

*embracing your health*

# Nutrition 101 – Class 1

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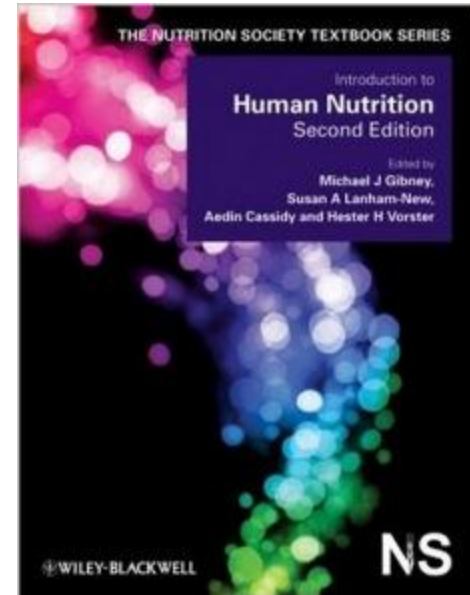


# Nutrition 101

“Introduction to Human Nutrition” second edition

Edited by Michael J. Gibney, Susan A. Lanham-New, Aedin Cassidy, and Hester H. Vorster

May be purchased online  
but is not required for  
the class.



# Classes

## Live classes from Chicago

 April 3<sup>rd</sup>, April 10<sup>th</sup>, and April 24<sup>th</sup>

## Webinar classes

 April 17<sup>th</sup>, May 1<sup>st</sup>, and May 8<sup>th</sup>

## Archived

 All classes for 1 year



# Nutrition 101 Classes

- Week 1 – Introduction and Body Composition
- Week 2 – Energy Metabolism
- Week 3 – Nutrition and Metabolism of Proteins and Amino Acids
- Week 4 – Digestion and Metabolism of Carbohydrates
- Week 5 - Nutrition and Metabolism of Lipids
- Week 6 – Dietary Reference Standards

# Nutrition 102 Classes

- Week 1 – The Vitamins
- Week 2 – Minerals and Trace Elements
- Week 3 – Measuring Food Intake
- Week 4 – Food Composition
- Week 5 – Food and Nutrition: Policy and Regulatory Issues *and* Nutrition Research Methodology
- Week 6 – Food Safety: A Public Health Issue of Growing Importance *and* Food and Nutrition-Related Diseases: The Global Challenge

# Introduction to Human Nutrition

## 👤 A Global Perspective on Food and Nutrition

- 👤 Human nutrition is a complex, multifaceted scientific domain indicating how substances in foods provide essential nourishment for the maintenance of life.



# Orientation

## 👤 First renaissance

👤 second half of the 18<sup>th</sup> century

👤 Nutrition was studied from a medical model by defining the chemical structures and characteristics of nutrients found in foods, their physiological functions, biochemical reactions and human requirements to prevent, first, deficiency diseases and, later also chronic non-communicable diseases.



# Orientation

## ❏ Second Renaissance

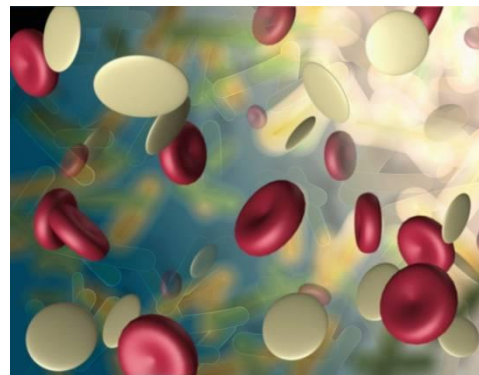
- ❏ Since the late 1980s
- ❏ Emphasis shifted from medical or pathological paradigm to a more psychosocial, behavioral one in which nutrition is defined as a basic human right, not only essential for human development but also as an outcome of development.





# Human Nutrition

- Describes the processes whereby cellular organelles, cells, tissues, organs, systems, and the body as a whole obtain and use necessary substances obtained from foods (nutrients) to maintain structural and functional integrity



# Nutrients

- Can directly influence genetic (DNA) expression, determining the type of RNA formed (transcription) and also the proteins synthesized (translation)
  - i.e. iron increases translation for the synthesis of ferritin
- Act as substrates and cofactors in all of the metabolic reactions in cells necessary for the growth and maintenance of structure and function

# Homeostasis

- Optimal function and survival of cells
- Nutrients and oxygen are provided to the internal environment by the circulating blood, which also removes metabolic end-products and harmful substances from this environment for excretion through the skin, the kidneys, and the large bowel
- The different organs and systems of the body extracts the nutrients and oxygen and transfers it to the blood for transport to the cells

# Nutrition

- 1<sup>st</sup> renaissance – study of nutrients and their functions. Study of the relationships between nutrition and health or ill-health
- 2<sup>nd</sup> renaissance – expands to include the study of all other external environmental factors that determine what and how much food and nutrients are available on a global level

# Study of Human Nutrition

- Seeks to understand the complexities of both social and biological factors on how individuals and populations maintain optimal function and health
- How the quality, quantity and balance of the food supply are influenced
- What happens to food after it is eaten
- Way that diet affects health and well-being

# Relationship of Nutrition and Health

- Optimum nutrition
- Under-nutrition: hunger
- Over-nutrition
- Malnutrition



*Nutrition is a major modifiable and powerful factor in promoting health, preventing and treating disease, and improving quality of life*

# Nutrients

- It is the combination and amounts of nutrients in consumed foods that determine health.
- To understand nutrition, you have to know about nutrients



# Nutrient Basics

- Chemical and physical structure and characteristics of the nutrient
- Food sources of nutrient, including food composition, the way in which foods are grown, harvested, stored, processed and prepared, and the effects of these on nutrient composition and nutritional value
- Digestion, absorption, circulatory transport, and cellular uptake of the nutrient, as well as regulation of all these processes



# Nutrient Basics

- Metabolism of the nutrient, its functions, storage, and excretion
- Physiological needs for the nutrient in health and disease, and during special circumstances (pregnancy, lactation, sport events), as well as individual variability
- Interactions with other nutrients, non-nutrients (phytochemicals), anti-nutrients, and drugs

# Nutrient Basics

- Consequences of under consumption and overconsumption of nutrients
- Therapeutic uses of the nutrient
- Factors influencing food and nutrition security and food safety



# Known Nutrients

- There are more than 50 known nutrients and many more chemicals in food thought to influence human function and health
- Nutrients do not exist alone except in water
- Nutrients interact with each other in foods, in the gut during digestion, fermentation and absorption, in the blood during transport, and in cells during metabolism
- Nutrients should not be studied in isolation, but integrated with other nutrients and seen in the context of total body function



# Hippocrates and Moses Maimonides

- For a long and healthy life, one should avoid too much fat in the diet, eat more fruit, get ample sleep, and be physically active
- This is still incorporated in the modern, science-based dietary guidelines of the twenty-first century



# Future for Nutrition Research and Practice

- There are 12,000 different substances in plant foods, not yet classified as nutrients, that could be examined
- Possible new functions of known nutrients, and even new nutrients, may be discovered, described, and applied in the future



# Functional Foods

- Foods that are new or novel foods, developed to have specific health benefits, in addition to the usual functions
- Spreads with phytosterols → lower LDL chol
- Starchy products with resistant starch → lower glycemic indices, to help control blood glucose levels



# Food Safety

- The continued provision of safe food, free from microorganisms, toxins, and other hazardous substances that cause disease, remains a huge challenge
- Need for continuous monitoring of the food supply by health officials





# Possible Hazardous Substances

- Microbial contamination
- Natural toxins
- Agricultural residues
- Environmental contamination
- Intentional additives



# Body Composition

- This data is used to evaluate nutritional status, growth and development, water homeostasis, and specific disease states



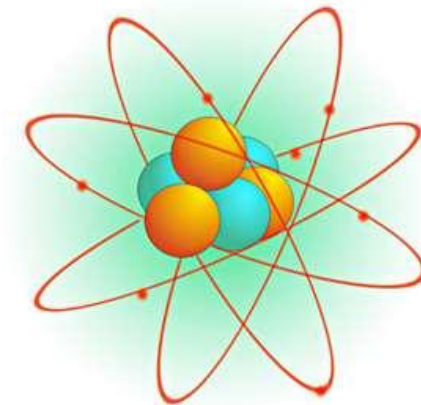
# 5 levels of body composition

- Atomic
- Molecular
- Cellular
- Tissue
- Whole Body



# Atomic Level

- Many chemical elements (atoms) are found in the human body, but the 6 elements oxygen, carbon, hydrogen, nitrogen, calcium, and phosphorus are the most abundant and together account for more than 98% of body weight



# Molecular Level

- ❏ Chemical elements in the human body are bound in molecules
- ❏ Main compartments are water, lipids, proteins, minerals, and carbohydrates



# Water

- Water in body can be as high as 60-70% of total body weight depending on body fat content
- Males have more body water than females, as their body fat content is lower
- Total body water can be divided into intracellular water and extracellular water, and the ratio of the two is an important health parameter that is disturbed in many diseases

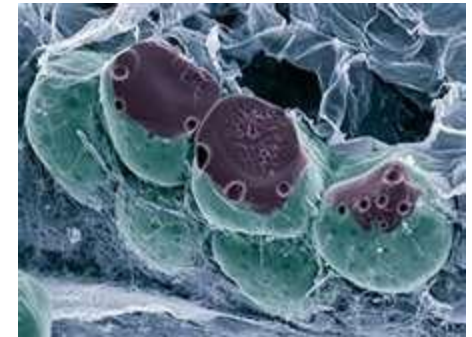
# Lipids

## ❏ Essential lipids

- ❏ Phospholipids (cell membranes)
- ❏ Sphingomyelin (nervous system)

## ❏ Nonessential

- ❏ Mostly triglycerides are the most abundant
- ❏ Energy store of the adult human body
- ❏ Insulate against cold
- ❏ Protect vital organs such as the kidneys against mechanical damage
- ❏ Enhance the body's appearance (to an extent)



# Body Fat

- In healthy “normal weight” men – 10-25%
- In healthy “normal weight” women – 15-25%
- In severe obese – 60-70%





# Body Protein

- 10-15%
- Higher in males than in females
- Males generally have more muscles



# Minerals

- 3-5% dependent on body fat
- Calcium and phosphorus found mostly in bones
- Carbohydrates are found in the body as glucose (blood sugar) and glycogen, a polysaccharide in muscle and liver cells that serves a short-term energy store




# Cellular Level



## Body cell mass

-  Cells with all their contents, such as water, proteins, and minerals

## Extracellular fluids

-  95% water
-  Plasma in intravascular space
-  Interstitial fluid in extravascular space

## Extracellular solids

-  Proteins – collagen
-  Minerals – bone minerals and soluble minerals in the extracellular fluid

# Tissue Level

- Cells with equal functions form tissues, including muscular, connective, epithelial, and nervous tissue
- Body weight = adipose tissue + skeletal muscle + bone + organs + rest



# Whole Body Level

- Body composition measurements at the whole body level use simple body parameters to give an insight into body composition




# Body Composition Techniques




## Direct

-  determined without or with only minor assumptions
-  Chemical carcass analysis

## Indirect

-  Determined indirectly
-  Determination of body protein from body nitrogen, assuming a constant conversion factor of 6.25 from nitrogen to protein

## Doubly indirect

-  Statistical relationship between easily measurable body parameters and the component of interest
-  Assessment of body fat from skin-fold thickness
-  Assessment of skeletal muscle mass by creatinine excretion

# Direct Methods

- ❖ Carcass analysis – only a few human cadavers form the basis for the assumptions that are normally used in indirect methods
- ❖ In vivo neutron activation analysis – allows the determination of specific chemical elements in the body



# Indirect Methods

- Densitometry – assumes that the body consists of a fat mass, in which all “chemical” fat is located, and the fat free mass, which consists of (fat-free) bones, muscles, water, and organs
- Body density can be determined by several techniques, the oldest and perhaps most accurate being underwater weighing



# Doubly Indirect Methods

## Anthropometry

Weight/height index such as BMI

The relationship between BMI and body fat % is age and gender dependent and is different among certain ethnic groups

Body Mass Index (BMI) Chart for Adults

Overweight (25-30) Underweight (16.5-20) Underweight (15.0)

HEIGHT in feet/inches and centimeters

WEIGHT	4'0"	4'1"	4'2"	4'3"	4'4"	4'5"	4'6"	4'7"	4'8"	4'9"	4'10"	4'11"	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	6'5"		
160 (56.7)	14.5	14.7	14.9	15.1	15.3	15.5	15.7	15.9	16.1	16.3	16.5	16.7	16.9	17.1	17.3	17.5	17.7	17.9	18.1	18.3	18.5	18.7	18.9	19.1	19.3	19.5	19.7	19.9	20.1	20.3	20.5	
200 (72.5)	18.2	18.5	18.8	19.1	19.4	19.7	20.0	20.3	20.6	20.9	21.2	21.5	21.8	22.1	22.4	22.7	23.0	23.3	23.6	23.9	24.2	24.5	24.8	25.1	25.4	25.7	26.0	26.3	26.6	26.9	27.2	27.5
250 (90.7)	22.8	23.2	23.6	24.0	24.4	24.8	25.2	25.6	26.0	26.4	26.8	27.2	27.6	28.0	28.4	28.8	29.2	29.6	30.0	30.4	30.8	31.2	31.6	32.0	32.4	32.8	33.2	33.6	34.0	34.4	34.8	35.2
300 (108.0)	28.2	28.7	29.2	29.7	30.2	30.7	31.2	31.7	32.2	32.7	33.2	33.7	34.2	34.7	35.2	35.7	36.2	36.7	37.2	37.7	38.2	38.7	39.2	39.7	40.2	40.7	41.2	41.7	42.2	42.7	43.2	43.7

Source: BMI scales rounded to the nearest whole number. BMI categories based on CDC (Centers for Disease Control and Prevention) criteria. © 2009 Vertex42 LLC

# Skinfold Thickness Measurements

- Body fat is located both internally and subcutaneously
- Total body fat can be estimated by measuring the amount of subcutaneous adipose tissue
- This can be estimated by measuring the thickness of the subcutaneous fat layer at different sites of the body using a skinfold caliper
- Females generally have more internal fat
- Measuring skinfolds adequately require a trained and experienced observer
- Obese and people with edema are difficult to measure

## Other Anthropometric Variables

- Measurements of widths of skeletal diameters provide an indication of the amount of skeletal mass
- There are formulae that allow the calculation of the skeletal mass from body height, wrist diameter, and knee diameter
- The current reference data for ideal weight in the USA use the elbow diameter to classify people in three types of body build
- The World Health Organization suggests an upper limit of waist to hip circumference ratio above 0.85 for females and 1.0 for males for abdominal fat distribution

# Bioelectrical Impedance

- A small alternating current is applied to the body
- It is assumed that the body consists of different components, of which water and dissolved electrolytes are able to conduct the current
- Hence, body impedance is a measure of body water.



# Body Composition

- ❖ Because of differences in body build, frame size, and other variables, there may be differences in the relationship between BMI and body fat percentage among ethnic groups
- ❖ Some Asians have a higher fat % and therefore greater risk for several chronic diseases at a given BMI than Caucasians
- ❖ Conversely, Africans often have higher bone density than Caucasians

# Questions, Comments





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