Like any other discipline in biology and medicine, chronobiology has developed its own nomenclature. In relation to rhythms numerous terms describing their properties and parameters were borrowed from physics. Biologic rhythms, however, do not show the same precision as their counterparts in physics and thus cannot be characterized by point estimates. Every parameter of a biologic rhythm is a statistical entity which always has to be viewed with its variance estimate. This qualification has to be kept in mind if terms used in physics are applied to biologic rhythms and is expressed in the term "circa" which is used to describe frequencies which are known to change their cycle length under certain conditions. Although the terms used in physics are mostly well-defined and described in mathematical terms, their adaptation to chronobiology has led to some differences in their use by different investigators.

Other terms were adopted or coined (often derived from Latin or Greek) to describe aspects of biologic rhythms for which no suitable term was available and/or in order to avoid a lengthy descriptive phrase, the frequent use of which in a chronobiologic text could be quite cumbersome. Many of these terms were necessary and have been introduced similar to every other subspecialty of medicine and have been widely accepted by the specialists in the field. However, since chronobiology is a new and rapidly developing specialty, many of the terms introduced recently are still unknown to many investigators and physicians who might benefit from the application of chronobiologic principles and findings to their work. We have tried to help the reader of this book by presenting many of the more widely used terms with a definition which is kept as simple and generally understandable as possible. We are aware that some chronobiologists may be using more complicated definitions which may have some merit as such but often make the understanding of chronobiologic texts rather difficult for the nonspecialized reader. We have not included terms which have not yet widely accepted and which are not generally used in the field. It is certain that, like in any living branch of science, some of these terms will be accepted while others will disappear as unnecessary or cumbersome. The following glossary is thus a snapshot of terms widely used today in chronobiology in a presentation aimed at being short and understandable (although sometimes perhaps simplified) and does not make any claim to completeness.

Acrophase. Measure of timing of a rhythm in relation to a defined reference time point selected by the investigator (e. g., local midnight for circadian rhythms); used for data which can be described by the fitting of a mathematical model, e.g., a cosine curve, and represents the crest time of the cosine curve best fitting to the data; may be expressed in (negative) degrees as the lag from the acrophase reference (360'C =1 period) or in calendar time units (e.g., hours and minutes for circadian rhythms, days or months for infradian rhythms).

Amplitude (A). The measure of one half of the extent of the rhythmic change estimated by the mathematical model (e.g., cosine curve) best fitting to the data (e.g., the difference between the maximum and the rhythm-adjusted mean (MESOR) of the best fitting curve).

Autorhythmometry. Self-measurement of biologic rhythms by the subject examined.

Bathyphase. The time of the lowest point of a mathematical model (e. g., cosine curve) fitted to a time series and describing a rhythm. If a sine or a cosine curve is fitted, the bathyphase will differ 180' from the acrophase, measured in relation to a defined reference time point selected by the investigator (e.g., local midnight for circadian rhythms); may be expressed in degrees as the lag from the phase reference (360' = I period) or in calendar time units (e. g., hours and minutes for circadian rhythms, days or months for infradian rhythm).

Biologic time structure. The sum of nonrandom time-dependent biologic changes, including growth, development, and aging, and a spectrum of rhythms with different frequencies.

Biological clocks.Self-sustained oscillators which generate biologic rhythms in absence of external periodic input (e. g., at the gene level in individual cells)

Biologic rhythm. A regularly recurring (periodic) component in a series of measurements of a biologic variable obtained as a function of time.

Chronergy. Represents the rhythmic change of the response of the organism to a drug (its total effect) according to its chronokinetics and its chronesthesy (see below).

Chronesthesy. Rhythmic (thus predictable-in-time) changes in the susceptibility or sensitivity of a target biosystem (cell or organism) to an agent. May be caused by temporal changes in receptors of target cells or organs, membrane permeability, etc.

Chronobiology.The science of investigating and objectively quantifying phenomena and mechanisms of the biologic time structure, including the rhythmic manifestations of life. Term derived from: Chronos (time), bios (life), and logos (science).

Chronobiotic. An agent capable of influencing biologic rhythm parameters (e.g., the phase setting).

Chronodesm. Time-qualified reference intervals. Reference intervals constructed along the time

scale by Gaussian or non-Gaussian methods. Include time qualified prediction and tolerance intervals.

Chronogram. Display of data as a function of time.

Chronopathology. Changes in an individual's biologic time structure preceding, coincident or following functional disorders or organic disease and/or time-dependent manifestation of disease.

Chronopharmacodynamics. Temporal variations in the mode of action of a drug.

Chronopharmacokinetics. The study of the temporal changes in absorption, distribution, metabolism, and elimination of a drug. Describes the influence of the time of administration of a drug on the mathematical parameters which describe these processes in terms of absorption rate, peak drug concentration (Cmax), time-to-peak drug concentration (Emax), area under the concentration time curve (AUC), half-life (t1/2), etc.

Chronotherapy. Use of treatment timed according to the stages in the sensitivity-resistance cycles of target (or nontarget) tissues and organs (or of the organism as a whole) to enhance the desired pharmacologic effect and/or reduce undesirable side effects of drugs or other therapeutic agents.

Chronotolerance. Time-dependent tolerance of an organism to environmental stimuli and xenobiotics. **Chronotoxicology**. Time-dependent variation in toxicity.

Circadian. About 24 h. The term describes rhythms with an about 24-h (> 20 to < 28 h) cycle length whether they are synchronized with a 24-h periodic surrounding or not.

Circadiseptan. A rhythm with a period of about 14 (± 3) days.

Circannual. A rhythm with a period of about 1 year (± 2 months), synchronized with or desynchronized from the calendar year.

Circaseptan. A rhythm with a period of about 7 (± 3) days, which may or may not be synchronized with the calendar week.

Circatrigintan. A rhythm with a period of about 30 (±5) days. Includes, in mature women during the time of ovarian activity, the menstrual cycle. The term is preferred to the term "menstrual" because rhythms of this frequency are found in premenarchal girls, postmenopausal women and in men.

Circavigintan. A rhythm with a period of about 20 (± 3 days).

Clinospectrometry. Resolving of a spectrum of rhythms and trends (cline) by (computer implemented) time series collection and analysis. With rhythms quantified as algorithmically formulated phenomena validated in inferential statistical terms.

Cosinor procedure. A mathematical-statistical method of describing a rhythm by determining by least squares technique the cosine curve best fitting to the data and exploring the presence of a rhythm by examining the null hypothesis for amplitude in an F-test. If a rhythm can be described by this procedure the cosinor yields a rhythm-adjusted mean (MESOR), an amplitude as measure of the

extent of the rhythm, and an acrophase as indication of its timing with variance estimates for each.

Cosinor. *Single cosinor* - a cosinor procedure applicable to single biologic time series.

Population mean cosinor - the cosinor procedure applicable to parameter estimates from three or more biologic time series for assessing the rhythm characteristics of a population. The parameter estimates are based on the means of estimates obtained from individuals in the samples.

Daily. Occurring every day.

Dampened oscillation. Oscillation decreasing (dampened) in amplitude due to inevitable loss of energy.

Desynchronization. State of two or more previously synchronized rhythmic variables that have ceased to exhibit the same frequency and/or the same acrophase relationships and show different than usual and/or changing time relations.

Diurnal. Day related (in contrast to nocturnal), e. g., diurnal (vs nocturnal) activity pattern.

Endogenous rhythm. Presumably genetically fixed biologic rhythm, persisting in an environment without outside time cues.

Entrainment. Coupling of two rhythms of the same frequency to one of them (the entraining agent or synchronizer) determining the phase of the other. e. g., Coupling of endogenous rhythms to environmental oscillator of the same frequency and/or determination of the phase of biologic rhythms by an internal pacemaker.

Episodic variation. Apparently irregular (nonrhythmic) variation of a biologic variable, e. g., episodic secretion of certain hormones (used by some as synonymous with "pulsatile").

External desynchronization. Desynchronization of a biologic rhythm from an environmental cycle.

Feedsideward coordination. Interaction of several rhythms (multifrequency coordination). Involves rhythmic and to that extent predictable sequences of effects depending upon the phase of each of the rhythms involved. "Feedsideward" may manifest itself as rhythmic alteration of stimulation, no effect or inhibition by an action of a rhythmic entity upon two other interacting entities.

Free running. Continuance of an endogenous bioperiodicity at least slightly but consistently different from any known environmental schedule, i. e., from its usual synchronizer or usual pacemaker rhythm.

Frequency (f). The number of cycles occurring per time unit; f is the reciprocal of the period (t).

Frequency ranges. Groups of frequencies (or periods) frequently encountered in biologic rhythms. (Circadian frequency range: rhythm with periods of about one day, i. e., by definition > 20 to < 28 h).

Infradian rhythm. Rhythm with a period longer (by definition > 28 h) than the circadian range; the term includes circaseptan, circatrigintan, circannual, and other rhythms of lower frequency.

Internal desynchronization. State in which two or more previously synchronized variables within the same organism have ceased to exhibit the same frequency and/or the same acrophase relationships and show different than usual and/or changing time relations.

Jet lag. Desynchronization and its clinical effect after rapid movement over several time zones (after trans- meridian flights).

Lighting regimen. The light-dark cycle (LD), or constant light (LL), or constant dark (DD) conditions used for chronobiologic studies.

Longitudinal sampling. Study of the same subject or of a group of subjects over numerous cycles.

Longitudinal study. Study of the same individual over a prolonged time span (e. g., aging).

Marker rhythm. Rhythm of use in monitoring an organism's biologic timing and/or the timing of a related rhythm showing a fixed time relation to the rhythm used as "marker". Can be used where appropriate for decision-making in applied or basic physiologic or pharmacologic work, e.g., for time of sampling, timing of therapy, or for assessing therapeutic response (without any implication of causal relations between the rhythmic process and its marker). See also "reference rhythm".

Masking of a rhythm. Alteration of the usual shape and/or parameters of a rhythm due to random or nonrandom environmental stimuli, persisting for the duration of the stimulus only (without persistent alteration of endogenous rhythm components). e.g., change in body temperature after a hot bath.

MESOR. Midline Estimating Statistic of Rhythm. The value midway between the highest and the lowest values of the (cosine) function best fitting to the data. The "M" is equal to the arithmetic mean only for equidistant data covering an integral number of cycles.

Pacemaker. A functional entity capable of self-sustaining oscillations which synchronize other rhythms (e.g., the suprachiasmatic nucleus in man).

Peak. The highest point in a series of measurements obtained as a function of time.

Period (t). Duration of one complete cycle in a rhythmic variation.

Phase. The value of a rhythmic biological variable at a certain time. Each instantaneous state of an oscillation represents a phase.

Phase advance. Involves the earlier occurrence of a rhythm's phase, usually the acrophase (denoted by a plus sign).

Phase delay. Involves the later occurrence of a rhythm's (acro)phase (denoted by a minus sign).

Phase drift. During free running of an endogenous rhythm with a period slightly but consistently different from its usual environmental synchronizer, the rhythm's acrophase will occur during every synchronizer cycle at a different time (e. g., clock hour in the case of circadian rhythms) in relation to the phase reference.

Phase reference. Time point chosen by the investigator as reference for the estimation of the timing of a rhythm (e. g., local midnight for circadian rhythms).

Phase response curve. Graphical plot indicating how the amount and the duration of a phase shift, induced by a single stimulus, depend upon the rhythm's stage at which the stimulus is applied.

Phase shift. Single relatively abrupt or gradual change in the timing of a rhythm (completed within a finite time span) and described by the difference between the initial and final (acro)phase.

Photoperiod. In a light-dark regimen the duration of the light span (e.g., in light-dark = LD 12:12 h, the photoperiod L = 12 h).

Plexogram. Display of original data covering spans longer than the period of a rhythm investigated along an abscissa of a single period (irrespective of time order of data collection).

Pulsatile variation. Variation of a biologic function with an irregular period higher than circadian of which a regular recurrence (rhythm) cannot be documented. May be the result of circadian-ultradian interactions or of other rhythmic and/or nonrhythmic mechanisms (used by some as synonymous with "episodic").

Reference rhythm. A rhythm in one variable used as a time reference for other rhythms, events, or actions. (See also "marker rhythms").

Rhythm. A regularly recurring and thus, to a certain degree, predictable (periodic) component of a (biologic) time series, demonstrated by inferential statistical means.

Scotoperiod. In a light-dark regimen the duration of the dark span (e. g., light-dark = LD 12:12 h the scotoperiod D = 12 h).

Seasonal variation. Change in a biologic system brought about by seasonal changes of temperature, light-span, etc, and not observed in the absence of such changes.

Self-sustained oscillation. System that can make use of a constant source of energy (to counteract energy losses) and is able to continue to oscillate without outside energy input.

Shift work. Transient or permanent change in work schedule in relation to the social surroundings (e.g., 3 x 8-h work shifts).

Suprachiasmatic nucleus. Group of hypothalamic neurons situated above the optic chiasm exhibiting an endogenous circadian oscillation acting as circadian pacemaker, receiving external phase information via the retina.

Synchronization. State of a system when two or more variables exhibit periodicity with the same frequency and specifiable acrophase and phase relation.

Synchronizer. Environmental periodicity determining the temporal placement of a biologic rhythm along an appropriate time scale. Synonyms: entraining agent, time giver, Zeitgeber.

Synchronizing agent. See Synchronizer.

Time giver See Synchronizer.

Time series. A series of measurements obtained as a function of time.

Transmeridian flight. Movement over time zones (see Jet lag).

Transverse sampling. Sampling of a group of subjects over one cycle of a rhythm.

Transverse study. Comparison of two groups differing by a parameter (e. g., age, sex, etc.) studied at one time (e. g., over one cycle).

Trough. The lowest point in a series of measurements obtained as a function of time.

Ultradian rhythm. Biologic rhythm with a period shorter than circadian (less than 20 h).

Zeitgeber See Synchronizer. It has to be understood that the "Zeitgeber" does not "give time" (does not induce a rhythm) but determines its arrangement in time (synchronizes).