

Background

Existing conditions, especially those that would be confused with the phenomenon to be observed or measured. As background *radiation*, it could be an existing measure of *radioactivity* before any additional would be introduced at that location. Sources of such can include cosmic rays and prior contaminations of an environment. Sometimes the term is used to identify some quantifier of an uninteresting region surrounding a *hot spot* of interest.

Background correction

A method to adjust a *radiation* detector's output to correct for *background* effects. This usually involves simply a subtraction of a background measure of *radioactivity* from a measurement that includes both it and that from the object of interest.

Example: A counter with a somewhat constant background of 400 *cpm* gives a gross *count rate* of 10,000 *cpm* when a sample is being counted. The net count rate for the sample alone is obtained by making a background correction: $10,000 - 400 = 9,600$ *cpm*.

Backprojection

Filtered backprojection.

Baseline

A standard state or condition to which things may be compared. A common practice in *imaging* strategy is to deliberately plan a *scan* in which the subject is at a baseline condition, such as a normal condition. This is in anticipation of another imaging at a different condition expected to have changes to be studied. The first scan would be referred to as a baseline scan. When monitoring the effectiveness of a therapy or progression of a disease, the first scan in a series of two or more could be the baseline scan and need not be a normal healthy condition.

Becquerel

The SI unit of *activity* of a *radionuclide*, equal to one *nuclear* disintegration or other nuclear transition from a particular *energy* state occurring in an amount of a radionuclide during a 1-s-long time interval. SI stands for *Système International d'Unités* (International System of Units), with its core units of the meter, kilogram, and second. With worldwide acceptance of its units, the becquerel is now preferred over the historically used *curie* ($= 3.7 \times 10^{10}$ Bq). Abbreviation is Bq.

Bed

A *scanner's* narrow horizontal platform on which the subject lies to be moved *axially* within the *gantry* in order to position appropriate subject sections within the scanner's *field of view*. Figure P.4 shows the bed associated with a *PET/CT*.

Bed position

A designated location of the *bed* as it is moved through the *scanner* for purposes of positioning a desired part of the subject in the *field of view*. During *whole body scans*, several bed positions would be used. In each of these an *image* would be acquired.

Beta

Beta particle.

Beta particle

Electron or *positron* upon its emission from an *atom*. Streams of these are called beta rays.

Bias

Any systematic, that is, not random, deviation of results or inferences from the truth, or processes leading to such deviation. In a clinical trial this can be a flaw in the study design or method of collecting or interpreting information. Biases can lead to incorrect conclusions about what the study or trial showed. In making measurements, bias designates systematic error in a result beyond effects from the random errors that are equally likely in their positive and negative effects on magnitude. See also *accuracy*.

Example: *Standardized uptake values* of a certain tissue are measured in *FDG-PET* for a particular population dominated by obese patients whose body fat content is rather high. Examination of the traditional formula for calculating the *SUV* shows proportionality to the total patient body weight. The latter here includes weight also from fat which is known to have rather low *FDG uptake* relative to average body tissues. Hence, for these obese patients, the *SUV* is biased upward when being compared to *SUV* data obtained from other patient populations with fat content in a normal range. However, the biased *SUVs* would not result if some refinement in the weight (e.g., such as employing the lean body mass) were used in all *SUV* calculations.

Binding potential

A quantity used in *tracer* studies of *receptor* density in certain biological processes where this binding potential, as a characteristic of the receptor's *uptake*, is proportional to the receptor density and its affinity for the drug having the tracer. Typically such processes involving transmitters and receptors would be *modeled* for interpreting *dynamic scans*. Methods of determining binding potential include calculations from: *rate constants* measured in *compartmental model* fitting to data, *slopes* in *Logan plots*, and sometimes just *activity concentrations* of regions with and without receptors. Acronym is *BP*.

Biological clearance rate

The rate at which an exogenous substance is removed or cleared from the whole or part of a subject. In colloquial usage it can be curtailed to *clearance*. As a quantifier of *washout*, it is the amount (quite often volume) of a substance leaving a system per unit time with dimensions then as amount/min or amount/s (such as ml/min or ml/s).

This concept of clearance rate can also be applied to a *tracer* in the blood, as a specific part of the subject then entering into some other part of the subject. The product of this clearance rate and tracer *concentration* in the blood, *C_p*, is the amount leaving per unit time – but just into some designated part of the subject. Note that this partial or local clearance rate concept may be distinguished from the concept of clearance rate from the subject as a whole.

In *compartmental modeling*, as in the example of Fig. C.3, it can be convenient in describing local processes to define clearance rate in terms of a *distribution volume* (rather than just volume) leaving per unit time, the dimensions then being ml/g/s. If such a clearance rate is designated K_1 for some organ of interest, then $K_1 C_p$ would be the amount quantifier, as *activity* per unit mass, that leaves the blood per unit time and enters this organ.

Biological half-life

Time for an administered substance, with no further additions occurring, to be reduced by a factor of 2 in its *concentration* by natural physiological processes. This is entirely separate from any *radioactive* decay that may or may not be present. See also *biological clearance rate*, *effective half-life*, and *half-life*.

Blank scan

Scan without any subject or *attenuating* material, but with a *source*, present. *Quality control* checks involving blank scans may use a uniform source or a *transmission* source. Also with the latter, it is useful to obtain ratios of a blank scan and a subject-present scan for the various *lines of response*. These give *attenuation correction* data.

Blood flow

1. Indicating volume blood flow rate, the volume of blood per unit time passing through a specified location, such as a point in a blood vessel or an entire organ. Units are ml/s.

Example: A typical *stroke volume* of blood pumped into the aorta in each of the resting 72 beats that occur in a minute is about 70 ml. This results in a volume blood flow rate at this point of $(72 \text{ beats/min}) \times (70 \text{ ml/beat}) = 5,040 \text{ ml/min} = 84 \text{ ml/s}$.

If 15% of this, namely, 756 ml/min, flows to the 1,400-g brain, then brain tissue *perfusion* on average is $(756 \text{ ml/min}) \div (1,400 \text{ g}) = 0.54 \text{ ml/min/g}$.

2. Used colloquially to designate perfusion.

Blood volume

In *compartmental modeling*, it is the local fraction of tissue occupied by blood. It can also be the volume of blood per unit of tissue amount in a region. These usages in *image* analysis designate a blood volume fraction or a blood *specific volume*.

They differ from general physiological usage that designates the total volume of blood in some organ or in the entire body.

BP

Binding potential.

Brodmann's area

One of 47 numbered regions within a map of the cerebral cortex. Each is characterized by a particular cell organization and also corresponds to a particular cortical function. This map can assist in locating a *region of interest* (*volume of interest*). See also *Talairach space*.

Bull's eye

A *color scale* or *gray scale* display of *polar maps* as concentric annuli. Figure P.3 shows numerically how a bull's eye would be constructed in preparation for this display. While a bull's eye can be used for *parameters* characterizing *voxels* of any volume, its typical use adapts to volumes in which there is some approximately cylindrical or conical character.

Describing *uptake* in chamber walls of the heart would be a popular use of the bull's eye. *Activity concentrations* would be a usual parameter for plotting, but others, such as those of *phase analysis*, can also be plotted.

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