**Clockology Survey**

Thank you for your interest in participating in this research.

**Background**

As the number of researchers in the circadian field has grown substantially in recent years, we have noticed increasing scope for miscommunication. Some classical terms are being used interchangeably with more modern phrases that may have several alternative meanings. This is confusing for students and presents a barrier to effective dissemination of research findings. Moreover, colourful circadian-related metaphors that lack a clear definition have emerged, and are becoming widespread. It would be useful for students and researchers from other disciplines if there were a website where they can easily find (a) a clear and unambiguous definition for the most frequently used terms employed in circadian research today and (b) updated definitions of the more classical terms based on current consensus usage.

**Aim**

To produce an evidence-based set of definitions for circadian terms and phrases guided by current consensus usage within the circadian research community

**Conduct**

This project is being conducted by the O’Neill Lab at the MRC Laboratory of Molecular Biology, Cambridge, UK, and uses an interactive set of 24 circadian-based questions presented in multiple formats.

Completion of the survey is estimated to take around 25 minutes. **Please do not attempt to submit answers more than once.** Before the circadian questions you will be asked to provide information to help us understand the demographics of responders; responses to these demographic questions are optional.

All of your data input will remain anonymous; we will not be collecting any person-identifying information nor using your data input in any way that would allow your identification. For some questions, you will have the opportunity to provide free-text entries. When doing so, please refrain from inputting data that might potentially identify you as an individual.

A combination of published and online resources fed into the development of this survey; a reference list is available on request to Sophie Koh at rqk20@cam.ac.uk who will also answer any queries you have about any of the survey questions.

**The survey will close on August 31st 2020** and results will be submitted for Open Access publication and posted on this website in due course.

For more information on our data sharing plan and how the data you provide will be processed as part of this study, please email Nina Rzechorzek at ninar@mrc-lmb.cam.ac.uk

**Q1 Please choose your preferred or most frequently used circadian model system** *<cartoon versions next to each option; movement of human icon along sine wave on each page to show progress>*

* *Arabidopsis*
* *Cyanobacterium*
* *Drosophila*
* *Eukaryotic cell*
* *Human*
* *Mouse*
* *Neurospora*
* *Ostreococcus*
* *Suprachiasmatic nucleus*
* *Zebrafish*
* *I can’t decide – please choose for me!*

**Q2 What was your assigned biological sex at birth?**

* *Female*
* *Male*
* *Other*
* *Prefer not to say*

**Q3 What is your gender?**

*<free text >*

**Q4 What country were you born in?**

*<free text>*

**Q5 Which ethnic origin do you primarily identify with?**

*<free text>*

**Q6 What country do you currently study or work in?**

*<free text>*

**Q7 What sector are you primarily based in?**

* *Academic/studying*
* *Industry*
* *Clinical*
* *Science communication/Publishing*
* *Government/Policy*
* *Funding body*
* *Prefer not to say*

**Q8 What career stage are you at?**

* *At school/applying to University/College*
* *Undergraduate (clinical/basic science)*
* *MSc in training (clinical/basic science)*
* *PhD in training (clinical/basic science; years 1-2)*
* *PhD in training (clinical/basic science; year 3 and above)*
* *Technician/Lab Manager*
* *Postdoc (basic science)*
* *Postdoc (clinician scientist)*
* *Junior Group Leader/PI/Assistant Professor/Junior Faculty*
* *Senior Group Leader/PI/Professor/Senior Faculty*
* *Departmental/Divisional/Institute Head/Director*
* *I am not working or studying in any area related to science*
* *Prefer not to say*

**Q9 For how many years have you been studying circadian biology or working in this field?**

* I have not been studying or working in this field at all
* > zero but < two years
* > two but < four years
* > four but < six years
* > six but < ten years
* > ten but < fifteen years
* > fifteen but < twenty years
* > twenty years
* Prefer not to say

**Q10. Please assign one of the drop-down word options on the right to the text definition on the left that you think is most appropriate.** If you have a better definition for any of these words please type this in the free text box at the bottom (total limit 100 words). *<option ‘Don’t know’ to be added to each drop-down menu>*

* **Circadian:** A self-sustained biological phenomenon that (i) persists in cycles under constant conditions with a period length of around 24h, (ii) can be entrained by or synchronises to environmental cues, and (iii) proceeds at approximately the same rate (same period length) across a physiological range of temperatures for a given organism
* **Diurnal:**  Biological process or activity that is synchronized with the day/night cycle and is completed once every 24h/every day by an organism whose activity occurs principally during the day (in light conditions) and during subjective day (in constant conditions); antonym to ‘nocturnal’. Also used to describe the kind of organism with this daytime schedule of activity.
* **Diel:** Biological process or activity completed once every 24 h or every day, but where there is ambiguity as to where the peak (acrophase) of activity occurs
* **Nycthemeral:**  Biological process or activity having the duration of 24 h or one day
* **Daily:** Biological process or activity having the duration of a 24h or one day, or occurring once every 24h or every day
* Other (please specify) <free text box>

**Q11. Below are some proposed definitions for ‘circadian rhythm’. Please rank them in your order of preference with (1) being most preferred and (6) being least preferred.** If you have a better definition for ‘circadian rhythm’ please type this in the free text box at the end of the survey. **Finally, please type in the free text box the lower and upper boundaries of a period length that you would consider to approximate 24 hours.**

* Biological rhythm whose free running period is an approximation to the period of the Earth’s rotation.
* Approximately 24h endogenous biological oscillation that persists under constant conditions, whose period is temperature compensated.
* Endogenous, self-sustained biological rhythm that persists under constant environmental conditions such as light, temperature, and food availability, with a period length of ~24 h whose phase can be reset (is entrainable) and whose period length is temperature compensated.
* Approximately 24h endogenous biological oscillation that persists under constant conditions, whose period is temperature compensated and whose phase is entrained by appropriate external stimuli
* An oscillation with a period of about 24 hours
* A self-sustained biological rhythm that (i) persists under constant conditions with a period length of around 24h, (ii) can be entrained by or synchronises to environmental cues, and (iii) proceeds at approximately the same rate (same period length) across a physiological range of temperatures for a given organism
* Please specify range of period lengths that approximate 24 hours (in whole numbers of hours) <free text box>

**Q12. Please use the rating scales below to indicate how you feel about the clarity, simplicity, and completeness of each of the 3 proposed definitions for the term ‘circadian oscillator’.** Each rating scale is numbered 1 to 5, where 1 is poor and 5 is optimal. **Finally, in less than 50 words please define the term ‘limit cycle oscillator’ in the free text box.** If you cannot think of a suitable definition please type ‘NA’ and move to the next question.

* Mechanism leading to the manifestation of a rhythmic phenomenon (oscillation), that either is self-sustained (with or without pacemaker ability), or depends on another oscillator (passive or slave-oscillator), or is characterized by a decrease in amplitude (damped oscillator).
* A functional biological entity or mechanism that generates self-sustained, approximately 24-hour rhythmic variation (oscillation) in a biological value
* An entity capable of generating a circadian periodic variation in the value of a biological quantity, especially a regular variation above and below some mean value
* Definition for ‘limit cycle oscillator’ <free text box>

**Q13. Please use the rating scales below to indicate how you feel about the clarity, simplicity, and completeness of each of the 3 proposed definitions for the term ‘circadian pacemaker’.** Each rating scale is numbered 1 to 5, where 1 is poor and 5 is optimal.

* A functional biological entity or mechanism that generates self-sustained, approximately 24-hour rhythmic variation (oscillation) in a biological value and is capable of imposing this rhythmicity on one or more other entities. A pacemaker is an oscillator, but not all oscillators are pacemakers.
* A functional biological entity or mechanism that generates self-sustained, approximately 24-hour rhythmic variation (oscillation) in a biological value and orchestrates all overt circadian rhythms and physiology of an organism
* A functional biological entity capable of self-sustaining oscillations with a period length of around 24 hours.

**Q14. Circadian resetting describes the process of phase adjustment of the circadian clock or a circadian rhythm in response to a stimulus or cue.** **Below are some terms used to classify resetting cues. Please use the rating scales to indicate how you feel about the utility of each term to describe a type of resetting cue.** Each rating scale is numbered 1 to 5, where 1 is useless and 5 is optimal. **Finally, in less than 50 words please define the term ‘phase singularity’ in the free text box.** If you cannot think of a suitable definition please type ‘NA’ and move to the next question.

**Terms** (rows)

Type 0 cue

Potent zeitgeber

Strong resetting cue

Type 1 cue

Weak zeitgeber

Weak resetting cue

Definition for ‘phase singularity’ <free text box>

**Q15. For each of the features listed below, select one or more boxes to indicate which version of the clock you think it applies to.**

**Clocks** (columns/checkbox options)

Circadian clock

Master clock

Core clock

Body clock

Biological clock

**Features** (rows)

Has an oscillator

Has inputs

Has outputs

Molecular entity

Cellular entity

Tissue/organ

Whole organism

Unicellular organisms

Multicellular organisms

Objectively measured with ease

Objectively measured with difficulty

Cannot be objectively measured

Necessary for cell-autonomous circadian rhythms

Sufficient for cell-autonomous circadian rhythms

**Q16. Please match the terms listed below to the most appropriate schematic by selecting one option from A to E.** If you feel that none of the schematics represent the term please select ‘Don’t know’. **Finally,** **in less than 50 words please define the term ‘phase marker’ in the free text box.** If you cannot think of a suitable definition please type ‘NA’ and move to the next question.

**Terms**

Acrophase

Phase

Phase angle

Phase shift

Phase of entrainment

Definition for ‘phase marker’ <free text box>

**Schematics** (choice of 5)

**Q17. Below is a definition for the term ‘masking’. Please select how you feel about this definition from the options given.**

The apparent coupling of an observable rhythm in an organism to a zeitgeber or other external factor, resulting in a shared period, where (in contrast to entrainment) this is not caused by an alteration of the endogenous clock that schedules the observable rhythm. The external factor directly affects the expression but not the phase of the overt rhythm.

**Options**

* Agree
* Disagree
* Don’t know
* I have typed a better definition in this free text box (limit 50 words) <free text box>

**Q18. Below is a definition for the term ‘range of entrainment’. Please select how you feel about this definition from the options given.**

The range of period lengths over which a circadian rhythm can be entrained by a zeitgeber. This range may reflect the strength of the entrainment cue and/or the robustness of the oscillator.

**Options**

* Agree
* Disagree
* Don’t know
* I have typed a better definition in this free text box (limit 50 words) <free text box>

**Q19. For each property listed below, select one or more boxes to indicate which term(s) it applies to**

**Terms** (column/checkbox options)

Clock gene

Clock-controlled gene

Clock protein

**Properties** (rows)

Sufficient for cell-autonomous circadian rhythm

Necessary for cell-autonomous circadian rhythm

Influences circadian phenotype under constant conditions

Influences circadian phenotype under entrained conditions

Influences circadian period length under constant conditions

Influences circadian period length under entrained conditions

Influences circadian amplitude under constant conditions

Influences circadian amplitude under entrained conditions

Influences circadian phase under constant conditions

Influences circadian phase under entrained conditions

**Q20. In 50 words or less, using the free text box below, please define the term ‘circadian reprogramming’.** If you cannot think of a suitable definition please type ‘NA’ and move to the next question.

<free text box>

**Q21. For the term ‘circadian input’ please select one check box to indicate how strongly associated this term should be with the given word or phrase.**

**Association** (columns/checkbox options)

Always

Sometimes

Never

**Words/phrases** (rows)

Enables feedback to oscillator

Can influence feedback to oscillator

Must influence feedback to oscillator

Requires feedback to oscillator

Affects oscillator phase

Affects oscillator period length

Affects oscillator amplitude

Is determined by oscillator phase

Is determined by oscillator period length

Is determined by oscillator amplitude

Is determined by input phase

Is determined by input period length

Is determined by input amplitude

Is determined by output phase

Is determined by output period length

Is determined by output amplitude

**Q22. For the term ‘circadian output’ please select one checkbox to indicate how strongly this term should be associated with the given word or phrase.**

**Association** (columns/checkbox options)

Always

Sometimes

Never

**Words/phrases** (rows)

Enables feedback to oscillator

Can influence feedback to oscillator

Must influence feedback to oscillator

Requires feedback to oscillator

Affects oscillator phase

Affects oscillator period length

Affects oscillator amplitude

Is determined by oscillator phase

Is determined by oscillator period length

Is determined by oscillator amplitude

Is determined by input phase

Is determined by input period length

Is determined by input amplitude

Is determined by output phase

Is determined by output period length

Is determined by output amplitude

**Q23. For each feature listed below, tick one or more boxes to indicate which term(s) it applies to**

**Terms** (columns/checkbox options)

Circadian time

Zeitgeber time

**Features** (rows)

Timescale covering one full circadian period

Timescale covering one full zeitgeber period

Arbitrary zero point

Zero point defined by subjective dawn for a given organism

Zero point defined by lights-on

Zero point defined by beginning of warm phase

Zero point defined by beginning of organism’s active phase

Internal time

External time

**Q24. In 50 words or less, using the free text box below, please define the term ‘state variable’ as it relates to a clock or oscillator.** If you cannot think of a suitable definition please type ‘NA’ and move to the next question.

<free text box>

**Q25. Below are some proposed definitions for ‘zeitgeber’. Please rank them in your order of preference with (1) being most preferred and (4) being least preferred.** If you have a better definition please type this in the free text box at the bottom (limit 50 words).

* That forcing external oscillation which entrains a biological rhythm and can only act as an input to the circadian clock
* A synchronizing agent (a stimulus capable of resetting a pacemaker or synchronizing a self-sustaining oscillation). The zeitgeber ‘reports’ the local time, not the ability to keep time.
* Any external or environmental cue that entrains or synchronizes an organism's biological rhythms to the Earth's 24-hour light/dark cycle and 12-month cycle
* Time giver
* Other (please specify) <free text box>

**Q26. Below are some proposed definitions for ‘zeitnehmer’. Please rank them in your order of preference with (1) being most preferred and (6) being least preferred.** If you have a better definition please type this in the free text box at the bottom (limit 50 words).

* That forcing internal oscillation which entrains a biological rhythm and can act as both an input to and an output of the circadian clock
* A synchronizing agent (a stimulus capable of resetting a pacemaker or synchronizing a self-sustaining oscillation) that arises internally. The zeitnehmer ‘anticipates’ the local external time, but does not confer the ability to keep time.
* Internal timing cue that acts as an input to a biological oscillator and provides timing information even under constant external conditions
* Any internal cue that entrains or synchronizes an organism's biological rhythms to the Earth's 24-hour light/dark cycle by anticipating an external timing cue; thus providing timing information even under constant external conditions
* Time keeper
* Time taker
* Other (please specify) <free text box>

**Q27. For each association listed below, tick one or more boxes to indicate which term(s) it should apply to in your opinion**

**Terms** (columns/checkbox options)

Circadian health

Circadian disruption

Circadian misalignment

**Associations** (rows)

Jet lag

Social jet lag

Sleep quality

Sleep duration

Alignment of body clock to external environment

Stable phase relationship between body clock and external environment

Desynchronization between a central clock and peripheral clock

Desynchronization from the external environment

Synchrony between central and peripheral clock

Synchrony with the external environment

Physical health

Mental health

Behaviour

Circadian lighting

Circadian meal timing

Shift work

**Q28. In 50 words or less, using the free text box below, please define the term ‘circadian robustness’.** If you cannot think of a suitable definition please type ‘NA’ and move to the next question.

<free text box>

**Q29. Below are some proposed definitions for ‘chronotype’. Please rank them in your order of preference with (1) being most preferred and (5) being least preferred.** If you have a better definition please type this in the free text box at the bottom (limit 50 words).

* The natural inclination of an individual animal that influences the cycle of sleep and activity in a 24-hour period.
* The natural inclination of an individual animal with regard to the times of day when they prefer to sleep or when they are most alert or energetic.
* The propensity for an individual animal to sleep at a particular time during a 24-hour period.
* The internal circadian rhythm or body clock of an individual animal that influences the cycle of sleep and activity in a 24-hour period
* The preference of a human to develop their daily routine during the first half of the day (morning type or ‘lark’) or during the second half of the day (evening type or ‘owl’), assessed as the sleep-corrected mid-phase of sleep on free days (MSFsc; corrected for ‘oversleep’ due to the sleep debt that individuals accumulate over the work week)
* Other (please specify) <free text box>

**Q30. Below are some proposed definitions for ‘circadian arrhythmicity’. Please rank them in your order of preference with (1) being most preferred and (4) being least preferred.** If you have a better definition please type this in the free text box at the bottom (limit 50 words).

* Complete lack of evidence of a circadian rhythm in an objectively-measured biological phenomenon of an organism or cells or tissues derived from an organism. Desynchronization of rhythms within a population of cells or between different tissues of the same organism is not sufficient to meet the definition of circadian arrhythmicity.
* Behavioral activity, gene, or protein expression that shows a loss of circadian-regulated oscillations or desynchrony of timekeeping
* Behavioral activity, gene, or protein expression that shows a loss of circadian-regulated oscillations that is not simply the result of desynchrony among individual cells or between different tissues of the same organism
* When an organism shows no significant peaks in the periodogram in the circadian range, activity is distributed throughout the light-dark cycle, and daily activity onsets and offsets cannot be identified via visual inspection of the periodogram
* Other (please specify) <free text box>

**Q31. For each association listed below, select one or more boxes to indicate which term(s) it should apply to in your opinion**

**Terms** (columns/checkbox options)

Synchronization

Desynchronization

**Associations** (rows)

Relationship between cellular rhythms

Relationship between organismal rhythms

Relationship between internal rhythm and external rhythm

Organismal population level

Cellular population level

Resetting

Phase coherence

Constructive interference

Destructive interference

Damping

**Q32. Please assign one of the drop-down word options on the right to the text definition on the left that you think is most appropriate.** If you have a better definition for any of these words please type this in the free text box at the bottom (limit 50 words per definition). *<option ‘Don’t know’ to be added to each drop-down menu>*

* **Chronomedicine:** The application of chronobiology to understand the diagnosis, treatment, pattern, and prevention of disease which can be related to the disturbance of one or more biological rhythms or impacted by them.
* **Chronotherapy:** Optimally timed treatment of disorders or diseases in order to improve treatment efficacy and/or reduce adverse effects of the treatment. This timing may take into account a combination of factors including biological rhythms within the patient and how these interact with pharmacokinetics and pharmacodynamics of a therapeutic agent, or the measurable impact of a therapeutic approach. This term can also be used to describe a therapeutic agent or approach that aims to improve or rescue circadian physiology within a patient.
* **Chronopharmacology:** The study of the optimal timing of administration of a therapeutic agent with respect to both its functional efficacy and the chronotype of the patient.
* **Chronopharmacokinetics:** The study of how the absorption, metabolism, and elimination of drugs relates to the time at which they are administered with respect to the circadian phase of the patient.
* **Chronopharmacodynamics:** The study of how the [effects](https://en.wiktionary.org/wiki/effect) of [drugs](https://en.wiktionary.org/wiki/drug) are modified based on the time at which they are administered with respect to the circadian phase of the patient.
* Other (please specify) <free text box>

**Q33. Please assign one of the drop-down word/phrase options on the right to the text definition on the left that you think is most appropriate.** If you have a better definition for any of these words/phrases please type this in the free text box at the bottom (limit 50 words per definition). *<option ‘Don’t know’ to be added to each drop-down menu>*

* **Parametric entrainment:** entrainment via discrete daily phase shifts
* **Non-parametric entrainment:** entrainment via a change in the velocity of the clock mechanism
* **Photic entrainment:** entrainment using a light cue which may involve an increase or decrease in light intensity or duration; most typically this applies to an alternating light-dark cycle.
* **Non-photic entrainment:** entrainment using anything other than a change in light intensity or duration
* **Phase response curve:** a curve describing the relationship between the circadian phase at which a stimulus is applied and the resultant phase shift of a circadian rhythm. The phase before the stimulus is plotted against the difference between the new phase and the old phase.
* **Phase transition curve:** a curve describing the relationship between the circadian phase at which a stimulus is applied and the resultant new phase of a circadian rhythm. The phase before the stimulus is plotted against the new phase.
* **Circadian integrated response characteristic (CIRC):** an approach to predict and model entrainment using the phase-dependent capacity of the circadian system to compress or expand its internal cycle length to adjust it to that of a zeitgeber
* Other (please specify) <free text box>

**Before submitting your answers, please state in the free text box below your current local time in 24-hour digital clock format (HH::MM).** Please also use this box to add any comments or queries about this survey, or an alternative definition for ‘circadian rhythm’ (limit 100 words).

<free text box>

*<Submit answers button>*

**Thank you for completing our survey. If you want to view live results for some of our anonymised, aggregate demographic data please click here:**

<Add link here>