BIOAVAILABILITY

(what we get from what we have taken in)

BIOAVAILABILITY

- Definition
- What makes it up
- Critical phase
- Hormonal factors in
- How its measured
- Membrane transporters
- Special cases for redox metals

First basic law of nutrition:

No nutrient is absorbed and utilized to the full extent that it is fed

Steven Blezinger

Define Bioavailability

- That which becomes bioavailable
- The fraction (or percentage) of nutrient absorbed that is useful to the body
- The degree to which an absorbed nutrient is available to the system

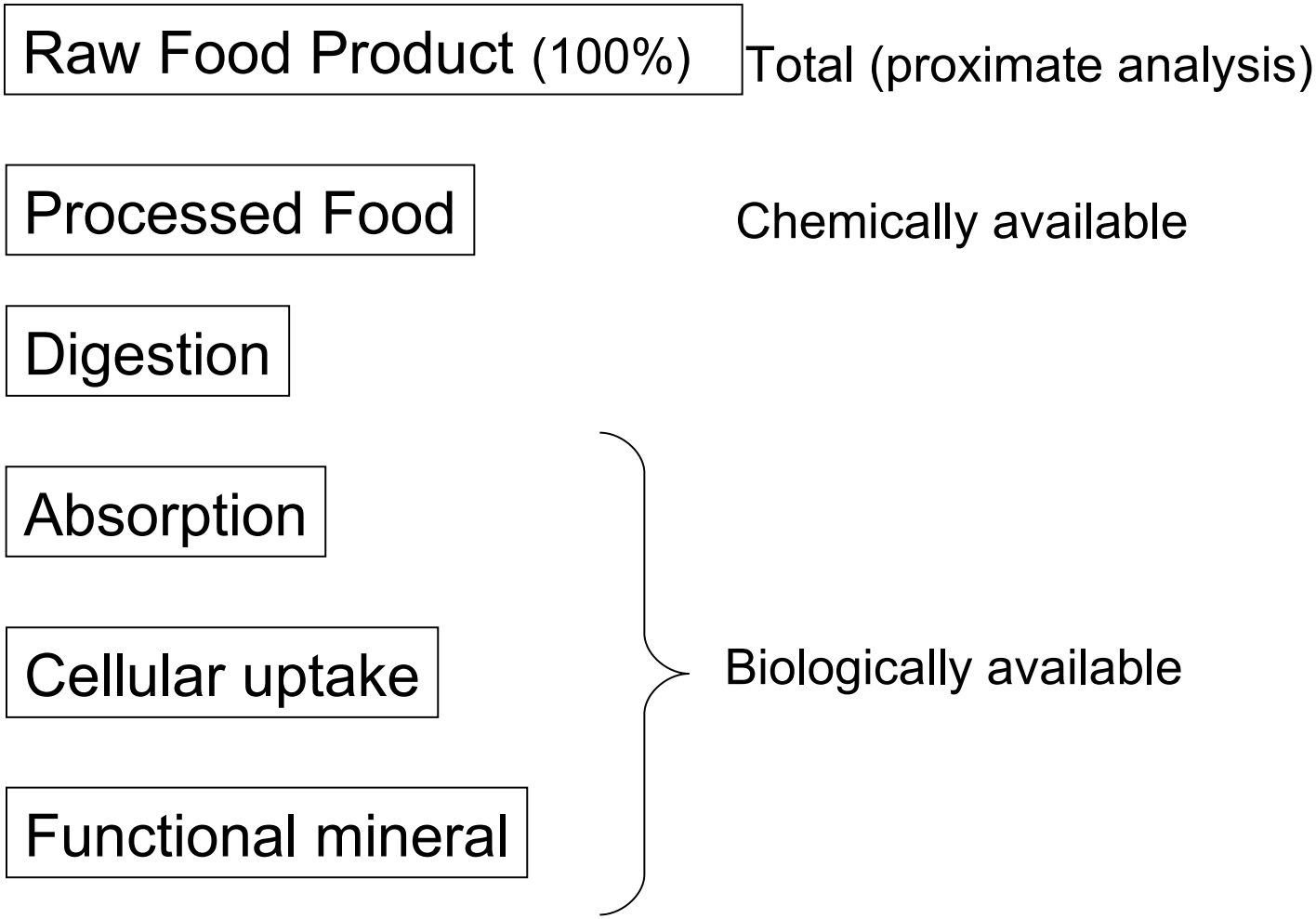
Nutritional Definition

Bioavailability is a post-absorption assessment of how much of a nutrient that has been absorbed becomes functional to the system

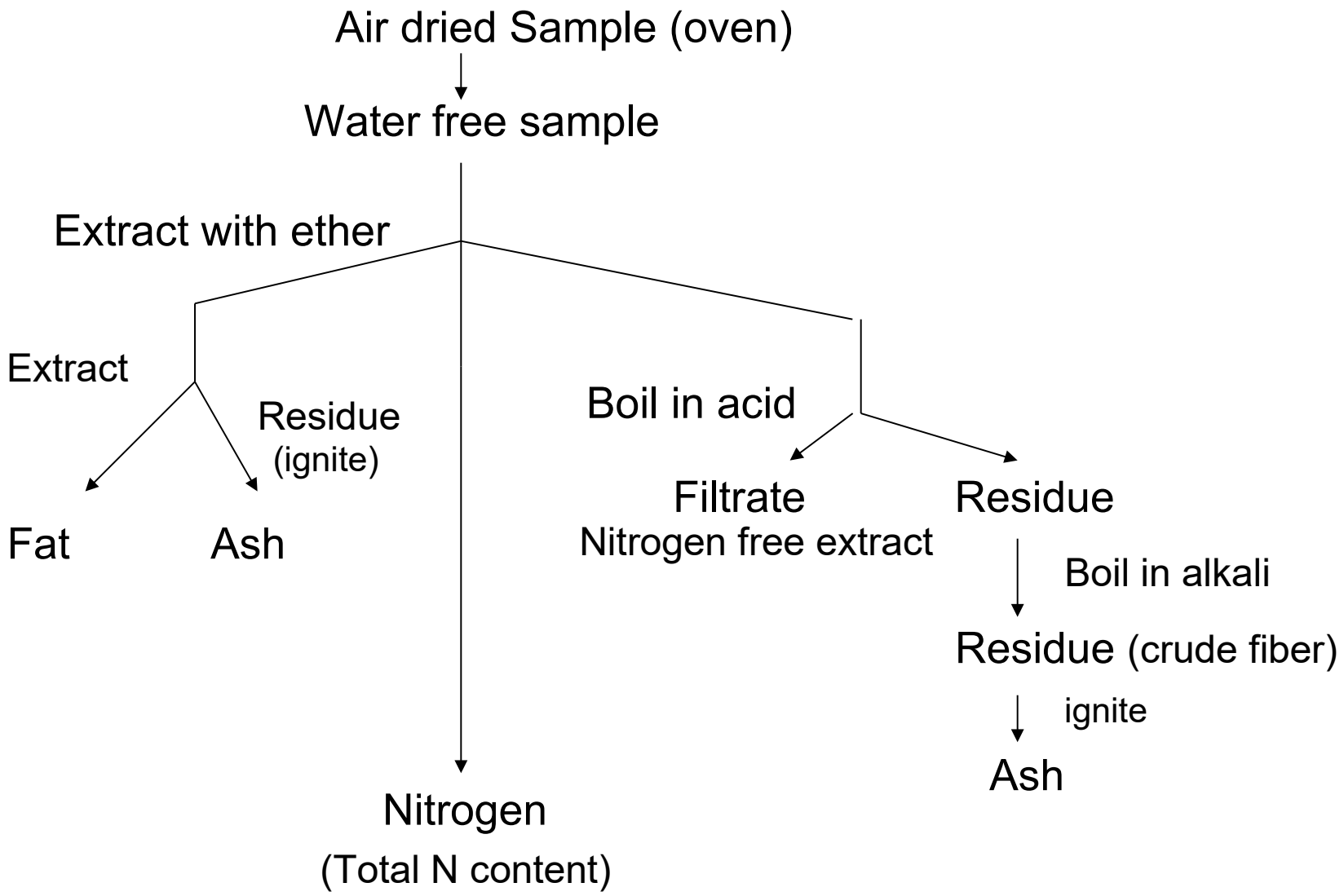
Food Science Definition

Bioavailability is a assessment of how much of a nutrient is retained in the food product after processing for the consumer

Bioavailability *in toto*



Basic Scheme of Proximate Analysis



Biological Availability

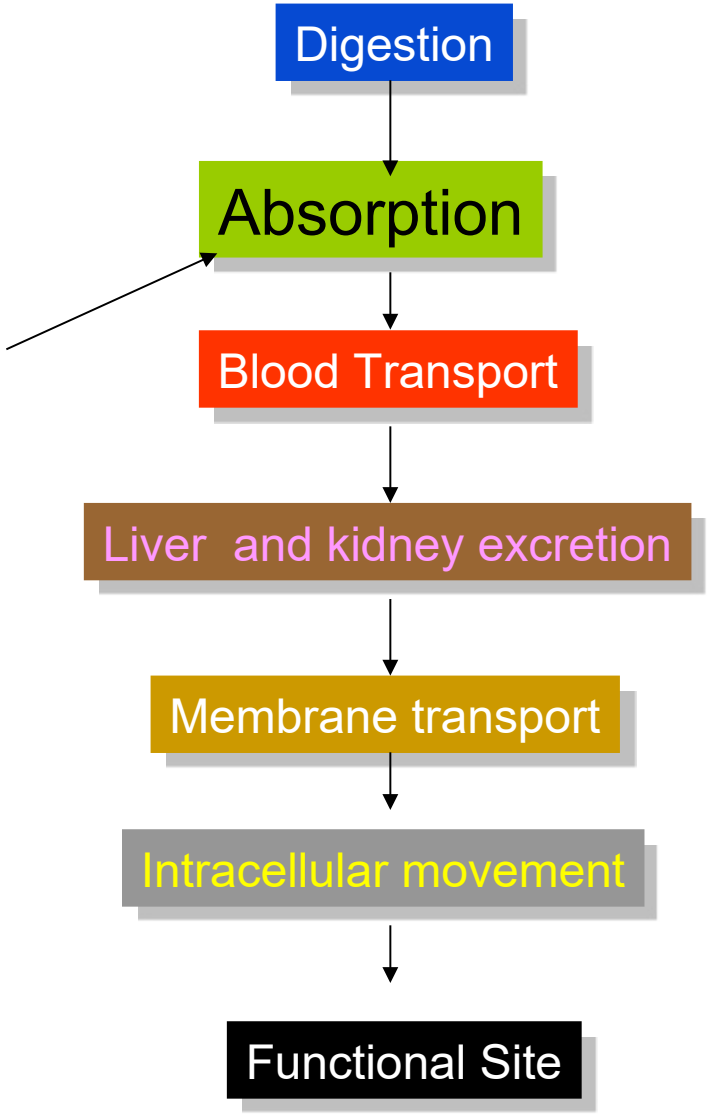
(Bioavailability)

Definition can be based on either the percentage of a nutrient **ingested** or the percentage of a nutrient **absorbed** that becomes useful to the organism

The percentage ingested is preferred by some because the percentage absorbed is difficult to determine and relies on an indirect analysis

The percentage absorbed is, nonetheless, a more accurate appraisal of bioavailability

The fraction of the total amount absorbed that performs a function



Which is the most critical phase for minerals?

Losses along the way

Recall

A nutrient is considered outside the body until it passes thru the intestinal barrier

The amount that gets absorbed depends on:

Extrinsic Factors

Digestibility of the food source

Solubility of the mineral

Elements in the food source that hinder or facilitate absorption

With a focus on the organism, bioavailability depends on:

Intrinsic Factors

Age
Health
Nutritional state
Physiological state
Genetic predisposition
Gender
Developmental stage
Species

Components of Bioavailability

- Digestion
- Absorption
- Liver surveillance
- Transport
- Transmembrane movement
- Intracellular movement
- Target binding

Absorptive Phase

Assimilation Phase

Why Not Absorption Alone as an index of Bioavailability

As pointed out by O'Dell, assimilation may be a major part of a mineral's bioavailability and needs to be assessed separately

	Absorption %	Retention %[a]
75Se as selenite	92	<50
75Se as selenomethionine	96	>80

[a]Arbitrary units

2-picolinic acid enhances zinc absorption in rats by nearly 60%. But, also increases zinc excretion so there is no net effect on retention and hence no increase in bioavailability

Contd..

An Overall Assessment of Minerals

- What they are (chemistry)
- What they do (biochemistry)
- How they get in our body (absorption)
- How they get into cells (transport, assimilation)
- How efficient are they (bioavailability)
- How are they regulated

Chemistry

1. Chemical properties relative to function
    1. Ionization
    2. Solubility
    3. Valence
    4. Electronic configuration

Biochemistry

1. Biochemical properties relative to function
    1. Macro vs microminerals
    2. Enzyme cofactors
    3. Pathway components
    4. Crystallization
    5. Binding proteins

Absorption

1. Solubility
    1. Mucins, ligands, pH
2. Valence
3. Transport proteins (intestinal sites)
4. Cytosolic transport and storage
5. Export factors

Transport and Assimilation

1. Transport proteins in plasma
2. Membrane receptors and channels
3. Membrane transport
    1. Simple diffusion
    2. Mediated diffusion
    3. Active transport
    4. Receptor mediated endocytosis
4. Cytosolic transport
    1. Vesicles
    2. Metallochaperones

Bioavailability

1. Ways to measure mineral bioavailability