-1,500 BC – **Rice cultivation** – Ganges valley

1,700 BC – **Wind powered machine** - Babylonia

~1,900 BC – Chocolate drinks – Olmec

Timeline of Food
Antiquity (2)

600 CE – Distillation of alcohol invented in China

607 CE – Massive canal btw. the Yellow and Yangtze rivers

691 BC – **First aqueduct in Niniveh** (N. Assyria, on Tigris)

530 BC – Tunnel of Eupalinos (Island of Samos, Greece)

500 BC – **Iron plough invented in China**

500 BC – Garum (fermented fish sauce = condiment) – Rome and Greece

327-324 BC – **Alexander Macedon brings rice from India**

100 BC – Seed-drill invented in China

Middle Ages

Primitive cooking ⇨ Poor nutrition ⇨ **Diseases of deficiencies:** Ricketts, scurvy, beriberi, pellagra

Use of spices to cover poor taste ⇨ Major commerce

Slow progress in agriculture

Benedictine abbeys' wines ⇨ Surviving vineyards

Modern Technological Advances

1809 – Nicole Appert (French confectioner) - **canning**

1866 – Gregor Mendel – **Mendelian inheritance**

1871 – Louis Pasteur – invented **pasteurization**

1895 – **Refrigeration** for food preservation – USA and UK

1944 – **Green Revolution (N. Borlaug) -** started in Mexico

1974 – China creates hybrid rice

2000 – **Genetically modified plants** cultivated around the world

“The Green Revolution”

1940s-1950s - Dr. Norman Borlaug’s **“Green Revolution”**

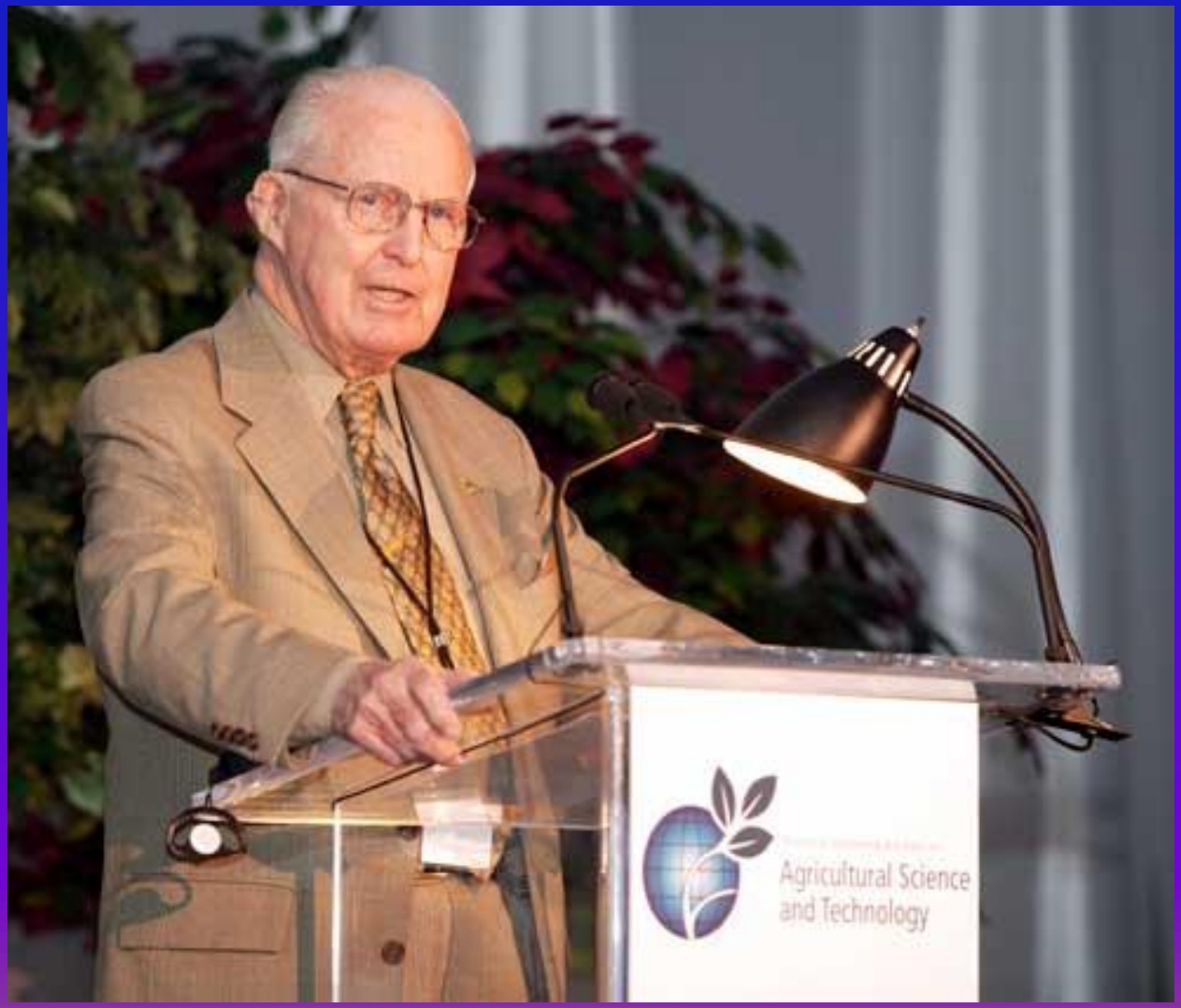
1990s - First GMO crops introduced into the marketplace

2012 - More than 420 Mil. acres of biotech crops in 28 countries by 20 million farmers

⬇

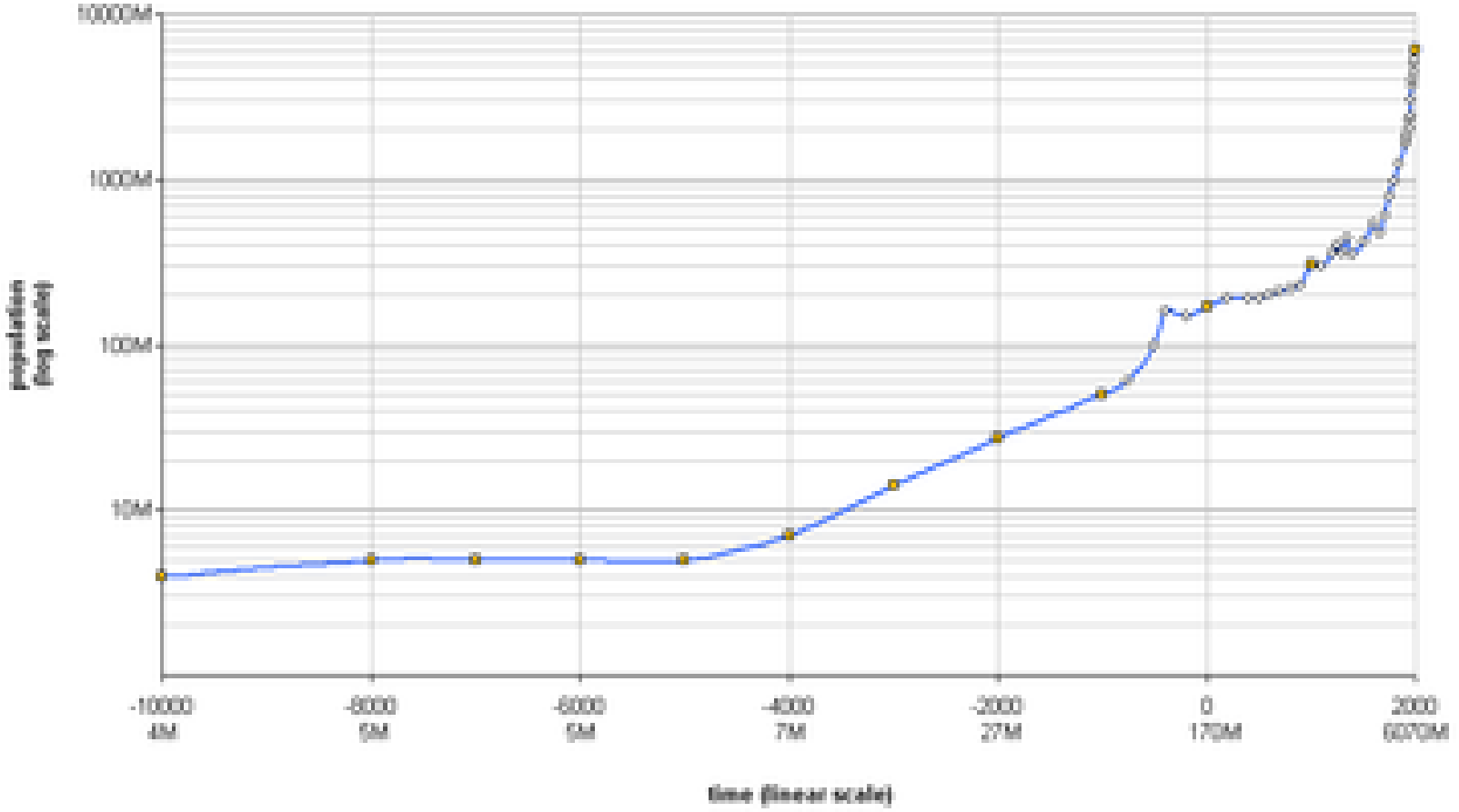
100% increase in crops since 1990s

NORMAN BORLAUG (1914 – 2009)
Father of the "Green Revolution"

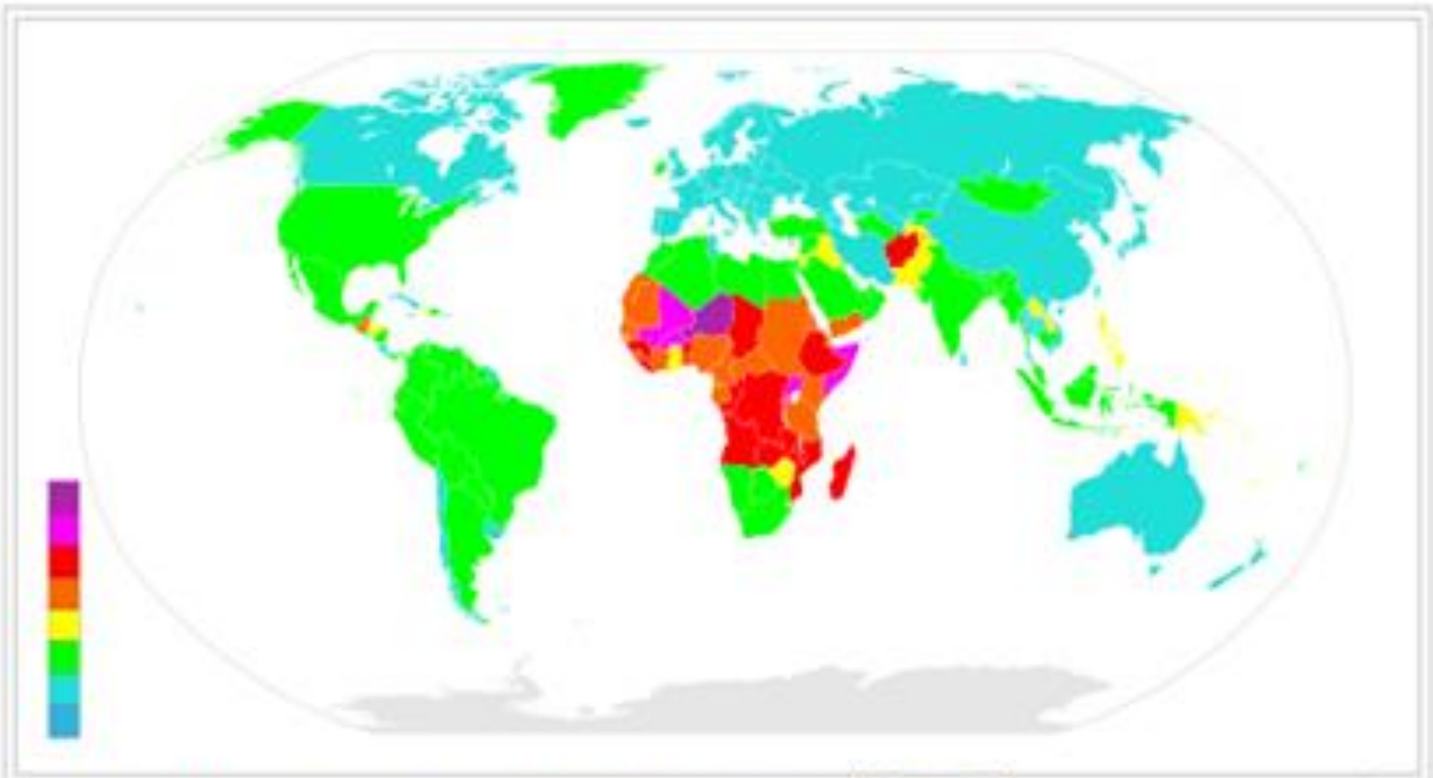


COULD ALL PEOPLE BE FED?

World Population - 10,000 BC – 2000 CE



World Fertility Rates (2005 – 2010)



2015 Agricultural Output in Billions USD

China	1,088
India	413
European Union	333
United States	290
Indonesia	127
Brazil	110

Acquired Problems in Agriculture

1. Soil
2. Water
3. Chemical fertilization

+ **Agricultural pollution**

4. Pesticides

AGRICULTURAL POLLUTION

Chemical Fertilizers (> 150 tons/yr.)

- ➔ ↓ soil microorganisms and small mammals
- ➔ ↓ insects and organic matter
- Phosphates ➔ algal growth in water
- Nitrates ➔ toxic, carcinogenic

Pesticides: Arsenic compounds
Plant parts
Petroleum products ("dirty dozen")
↑ Breast cancer (Hawaii)

CHLORINATION BY-PRODUCTS

Chlorine + natural organic substances present in untreated water → Trihalomethanes (THM's)

THM are organohalogen compounds derivatives of methane

Ecological studies: Bladder, colon, rectal, lung, brain cancer

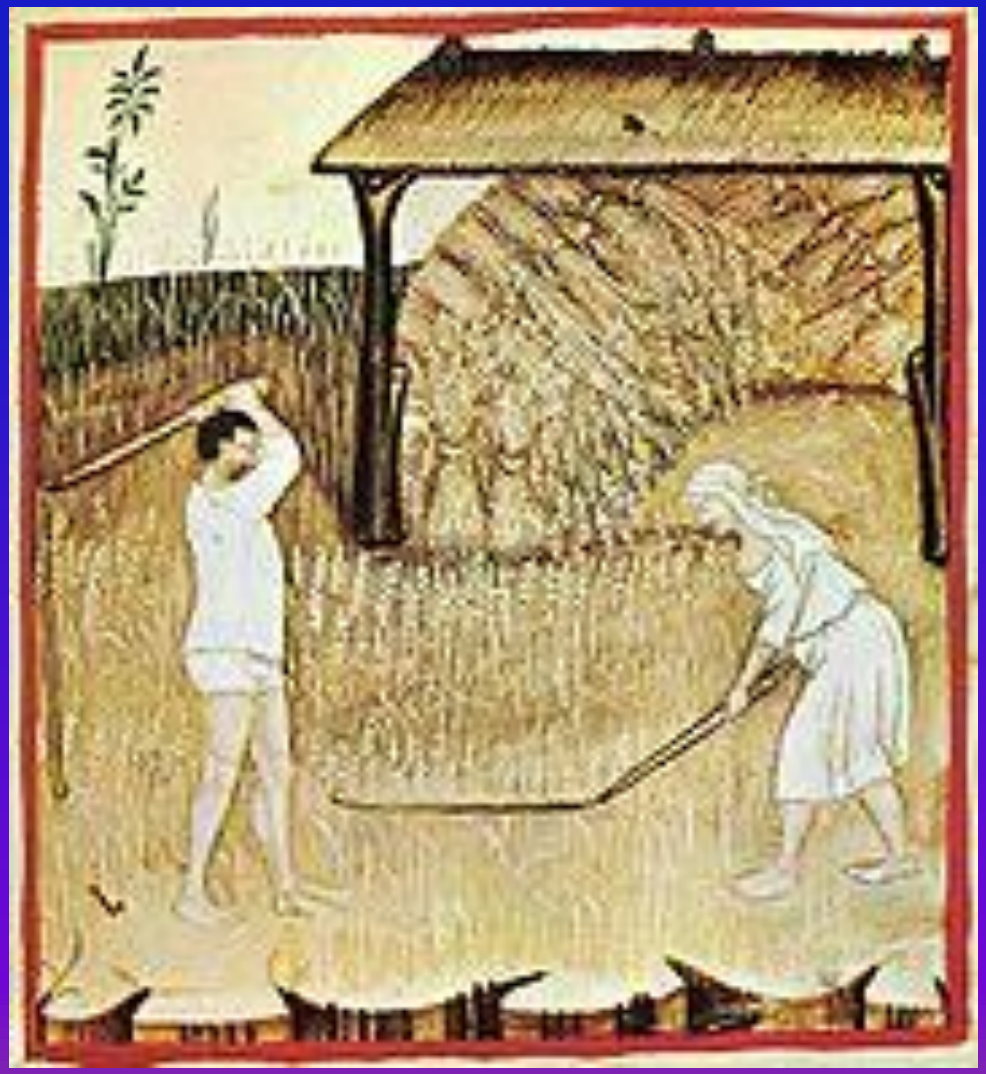
TIMELINE OF FOODS

GRAINS

Sumerian Harvester's Sickle Made of Baked Clay - c. 3000 BC

Threshing in Ancient Egypt

Threshing of Grain, 14th Century



Rice terraces in the Philippines

Agicultural Calendar

The Harvesters – Peter Bruegel, 1565

VEGETABLES

Ancient American Crops

Cereals: maize (corn), barley

Pseudo-cereals: Quinoa, sunflower

Pulses: Beans, peanuts

Fiber: Cotton, yucca, agave

Roots: potatoes, jicama, many tubers

Fruits: Tomatoes, peppers, avocados, many sorts of berries, papayas, passion fruit

Melons: Squashes

Nuts: Peanuts, walnuts, pecan, and others

Meat and Poultry: Turkey, bison

Other: Tobacco, vanilla, cocoa, chocolate, rubber

Timeline of American Crop Cultivation

Date	Crop	Location
7000 BC	Maize	Mexico
5000 BC	Cotton	Mexico
4800 BC	Peppers, squash avocados	Mexico
4000 BC	Beans	Mexico
4000 BC	Nuts	South America
2000 BC	Sunflowers, beans	South America

American Crops

Corn, a Staple in Mayan Diet

MEAT

Meat Preservation

>10,000 BC - **Ice packing**

4500 BC - **Sun drying**

3500 BC - Fish preservation (Sumerians)

3000 BC - **Salt curing -** from the Dead Sea – (Jews)

200 CE - **Meat cured with salt (**Greeks and Romans)

1300 - Meat cured with salt (Chinese)

1590 - Meat smoked (Indians)

Meat Preservation (cont'd)

1809 - **Canning**

1934 - **The refrigerator invented**

1940 - Fermenting meat for sausages ⇨↓pH ⇨↓ bacterial growth

1960 - Irradiation

1989 - Thermal heating

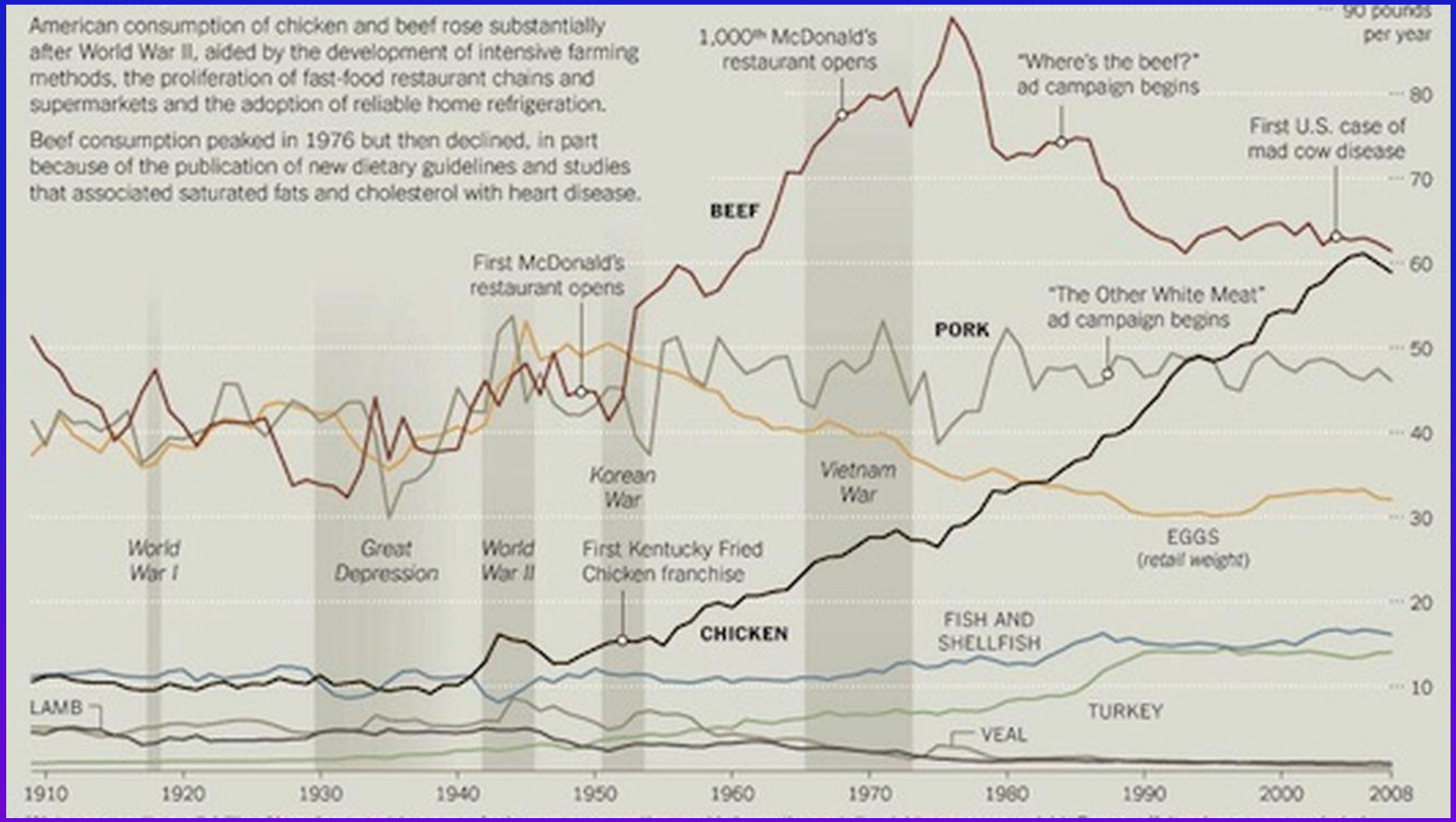
1993 - Solar drying

2000+ - **Chemical preservation**

Nutritional Content of 4 oz. of Meat

Source	Calories	Protein	Carbs	Fat
Fish	110–140	20–25 g	0 g	1–5 g
Chicken	160	28 g	0 g	7 g
Lamb	250	30 g	0 g	14 g
Steak (beef top round)	210	36 g	0 g	7 g
Beef (T-bone)	450	25 g	0 g	35 g

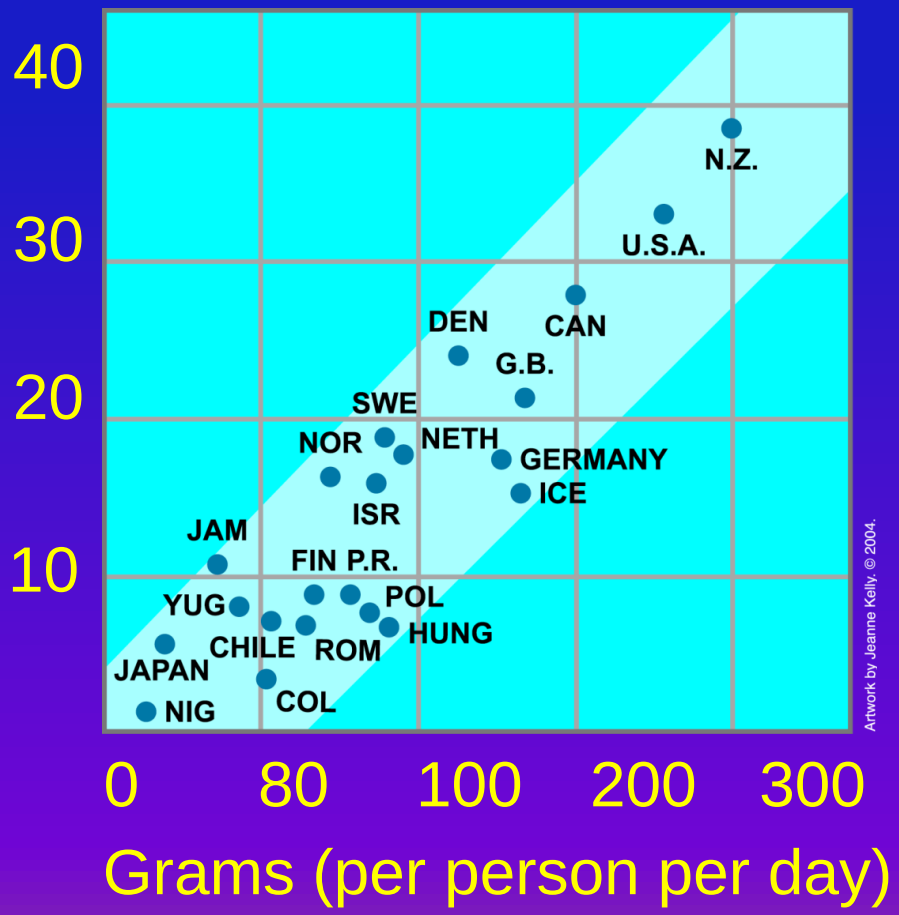
Meat consumption in United States



INCREASE IN MEAT CONSUMPTION AFTER WW2 DUE TO DUE TO: HOME REFRIGERATION, INTENSE FARMING METHODS, SUPERMARKETS AND RESTAURANTS

Diet: Limit Fats and Calories

Correlation Between **Meat Consumption** and **Colon Cancer Rates** in Different Countries



Fish Preservation

Since antiquity: Fish curing by drying, salting, smoking, and pickling

19th century – Canning (sardines)

Modern times - Freezing

Eating Fish

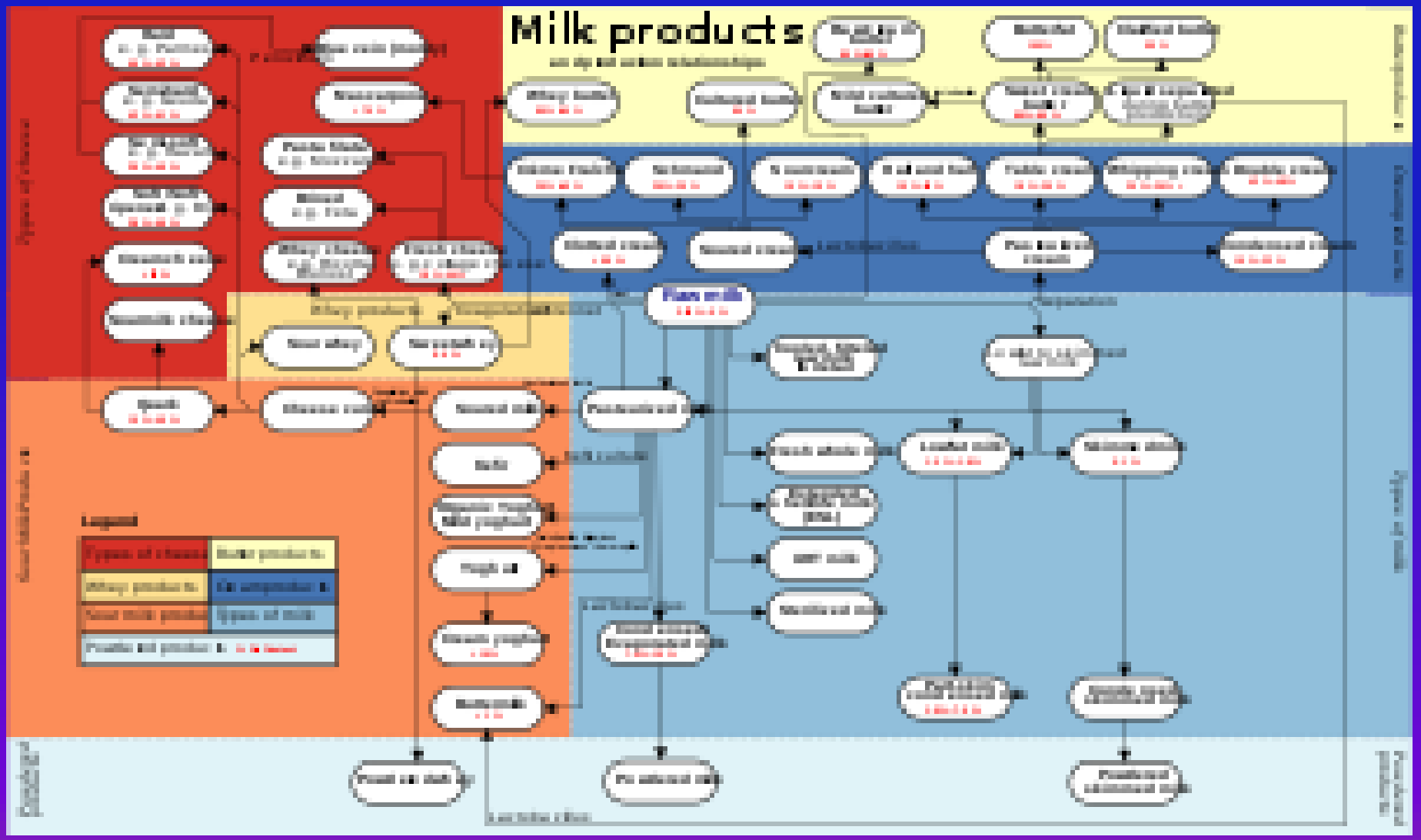
Important nutrient. To eat at least once a week

1. Proteins
2. Omega-3 fatty acids (salmon, trout, tuna, mackerel, sardines)
3. Vitamin D
4. Iodine

- Prevents heart attacks, strokes (~15% less)
- Helps in the development of brain and eyes
- Protects from age-related deterioration

DAIRY PRODUCTS

Dairy Products



Dairy Products

Milk is a **complete food**: Protein, fat, carbs, vitamins

Standardized by the fat level and fermentation:

- Cream
- Butter
- Cheeses
- Yogurt, etc.

To be avoided in presence of lactose intolerance and allergy.

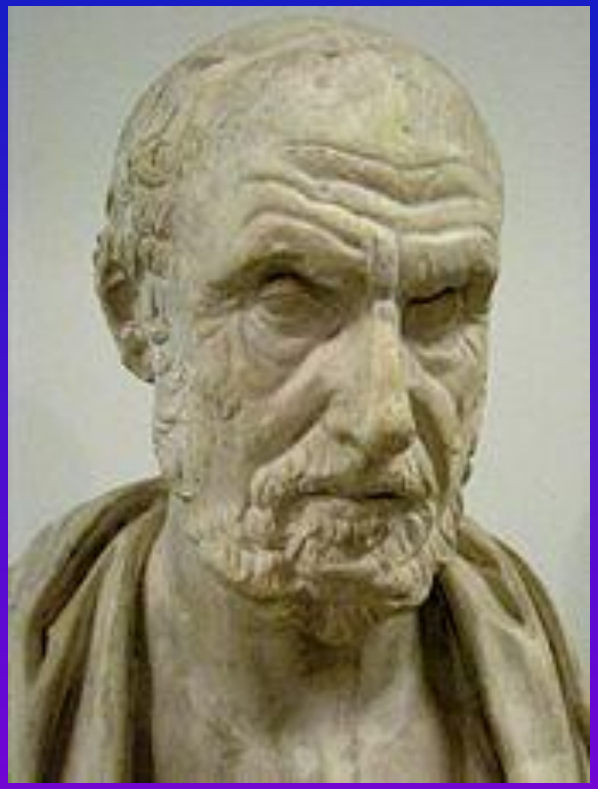
No connection with cardiovascular disease (excluding butter).

NUTRITION

Hippocrates of Cos (Greek, ~400 BC)

"Let Thy Food Be Thy Medicine and Thy Medicine Be Thy Food“

“A Wise Man Should Consider that Health Is the Greatest of Human Blessings”



Definition

The process of nourishing or being nourished, especially the process by which **a living organism assimilates food and uses it for growth and replacement of tissues**.

Nutrients are substances that are essential to life, which must be supplied by food.

Nutrition through the Dark Ages

Many fallacies

Witchcraft

Example: Treatment of eye disease:

Squeezing the juice of liver into the eye was effective

(Vitamin A is stored in the liver in large amounts)

History of Nutrition

1500s - Leonardo da Vinci compared the process of **metabolism** in the body to the burning of a candle.

1747 – British physician James Lind – Scientific experiment on sailors.

Lime juice prevented scurvy

(Lime juice contains vitamin C)

Vitamin C was discovered only in 1930.

Antoine Lavoisier (French, 1743 - 1794)

Father of Chemistry and Nutrition

Discovered the Basal Metabolism and Oxidation of Food as Source of Body Temperature)

Modern History of Nutrition

Early 1800's – Discovery: Foods are composed primarily of four elements: **carbon, nitrogen, hydrogen,** and **oxygen.**

Methods were developed for determining the amounts of these elements.

1840 -- Justus Liebig of Germany, was the first to point out the chemical makeup of carbohydrates, fats and proteins.

Discovery of Vitamins (By Trial and Error)

1897 - Christiaan Eijkman, a Dutchman working in Java: Some of the natives developed Beriberi (heart problems and paralysis). Chickens fed the native diet of white rice also developed the symptoms of Beriberi.

He fed the chickens unprocessed brown rice (with the outer bran intact), **they did not develop the disease.**

Eijkman then fed brown rice to his patients and they were cured.

Nutritionists later learned that the outer rice bran contains **vitamin B1**, also known as **thiamine.**

Discovery of Vitamin A

1912 - E.V. McCollum, (USDA at the University of Wisconsin) - Widespread discovery of nutrients.

He discovered the first fat soluble vitamin, **Vitamin A.**

He found that rats fed butter were healthier than those fed lard, as butter contains more Vitamin A.

Vitamins

1912 - Dr. Casmir Funk was the first to coin the term **vitamins**, substances that could prevent the diseases of scurvy, beriberi and pellagra (a disease caused by the deficiency of niacin (vitamin B-3).

"Vital amines" ⇨ **Vitamins**

1930's - William Rose discovered the **essential amino acids**, the building blocks of proteins.

More on Vitamins

1940's - The water soluble **vitamins B** and **C** were identified.

1968 - Linus Pauling, Nobel Prize winner in chemistry, advised taking large amounts of vitamin C

Large amounts of vitamin C ⇨ No major effect

Vitamins and Minerals

1950s to the Present - The roles of essential nutrients as part of bodily processes have been brought to light.

The role of vitamins and minerals as components of enzymes and hormones that work within the body.

Detoxifying Agents

Removal of toxic substances from a living organism

- Antioxidants
- Alcohol detoxification
- Drug detoxification
- Metabolic detoxification
- Hemodialysis
- Chelation therapy

- Detox diets = No scientific support

Antioxidants

A paradox of human metabolism:

The vast majority of life processes require **oxygen**, yet oxygen is a highly reactive molecule that damages living organisms by producing **reactive oxygen species (ROS)**

Organisms contain a complex network of **antioxidant** metabolites and enzymes that work together to prevent oxidative damage to cellular components

Reactive oxygen species (radicals) are incriminated in **cancer**

Antioxidants (cont'd)

Best antioxidants (AO) are from fruits and vegetables

Vitamins A, C, and **E** from fruits and nuts, respectively

Berries: blueberries and blackberries are highest in AO.

Flavonoids: Red wine, dark chocolate, tea

Blackberries – Polyphenol antioxidants

Nutritive Cancer Chemopreventive Agents

Agents	Major Food Source	Mode of Action
Vitamin A	Vegetables, fruits	Antioxidant
Vitamin C	Fruits (citrus), vegetables	Antioxidant
Vitamin E	Vegetable oils	Antioxidant
Selenium	Meat, eggs, dairy products	Antioxidant
Calcium	Dairy products	Binds bile and fatty acids

THE DAWN OF MOLECULAR EPIDEMIOLOGY OF HUMAN CANCER

"NO ONE SUPPOSES THAT ALL THE INDIVIDUALS OF THE SAME SPECIES ARE CAST IN THE VERY SAME MOLD"

C. Darwin, 1859

NUTRITION AND THE HUMAN BODY

The Food Pyramid

The first food pyramid was published in Sweden in 1974

The food pyramid was introduced by the USDA in 1992. It was called the "Food Guide Pyramid"

It was updated in 2005 and then replaced by “My Plate” in 2011

“MyPlate” – USDA 2011

DIGESTION (I)

The assembly of physical, chemical, and biological processes that make possible for the food to give us the needed **energy**, **growth,** and **cell repair.**

PROCESSES:

Physical: Mechanical, watering

Chemical: Enzymes

Biological: Absorption

DIGESTION (II)

Mechanical process (chewing in the mouth), churning the food in the stomach.

GI Juices added to soften the foodstuffs and enzymes split the nutritional stuff into absorbable chemical entities:

Carb. ➢ glucose – absorbed in the gut

Fats ➢ fatty acids – absorbed in the gut

Proteins ➢ amino-acids – absorbed in the gut

Most of the water is absorbed in the large bowel

METABOLISM

All the chemical processes aimed to maintain the cellular homeostasis

Catabolism = breaking down the molecules to obtain energy

Anabolism = synthesis of all compounds needed by the cells

A complete diet must supply:

- **Carbohydrates (carbs), proteins, and fats**
- **18 inorganic elements (minerals)**
- **17 vitamins (essential for life)**
- **Water**

CARBS, PROTEINS, LIPIDS

	Energy value
Carbohydrates: Supplied as starch, sugar, cellulose (fiber). Starch and sugar are essential.	4 Cal/Gm
Proteins: Supplied as eggs, milk, soybeans, meats, vegetables, and grains. 8 essential amino acids.	4 Cal/Gm
Fats and lipids: animal fats (saturated) and vegetable fats (unsaturated). 3 are essential (linoleic, linolinic, and arachidonic).	9 Cal/Gm

NORMAL DAILY INTAKE ~2,500 CAL.

Weight Balance

Ideal Body weight

Balanced weight

Gaining weight

Losing Weight

AMERICAN CANCER SOCIETY DIETARY GUIDELINES

- Reduce fat intake to 30% of daily calories
- Increase fiber intake to 20-30 g/day
- Eat a variety of vegetables and fruits daily
- Avoid obesity (Increased cancer rates in obese people)
- Consume alcoholic beverages in moderation, if at all
- Minimize consumption of salt-cured, pickled, or smoked foods

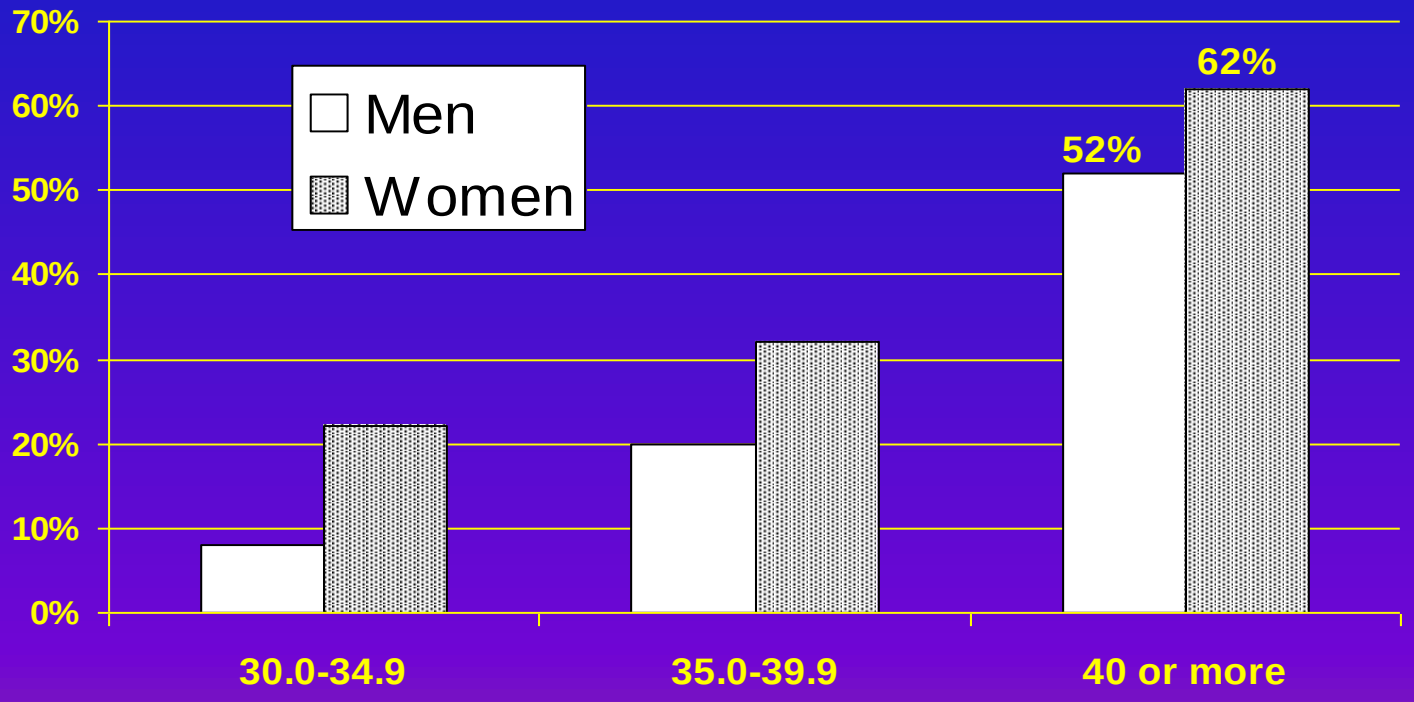
Body Mass Index (BMI)

BMI = Weight (kg)/Height^2 (m^2) Metric Units

BMI = 703 x Weight (lb)/Height^2 (in^2) U.S. Units

BMI < 18.5	Below normal weight
BMI > 18.5 - < 25	Normal weight
BMI > 25 - < 30	Overweight
BMI > 30 - < 35	Class I Obesity
BMI > 35 - < 40	Class II Obesity
BMI > 40	Class III Obesity

Cancer Death Rates of Obese Compared to that of Individuals with Normal Body Weight (BMI < 25)



Obesity and Cancer
New Findings

- ~30% of adults are obese **(BMI > 30)**
- ~35% of adults are overweight (BMI 25 - 30)

- Women: Uterine cancer x 6

  Kidney cancer x 5
- Men: Liver cancer 6-fold

  Colorectal cancer ~1.75-fold

Illnesses Caused by Improper Intake of Nutrients

Nutrients	Deficiency	Excess
Calories	Starvation	Obesity, DM, CVD
Carbohydrates	Low Energy level	Obesity, DM, CVD
Protein	Kwashiorkor	Ketoacidosis in DM
Sat. Fat	Low test., vitamin deficiencies	Obesity, CVD
Trans fat	None	Obesity, CVD
Unsaturated Fat	Vitamin deficiencies	Obesity, CVD
Calcium	Osteoporosis, tetany,	Fatigue, depression, kidney stones
Iron	Anemia	Hemochromatosis, cirrhosis, heart dis.

CVD = CARDIOVASCULAR DISEASE

Illnesses Caused by Improper Intake of Vitamins

Vit. A	Xerophthalmia, night blindness	Cirrhosis
Vit. B_1	Beri-Beri	?
Vit. B_2	Skin and corneal lesions	?
Niacin	Pellagra	Cardiac arrhythmias, birth def.
Vit. B_{12}	Pernicious anemia	?
Vit. C	Scurvy	Diarrhea
Vit. D	Rickets	Hypervitaminosis D
Vit. E	Neurological diseases	Excessive bleeding
Vit. K	Hemorrhage	Liver damage
Omega-3 fatty acids	CVD	Bleeding, Stroke, Poor sugar control in DM
Omega-6 fatty acids	None	CVD, Cancer

DISEASES OF METABOLISM

	Metabolism affected		Blood
Diabetes mellitus	Carbohydrates	➢	Sugar
High cholesterol	Lipids	➢	Cholesterol
Gout	Proteins	➢	Uric acid

NUTRIENTS, VITAMINS, AND THE LAW

Pharmaceutical Industry and the Consumer

1994 – 2000 - Vitamin bottle labels and nutritional web sites include a phrase saying that their “products and information are not intended to diagnose, cure, or prevent a disease.”

It is usually stated that the health claims “have not been evaluated by the FDA.”

The **Dietary and Supplement Health and Education Act** was approved by Congress in October 1994 and updated in January 2000. **It sets forth what can and cannot be said about a pharm product without prior FDA review.**

FDA and the Nutritional Supplements

2000 – FDA: Supplement makers cannot state their products can improve the structure or function of the body or improve common, minor symptoms.

Allowed statements: "maintains a healthy heart", "helps you relax", "is good for symptoms of PMS", "strengthens joint structure", etc.

Overall, due to this law, vitamin, herbs, and nutrient manufacturers have greater freedom to say what their products can do to improve our health.

More About Vitamins/Nutritional Additives (cont'd)

While this law limits what vitamin manufacturers can claim about preventing or curing diseases, its passage has been a major milestone in the natural health field.

It opens the way for people to obtain the information they need to make the best nutritional choices for themselves.

FOOD STORAGE, PRESERVATION, AND TRANSPORT

Food Preservation Methods

2,000 BC - **Sun drying** ⇨ better taste (?)

600 CE - **Jam** ⇨ boiling the pulp, adding sugar ⇨ spreadable concoction

1,400 CE – **Curing -** Uses salt or sea salt:

- Extracts the water
- Sterilizes the meat
- Salt slows down the oxidation process

Food Preservation (cont'd)

1,758 CE - **Refrigeration** - Benjamin Franklin and John Hadley - Evaporation of highly volatile liquids, such as alcohol and ether lowers the temperature

1,809 CE - **Canning** – Boiling the food and sealing it in closing cans

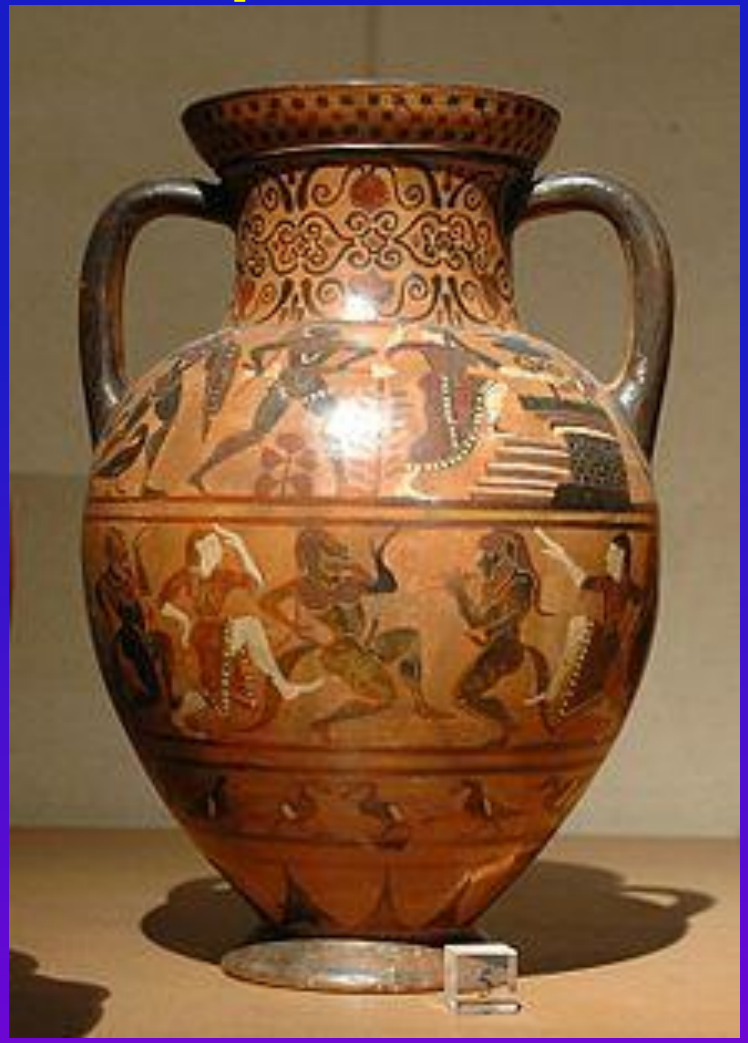
1,871 CE - **Pasteurization** of milk

1,945 CE - **Vacuum Packing**

2,000+ CE - **Chemical Preservation**

Ceramic Vessel from Mesopotamia
4500 – 4000 BC

Ceramic Amphora 540 – 530 BC



TYPES OF FOOD
Other than regular food

Comfort Food
Fast Food
Junk Food
Natural Food

Organic Food
Slow Food

Whole Food

MADELEINE (French Comfort Food – Marcel Proust's *"In Search of Lost Time"*)

British Comfort Food – Sausages and Mash)

Fish and Chips

Lamb Shish Kebab

Universal Comfort Food – Chicken soup (Mothers' Remedy)

History of Fast Food

Name	Year Founded	Place
KFC	1930	North Cotton, KY
Bob Big Boy's	1936	Burbank, CA
Dairy Queen	1940	Joliet, IL
Carl's Jr.	1941	Los Angeles, CA
Baskin-Robbins	1945	Glendale, CA
Jack in the Box	1951	San Diego, CA
McDonald's	1955	Des Plaines. IL

The Classic Trio: Burger, French Fries, and a Soft Dink

SLOW FOOD (Good, clean, and fair)

An International Organization with the aim to promote local foods and traditional gastronomy and food production.

An opposition to fast food, industrial food production, and globalization.

Founded in Italy in 1986. Members in 150 countries.

Slow Food - Restaurant in Santorini, Greece

National Organic Program (USDA)

From Hunting/Gathering to Processed Food and Genetic Engineering

2,000,000 years – Hunting & gathering: Meat, vegetables, roots, fruits, mostly raw

10,000 years – Agriculture: Grains, diary

200+ years – Industrial revolution: Factory farms, canning, pesticides, processed flour, and sugar

50 years – Proliferation of processed foods, fast food, TV dinners, convenience foods

10 years – Genetic engineering, fertilizers, hormones in meats, organic food

From Hunting/Gathering to Processed Food and Genetic Engineering

ALCOHOLIC BEVERAGES

Fruit and Vegetable Fermentation

Sugar fermentation ⇨ **Alcohol**

Any fruit or cereal may produce an alcoholic drink

Not distilled

Honey ⇨ mead

Barley ⇨ beer

Grapes ⇨ wine

Apples ⇨ cider

Fruits ⇨ liqueurs

Herbs ⇨ Vermouth

Distilled

Potatoes ⇨ vodka

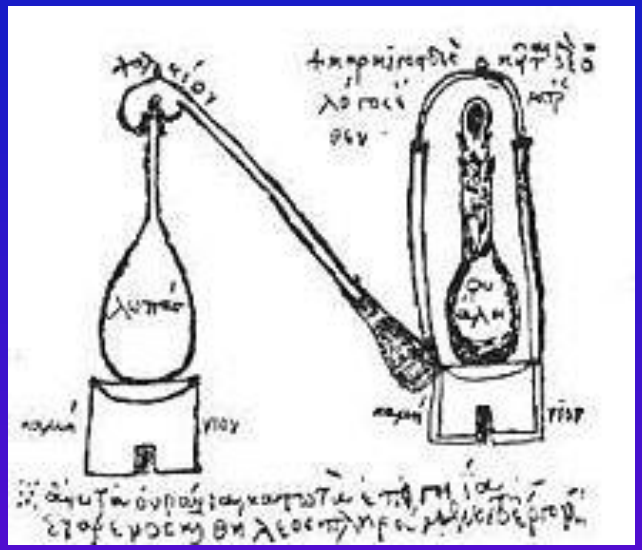
Corn ⇨ bourbon

Wheat ⇨ whiskey

Agave ⇨ tequila

Plums ⇨ Slivovitz

The Alembic



Ancient

Medieval

Modern

WINE

History Of Wine (I)

C. 8000 BC - 6000 BC - First evidence of wine production in Georgia? Or Armenia?

Product of *Vitis vinifera vinifera,* a sturdy plant.

Adopted in the religious ritual, Persia, Greece.

Dionysus, Greek “god of wine”

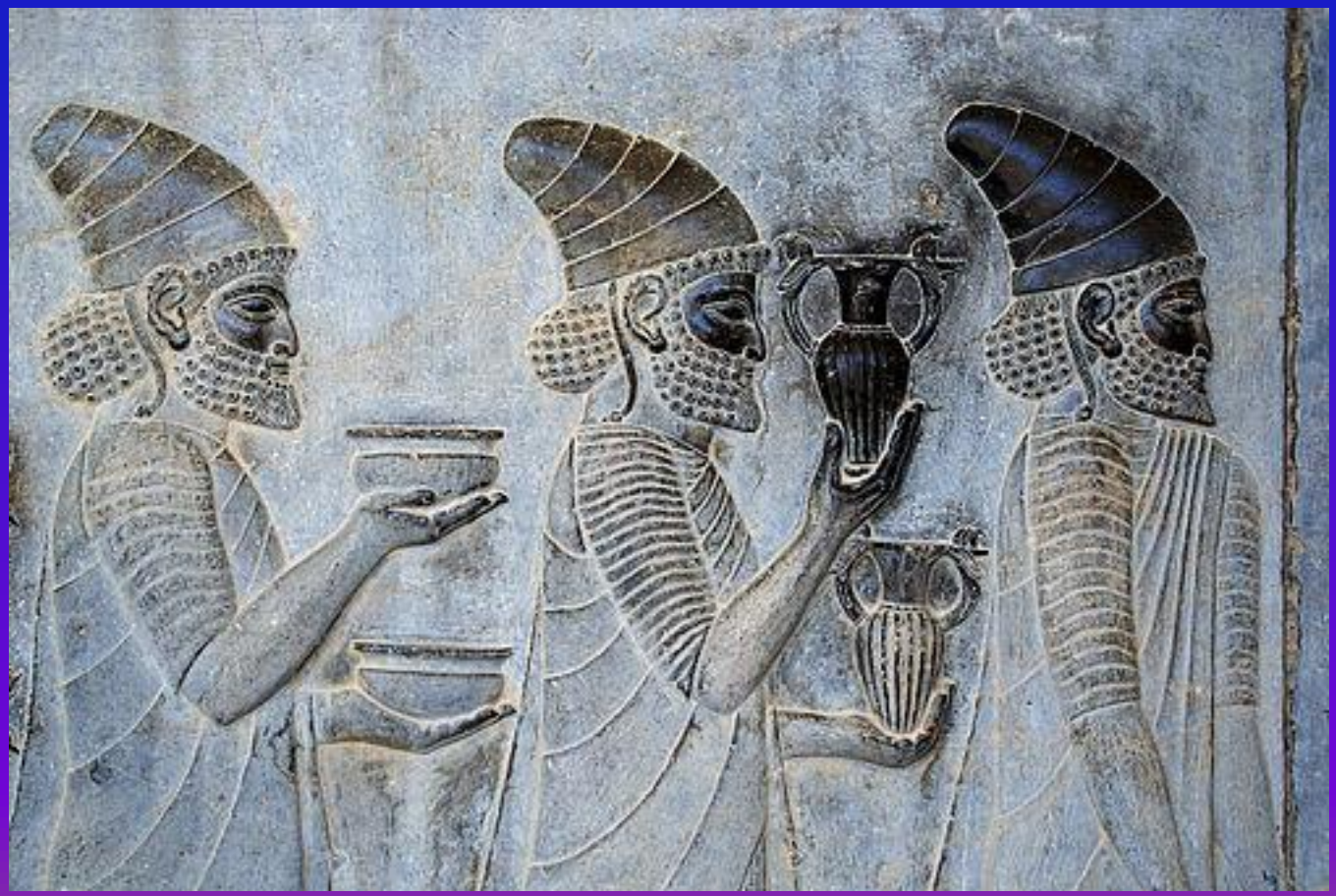
C. 3000 BC - Phoenicia was the intermediary for wine culture in Egypt

Wine arrived in China through Macedon’s Indo-Greek kingdom

The Areni 1 caves in Armenia
Site of oldest winery

Armenians bringing wine to the Persian Shah

Relief on stone in Persepolis, Iran



History of Wine (II)

2,800 BC - 600 BC – Wine making in Mesopotamia (Epic of Gilgamesh)

2,000 BC - Wine making reached the Greek and Italian peninsulas

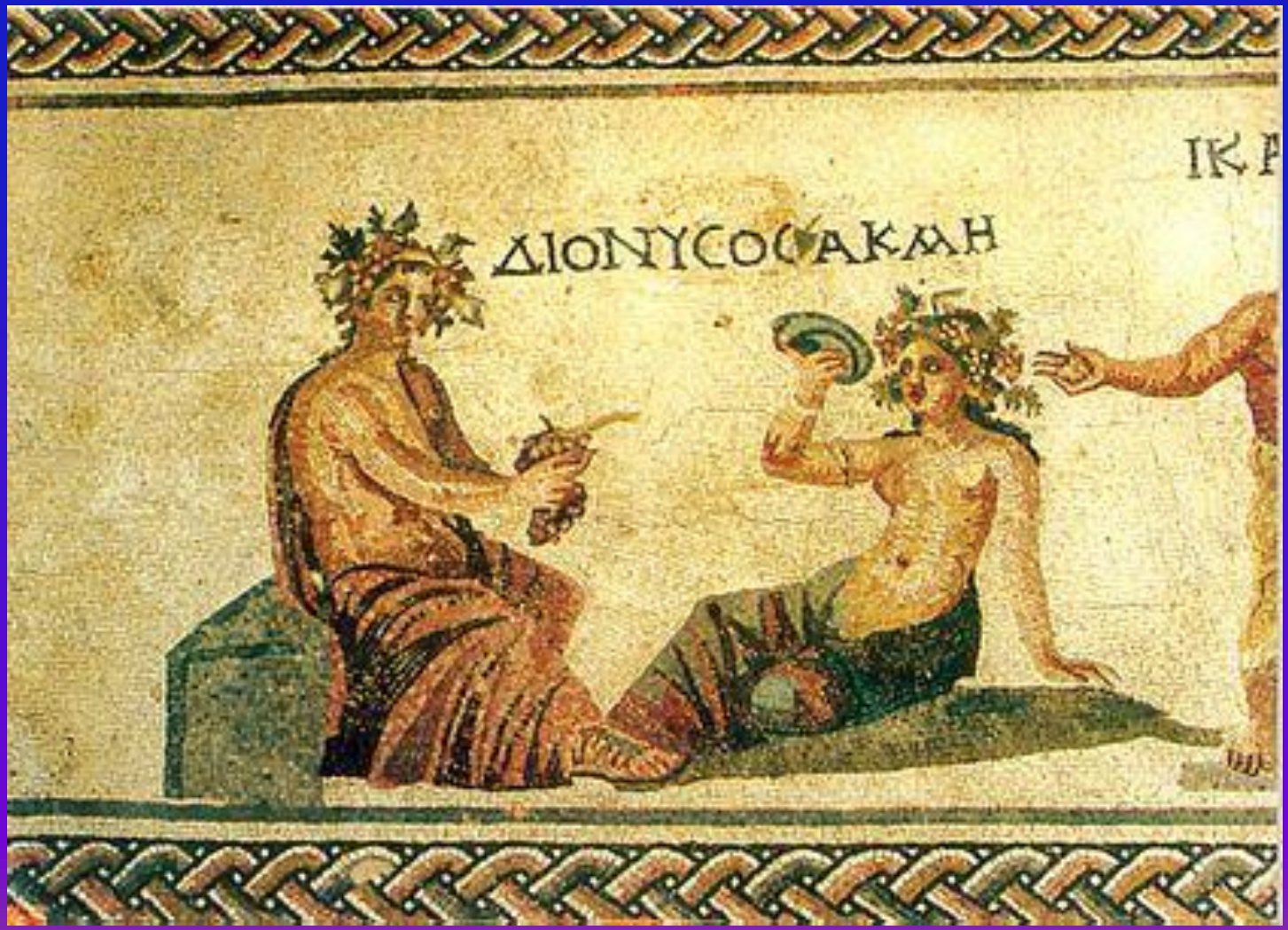
1st cent. CE - Roman Empire ⇨ Great business

Western Europe wines are from the Roman source

Barrels made in the Gaul (today's France), glass bottles in Syria, clay vessels in Mesopotamia

5th - 8th cent. CE - Barbarian invasions – Christian, Jewish, and Muslim churches preserved winemaking for ritual purposes

Hellenistic mosaic showing Dionysos, the god of wine



Gallo-Roman River Boat with Wine Barrels – 2nd cent. CE

History of Wine (III)

Modern times – European wine cultivated by the Benedictine monks

Dom Perignon, Burgundy, Bordeaux wines in France

Rheingau and Riesling in Germany

Mexico – 16th cent. through the conquistadors, for the Holy Eucharist

16th cent. Wine culture from Europe in California, Argentina, and Chile. Spanish sacramental wine

19th cent. European varieties

1863 - *Phylloxera* louse infested Europe ⇨70% destruction of vineyards. American vines were immune ⇨ grafted French vines and saved them.

END OF LECTURE # 3