The Edge: Optimal Weight and Health Management

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Abstract: A methodology for maintaining a target weight is described.

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1 First Steps

First things first; we must make clear what weight and mass are, physically. [2]

Definition 1. weight is the vertical force exerted by a mass as a result of gravity.

Definition 2. mass is the amount of matter in an object

Definition 3. force is a physical influence, which when applied to an object causes it to accelerate in the direction from which it was applied.

Now, it is not polite to objectify people, but in physics accounting parlance people are just as much objects as anything else is, otherwise caskets would not weigh anything.

2 Biology

2.1 The Origins of Life: Abiogenesis

Definition 4. abiogenesis is the natural process by which life has arisen from non-living matter, such as simple organic compounds.
While the details of this process are still unknown, the prevailing scientific hypothesis is that the transition from non-living to living entities was not a single event, but an evolutionary process of increasing complexity that involved molecular self-replication, self-assembly, autocatalysis, and the emergence of cell membranes.

**Definition 5.** Weak bonds are those forces of attraction that, in biological situations, do not take a large amount of energy to break. ... In biological terms, ionic bonds, hydrogen bonds, and van der Waals interactions are considered weak bonds.

### 2.2 Self-Assembly and Mechanisms of Control

Self-assembly and control are essential functions that cells perform by spontaneously bonding via multiple specific weak bonds as they are jostled about by random thermal motions in their surrounding environments. [1, 3-2]

#### 2.2.1 Allostary (ATP and ADP)

**Definition 6.** Allostery refers to processes whereby a binding event at one site of a biological macromolecule affects the binding activity at another distinct functional site, enabling the regulation of the corresponding function.

**Definition 7.** Adenosine triphosphate (ATP) is a naturally occurring nucleotide, which has multiple biochemical functions in cells. It is also active extracellularly, acting via P2X (ligand-gated positively charged ion channels) and P2Y receptors (7-transmembrane receptors), which are expressed in most cell types throughout the body. ATP is released as an excitatory co-transmitter with norepinephrine from postganglionic sympathetic nerves, with acetylcholine from postganglionic parasympathetic nerves and from sensory, enteric and central neurons.

#### 2.2.2 Phosphorylation/Dephosphorylation (glycogen)

#### 2.2.3 Hormone and Cyclic AMP cascade (glycogen)

#### 2.2.4 End-product Inhibition (amino acid)

### 2.3 What is Inflammation and How Is It Connected to Homeostasis?

**Definition 8.** Homeostasis is metabolic equilibrium actively maintained by several complex biological mechanisms that operate via the autonomic nervous system to offset disrupting changes

A framework that highlights the connections between homeostasis and inflammation based on concepts previously developed in control theory and dynamical systems theory is presented in [5].

### 3 Weight Management

#### 3.1 Measure Body Fat Percentage

Use some calipers, or fancy scales, or go to a professional gym and find out what your current body fat percentage is as accurately as you can determine.

#### 3.2 Measure Weight

Record your weight with no clothes on after a good nights rest before eating or drinking anything.
3.3 Determine Amount of Muscle Mass

To determine the amount of muscle mass you have, multiply the amount that your scales indicate in your local gravitational field (maybe Mars colonists will use this system one day, but most likely you are on Earth where the force is approximately 32.15 feet per second or 21.9 miles per hour near the surface) by your current body fat percentage estimate; now, subtract this amount from your total weight. This amount is the amount of lean muscle mass you have. To use the formula below, you will need to convert these amounts into units of kilograms. To convert from pounds to kilograms use the formula

\[ 1 \text{ kg} = 2.20462 \text{ lb} \]  

so that

\[ \ell = \frac{\text{weight in lbs}}{2.20462} \]  

3.4 Use The Katch-McArdle Formula to Calculate Daily Your Resting Energy Expenditure

The Katch-McArdle formula is used to predict Resting Daily Energy Expenditure (RDEE). The Cunningham formula is commonly cited to predict RMR instead of BMR; however, the formulas provided by Katch-McArdle and Cunningham are the same.

- \( P = 370 + (21.6 \cdot \ell) \)

where \( \ell \) is the lean body mass (LBM in kg)

- \( \ell = m \left(1 - \frac{f}{100}\right) \)

where \( f \) is the body fat percentage. According to this formula, if the woman in the example has a body fat percentage of 30%, her Resting Daily Energy Expenditure (the authors use the term of basal and resting metabolism interchangeably) would be 1262 kcal per day. [3, p.266] [4, p.57]

3.5 Use Daily Resting Energy Expenditure \( P \) To Determine Optimal Consumption Plan

Now that we know approximately the base rate at which we burn energy, \( P \), this number tells us the number of calories we burn simply existing and not even exerting ourselves in any way or exercising. To have a balanced diet, we need to always try to get as close as possibly to having these 3 macronutrient proportions:

- 60% Protein
- 30% Carbohydrates (Lower Glycemic Index is Better)
- 10% Fat (As little saturated fat as possible)

3.6 To Lose Weight At Your Bodies Optimal Rate You Need to Consume Roughly \( P - 500 \) Calories

If you exercise, there is a scaling factor, but the main goal is to consume 500 calories per day less than you burn. By doing this, you will not starve your cells and send them into conservation mode nor will you flood them with excess energy which gets converted into lipids(fat).

3.7 Record Your Weight Daily: There will be Random Variance Around a Mean

This information is very encouraging after you have gathered it for a few weeks and have enough data-points to see the linear downward trend and the variance of weight fluctuation.

3.8 Keep Going Back to the First Steps :)
Bibliography