



University of Groningen

Natural entrainment of circadian systems

Hut, Roelof Anne

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2001

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Hut, R. A. (2001). Natural entrainment of circadian systems: A study in the diurnal ground squirrel, *Spermophilus citellus*. Groningen : s.n.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

References

- Aggelopoulos NC and Meissl H (2000) Responses of neurons of the rat suprachiasmatic nucleus to retinal illumination under photopic and scotopic conditions. *J Physiol* 523: 211-222.
- Amir S and Robinson B (1995) Ultraviolet light entrains rodent suprachiasmatic nucleus pacemaker. *Neuroscience* 69: 1005-1011.
- Amir S and Stewart J (1996) Resetting of the circadian clock by a conditioned stimulus. *Nature* 379: 542-545.
- Arnauld E, Bibene V, Meynard J, Rodriguez F, and Vincent J-D (1989) Effects of chronic icv infusion of vasopressin on sleep-waking cycle of rats. *Am J Physiol* 256: R674-R684.
- Aronin N, Sagar SM, Sharp FR, and Schwartz WJ (1990) Light regulates expression of a Fos-related protein in rat supra chiasmatic nuclei. *Proc Nat Acad Sci USA* 87: 5959-5962.
- Aschoff J (1960) Exogenous and endogenous components in circadian rhythms. *Cold Spring Harbor Symp Quant Biol* 25: 11-28.
- Aschoff J (1964) Die Tagesperiodik licht- und dunkelaktiver Tiere. *Rev Suisse Zool* 71: 528-558.
- Aschoff J (1979) Circadian rhythms: influences of internal and external factors on the period measured in constant conditions. *Z Tierpsychol* 49: 225-249.
- Aschoff J (1982) The circadian rhythm of body temperature as a function of body size. In: A companion to animal physiology. Taylor CR, Johansen K, and Bolis L (eds.) Cambridge University Press, Cambridge, UK, pp 173-188.
- Aschoff J and Wever R (1962) Beginn und Ende der täglichen Aktivität freilebender Vögel. *J Ornithologie* 103: 2-27.
- Barnes BM (1989) Freeze avoidance in a mammal: Body temperatures below 0°C in an Arctic hibernator. *Science* 244: 1593-1595.
- Barnes BM and Ritter D (1993) Patterns of body temperature change in hibernating arctic ground squirrels. In: Life in the cold; Ecological, physiological, and molecular mechanisms. Carey C, Florant GL, Wunder BA, and Horwitz B (eds.) Westview press, Bolder, San Francisco, Oxford, pp 119-130.
- Barnes BM, Kretzmann M, Licht P, and Zucker I (1986) The influence of hibernation on testis growth and spermatogenesis in the Golden-Mantled Ground Squirrel, *Spermophilus lateralis*. *Biology of Reproduction* 35: 1289-1297.
- Barnes BM, Kretzmann M, Zucker I, and Licht P (1988) Plasma androgen and gonadotropin levels during hibernation and testicular maturation in golden-mantled ground squirrels. *Biology of Reproduction* 38: 616-622.
- Baudinette RV (1974) Physiological correlates of burrow gas conditions in the California ground squirrel. *Comp Biochem Physiol* 48A: 733-743.
- Beckman AL and Stanton TL (1976) Changes in CNS responsiveness during hibernation. *Am J Physiol* 231: 810-816.
- Beersma DGM and Daan S (1993) Strong or weak phase resetting by light pulses in humans ? *J Biol Rhythms* 8: 340-347.
- Beersma DGM and Hiddinga AE (1998) No impact of physical activity on the period of the circadian pacemaker in humans. *Chronobiol Internat* 15: 49-57.
- Beersma DGM, Daan S, and Hut RA (1999) Accuracy of circadian entrainment under fluctuating light conditions: contributions of phase and period responses. *J Biol Rhythms* 14: 320-329. Chapter 9.
- Belovsky GE (1987) Foraging and optimal body size: an overview, new data and a test of alternative models. *J Theor Biol* 129: 275-287.
- Bennett ATD, Cuthill IC, Partridge JC, and Lunau K (1997) Ultraviolet plumage colors predict mate preferences in starlings. *Proc Nat Acad Sci USA* 94: 8618-8621.
- Bennett ATD, Cuthill IC, Partridge JC, and Maier EJ (1996) Ultraviolet vision and mate choice in zebra finches. *Nature* 380: 433-435.

- Benshoff HM, Brainard GC, Rollag MD, and Lynch GR (1987) Suppression of pineal melatonin in *Peromyscus leucopus* by different monochromatic wavelengths of visible and near-ultraviolet light (UV-A). *Brain Res* 420: 397-402.
- Boivin DB and Czeisler CA (1998) Resetting of circadian melatonin and cortisol rhythms in humans by ordinary room light. *Neuroreport* 9: 779-782.
- Boivin DB, Duffy JF, Kronauer RE, and Czeisler CA (1996) Dose-response relationships for resetting of human circadian clock by light. *Nature* 379: 540-542.
- Boulos Z (1995) Wavelength dependence of light-induced phase shifts and period changes in hamsters. *Physiol Behav* 57: 1025-1033.
- Boulos Z, Macchi M, and Terman M (1996a) Effects of twilights on circadian entrainment patterns and reentrainment rates in squirrel monkeys. *J Comp Physiol A* 179: 687-694.
- Boulos Z, Macchi M, and Terman M (1996b) Twilight transitions promote circadian entrainment to lengthening light-dark cycles. *Am J Physiol* 271: R813-R818.
- Bowmaker JK, Heath LA, Wilkie SE, and Hunt DM (1997) Visual pigments and oil droplets from six classes of photoreceptor in the retinas of birds. *Vision Res* 37: 2183-2194.
- Boyer BB and Barnes BM (1999) Molecular and metabolic aspects of mammalian hibernation. *BioScience* 49: 713-723.
- Brainard GC, Barker FM, Hoffman RJ, Stetson MH, Hanifin JP, Podolin PL, and Rollag MD (1994) Ultraviolet regulation of neuroendocrine and circadian physiology in rodents. *Vision Res* 34: 1521-1533.
- Bult A, Hiestand L, Van der Zee EA, and Lynch CB (1993) Circadian rhythms differ between selected mouse lines: A model to study the role of vasopressin neurons in the suprachiasmatic nucleus. *Brain Res* 32: 623-627.
- Burkhardt D (1982) Birds, Berries and UV. *Naturwissenschaften* 69: 153-157.
- Burkhardt D (1989) UV vision: a bird's eye view of feathers. *J Comp Physiol A* 164: 787-796.
- Burkhardt D (1996) Die Ultraviolett-Tüchtigkeit des Vogelauges und einige Konsequenzen. *Naturwissenschaften* 83: 492-497.
- Burkhardt D and Finger E (1991) Black, white and UV: how birds see birds. *Naturwissenschaften* 78: 279-280.
- Caldwell MM and Robberecht R (1980) A steep latitudinal gradient of solar ultraviolet-B radiation in the arctic-alpine life zone. *Ecology* 61: 600-611.
- Canguilhem B, Malan A, Masson-Pévet M, Nobelis P, Kirsch R, Pévet P, and Le Minor J (1994) Search for rhythmicity during hibernation in the European hamster. *J Comp Physiol B* 163: 690-698.
- Card JP and Moore RY, (1991) The organisation of visual circuits influencing the circadian activity of the suprachiasmatic nucleus. In: *Suprachiasmatic nucleus; the mind's clock*. Klein DC, Moore RY, and Reppert SM (eds.) Oxford university press, Oxford, pp 51-76.
- Castel M, Feinstein N, Cohen S, and Harari N (1990) Vasopressinergic innervation of the mouse suprachiasmatic nucleus: an immuno-electron microscopic analysis. *J Comp Neurol* 298: 172-187.
- Chen D-M and Goldsmith TH (1986) Four spectral classes of cone in the retinas of birds. *J Comp Physiol A* 159: 473-479.
- Chou BR and Cullen AP (1984) Spectral transmittance of the ocular media of the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). *Can J Zool* 62: 825-830.
- Cooper GF and Robson JG (1969) The yellow colour of the lens of the grey squirrel (*Sciurus carolinensis leucotis*). *J Physiol Lond* 203: 403-410.
- Czeisler CA, Kronauer RE, Allan JS, Duffy JF, Jewett ME, Brown EN, and Ronda JM (1989) Bright light induction of strong (type 0) resetting of the human circadian pacemaker. *Science* 244: 1328-1333.
- Daan S (1973a) Activity during natural hibernation in three species of Vespertilionid bats. *Netherlands Journal of Zoology* 23: 1-71.
- Daan S (1973b) Periodicity of heterothermy in the garden dormouse, *Eliomys quercinus* (L.). *Netherlands Journal of Zoology* 23: 237-265.
- Daan S (1977) Tonic and phasic effects of light in the entrainment of circadian rhythms. *Ann New York Ac Sci* 290: 51-59.
- Daan S (2000) Colin Pittendrigh, Jürgen Aschoff and the natural entrainment of circadian systems. *J Biol Rhythms* 15: 195-207.
- Daan S and Aschoff J (1975) Circadian rhythms of locomotor activity in captive birds and mammals: their variations with season and latitude. *Oecologia* 18: 269-316.
- Daan S and Pittendrigh CS (1976) A functional analysis of circadian pacemakers in nocturnal rodents. II. The variability of phase response curves. *J Comp Physiol A* 106: 253-266.
- Daan S and Slopeema S (1978) Short-term rhythms in foraging behavior of the common vole, *Microtus arvalis*. *J Comp Physiol* 127: 215-227.

- Daan S, Damassa D, Pittendrigh CS, and Smith ER (1975) An effect of castration and testosterone replacement on a circadian pacemaker in mice (*Mus musculus*). *Proc Nat Acad Sci USA* 72: 3744-3747.
- Daan S, Masman D, Strijkstra AM, and Kenagy GJ (1991) Daily energy turnover during reproduction in small birds and mammals: its relationship to basal metabolic rate. In: *Acta XX Congressus Internationalis Ornithologici*. pp 1976-1987.
- Dartnall HJA (1953) The interpretation of spectral sensitivity curves. *Brit med Bull* 9: 24-30.
- Das D, Wilkie SE, Hunt DM, and Bowmaker JK (1999) Visual pigments and oil droplets in the retina of a passerine bird, the canary *Serinus canaria*: microspectrophotometry and opsin sequences. *Vision Res* 39: 2801-2815.
- De Groot MHM (1998) Classical conditioning of the circadian system of rodents: effects of conditioned and unconditioned stimuli on behaviour and immediate-early gene expression. Thesis, Dalhousie University.
- DeCoursey PJ (1964) Function of a light response rhythm in hamsters. *J Cell Comp Physiol* 63: 189-196.
- DeCoursey PJ (1986) Light-sampling behavior in photoentrainment of a rodent circadian rhythm. *J Comp Physiol A* 159: 161-169.
- DeCoursey PJ (1989) Photoentrainment of circadian rhythms: an ecologist's viewpoint. In: *Circadian Clocks and Ecology*. Hiroshige T and Honma K (eds.) Hokkaido Univ. press, Sapporo, pp 187-206.
- DeCoursey PJ, Krulas JR, Mele G, and Holley DC (1997) Circadian performance of suprachiasmatic nuclei (SCN)-lesioned antelope ground squirrels in a desert enclosure. *Physiol Behav* 62: 1099-1108.
- Deelman LE, Henning RH, Hut RA, Van der Zee EA, and Epema AH (1998) Changed responsiveness of aortic tissue in hibernating ground squirrels. *Anesthesiology* 89: U440-U440.
- De Lean A, Munson PJ, and Rodbard D (1978) Simultaneous analysis of families of sigmoidal curves: application to bioassay, radiogand assay, and physiological dose-response curves. *Am J Physiol* 235: E97-E102.
- Derim-Oglu EN and Maximov VV (1994) Small passerines can discriminate ultraviolet surface colors. *Vision Res* 34: 1535-1539.
- Dixon ER (1978) Spectral distribution of Australian daylight. *J Opt Soc Am* 68: 437-450.
- Dkhissi-Benyahya O, Sicard B, and Cooper HM (2000) Effects of irradiance and stimulus duration on early gene expression (Fos) in the suprachiasmatic nucleus: temporal summation and reciprocity. *J Neurosci* 20: 7790-7797.
- Dutsch HU (1969) Atmospheric ozone and ultraviolet radiation. In: *Climate of the free atmosphere*. Rex DF (ed.) Elsevier Publishing Company, Amsterdam, pp 383-430.
- Earnest DJ, Digiorgio SM, and Sladek CD (1991) Effects of tetrodotoxin on the circadian pacemaker mechanism in suprachiasmatic explants in vitro. *Brain Res Bull* 26: 677-682.
- Edgar DM and Dement WC (1991) Regularly scheduled voluntary exercise synchronizes the mouse circadian clock. *Am J Physiol* 261: R928-R933.
- Edgar DM, Martin CE, and Dement WC (1991) Activity feedback to the mammalian circadian pacemaker: influence on the observed measures of rhythm period length. *J Biol Rhythms* 6: 185-199.
- Eigner D, Wündsche L, and Lützw-Kafka Av (1984) Spectral sensitivity of the European ground squirrel (*Citellus citellus* L.). *Ophthalmic Res* 16: 48-53.
- Emmerton J, Schwermer J, Muth I, and Schlecht P (1980) Spectral transmission of the ocular media of the pigeon (*Columba livia*). *Invest Ophthalmol Vis Sci* 19: 1382-1387.
- Enright JT (1980) *The timing of sleep and wakefulness*. Springer-Verlag, Berlin.
- Everts LG, Strijkstra AM, Hut RA, Hoffmann IE, and Millesi E (submitted) Seasonal variation in daily activity patterns of European ground squirrel. *Z Säugetierkunde*. Chapter 2.
- Freedman MS, Lucas RJ, Soni B, Von Schantz M, Muñoz M, David-Gray Z, and Foster R (1999) Regulation of the mammalian circadian behavior by non-rod, non-cone, ocular photoreceptors. *Science* 284: 502-504.
- Gates DM (1966) Spectral distribution of solar radiation at the earth's surface. *Science* 151: 523-529.
- Gerkema MP, Daan S, Wilbrink M, Hop MW, and Van der Leest F (1993) Phase control of ultradian feeding rhythms in the common vole (*Microtus arvalis*): the roles of light and the circadian system. *J Biol Rhythms* 8: 151-171.
- Gerkema MP, Van der Zee EA, and Feitsma LE (1994) Expression of circadian rhythmicity correlates with the number of arginine-vasopressin-immunoreactive cells in the suprachiasmatic nucleus of common voles, *Microtus arvalis*. *Brain Res* 639: 93-101.
- Gettinger RD (1984) A field study of activity patterns of Thomomys bottae. *J Mammal* 65: 76-84.
- Grahn DA, Miller JD, Hough VS, and Heller HC (1994) Persistence of circadian rhythmicity in hibernation ground squirrels. *Am J Physiol* 266: R1251-R1258.
- Gwinner E (1996) Circadian and circannual programs in avian migration. *J Exp Biol* 199: 39-48.

- Hastings MH, Duffield GE, Smith EJD, Maywood ES, and Ebling FJP (1998) Entrainment of the circadian system of mammals by nonphotic cues. *Chronobiol Internat* 15: 425-445.
- Hau M and Gwinner E (1994) Melatonin facilitates synchronisation of sparrow circadian rhythms to light. *J Comp Physiol A* 175: 343-347.
- Hau M and Gwinner E (1995) Continuous melatonin administration accelerates resynchronisation following phase shifts of a light-dark cycle. *Physiol Behav* 58: 89-85.
- Heldmaier G and Ruf T (1992) Body temperature and metabolic rate during natural hypothermia in endotherms. *J Comp Physiol B* 162: 696-706.
- Heldmaier G, Steiger R, and Ruf T, (1993) Suppression of metabolic rate in hibernation. In: *Life in the Cold III: Ecological, Physiological, and Molecular Mechanisms*. Carey C, Florant G, Wunder B, and Horwitz B (eds.) Westview Press, Boulder (CO), USA, pp 545-548.
- Henning RH, Deelman LE, Hut RA, Van der Zee EA, Buikema H, Nelemans SA, De Zeeuw D, Daan S, and Epema AH (submitted) The role of nitric oxide in the normalisation of vascular function during arousal in the hibernating ground squirrel.
- Honma K and Honma S (1988) A human phase response curve for bright light pulses. *Jap J Psych Neurol* 42: 167-168.
- Hoogeboom I, Daan S, Dallinga H, and Schoenmakers M (1984) Seasonal change in daily timing of behaviour in the common vole *Microtus arvalis*. *Oecologia* 61: 18-31.
- Huber S (1995) Lebensraumnutzung, Verhalten und ihre Bedeutung für die Fortpflanzungsbiologie beim Europäischen Ziesel (*Spermophilus citellus citellus*). PhD thesis, University of Vienna, Austria.
- Hunt S, Cuthill IC, Bennett ATD, and Griffiths PE (1999) Preferences for ultraviolet partners in the blue tit. *Anim Behav* 58: 809-815.
- Hunt S, Cuthill IC, Swaddle JP, and Bennett ATD (1997) Ultraviolet vision and band-colour preferences in female zebra finches, *Taeniopygia guttata*. *Anim Behav* 54: 1383-1392.
- Hut RA and Scharff A (1998) Endoscopic observations on tunnel blocking behaviour in the European ground squirrel (*Spermophilus citellus*). *Z Säugetierkunde* 63: 377-380. Chapter 4.
- Hut RA, Barnes BM, and Daan S (submitted a) Body temperature patterns before, during, and after semi-natural hibernation in the European ground squirrel. *J Comp Physiol B*. Chapter 5.
- Hut RA, Jansen K, Van der Zee EA, Gerkema MP, and Daan S (submitted b) Gradual reappearance of post hibernation circadian rhythmicity correlates with numbers of vasopressin containing neurons in the supra chiasmatic nuclei of European ground squirrels. *J Comp Physiol B*. Chapter 6.
- Hut RA, Mrosovsky N, and Daan S (1999a) Nonphotic entrainment in a diurnal mammal, the European ground squirrel (*Spermophilus citellus*). *J Biol Rhythms* 14: 409-419. Chapter 8.
- Hut RA, Scheper A, and Daan S (2000) Can the circadian system of a diurnal and a nocturnal rodent entrain to ultraviolet light ? *J Comp Physiol A* 186: 707-715. Chapter 7.
- Hut RA, Van Oort BEH, and Daan S (1999b) Natural entrainment without dawn and dusk: the case of the European ground squirrel (*Spermophilus citellus*). *J Biol Rhythms* 14: 290-299. Chapter 3.
- Ingram CD, Snowball RK, and Mihai R (1996) Circadian rhythm of neuronal activity in the suprachiasmatic nucleus slices from the vasopressin-deficient Brattleboro rat. *Neuroscience* 75: 635-641.
- Jacobs GH (1978) Spectral sensitivity and colour vision in the ground-dwelling sciurids: results from golden mantled ground squirrels and comparisons for five species. *Anim Behav* 26: 409-421.
- Jacobs GH (1992) Ultraviolet vision in vertebrates. *Am Zool* 32: 544-554.
- Jacobs GH and Yolton RL (1969) Dichromacy in the ground squirrel. *Nature* 223: 414-415.
- Jacobs GH and Yolton RL (1971) Visual sensitivity and color vision in ground squirrels. *Vision Res* 11: 511-537.
- Jacobs GH and Yolton RL (1972) Some characteristics of the eye and the electroretinogram of the prairie dog. *Exp Neurol* 37: 538-549.
- Jacobs GH, Fisher SK, Anderson DH, and Silverman MS (1976) Scotopic and photopic vision in the California Ground squirrel: Physiological and anatomical evidence. *J Comp Neurol* 165: 209-228.
- Jacobs GH, Neitz J, and Deegan JF (1991) Retinal receptors in rodents maximally sensitive to ultraviolet light. *Nature* 353: 655-656.
- Jacobs GH, Tootell RBH, Fisher SK, and Anderson DH (1980) Rod photoreceptors and scotopic vision in ground squirrels. *J Comp Neurol* 189: 113-125.
- Janik D and Mrosovsky N (1993) Nonphotically induced phase shifts of circadian rhythms in the golden hamster: Activity-response curves at different ambient temperatures. *Physiol Behav* 53: 431-436.
- Jansen K, Van der Zee EA, and Gerkema MP (1998) Concurrent decrease of vasopressin and protein kinase C alpha immunoreactivity during the light phase in the vole suprachiasmatic nucleus. *Neurosci Lett* 81-84.

- Jansen K, Van der Zee EA, and Gerkema MP (1999) Organotypic suprachiasmatic nuclei cultures of adult voles reflect locomotor behavior: differences in number of vasopressin cells. *Chronobiol Internat* 16: 745-750.
- Jansen K, Van der Zee EA, and Gerkema MP (submitted) Being circadian or not: vasopressin release in cultured SCN mirrors behavior in adult voles.
- Jewett ME, Kronauer RE, and Czeisler CA (1991) Light-induced suppression of endogenous circadian amplitude in humans. *Nature* 350: 59-62.
- Jewett ME, Kronauer RE, and Czeisler CA (1994) Phase amplitude resetting of the human pacemaker via bright light: a further analysis. *J Biol Rhythms* 9: 295-314.
- Johnson CH (1990) An atlas of phase response curves for circadian and circatidal rhythms. Department of Biology, Vanderbilt University, Nashville, Te.
- Joshi D and Chandrashekar MK (1985a) White light of different spectral composition causes differential phase shifts of circadian rhythm of activity in a Bat. *Naturwissenschaften* 72: 548-549.
- Joshi D and Chandrashekar MK (1985b) Spectral sensitivity of the photoreceptors responsible for phase shifting the circadian rhythm of activity in the bat, *Hipposideros speoris*. *J Comp Physiol A* 156: 189-198.
- Kas MJH (1999) Sleep and circadian timekeeping in *Octodon degus*; behavioural and photic determinants of activity phase preference. PhD thesis, University of Groningen, the Netherlands.
- Kas MJH and Edgar DM (1998) Crepuscular rhythms of EEG sleep-wake in a hystricomorph rodent, *Octodon degus*. *J Biol Rhythms* 13: 9-17.
- Kawamura H and Inouye ST, (1979) Circadian rhythm in a hypothalamic island containing the suprachiasmatic nucleus. In: Biological rhythms and their central mechanism. Suda M, Hayaishi O, and Nakagawa H (eds.) Elsevier, Amsterdam, pp 335-341.
- Kenagy GJ (1980) Center-of-gravity of circadian activity and its relation to free-running period in two rodent species. *J Interdiscipl Cycle Res* 11: 1-8.
- Kenagy GJ, Sharbaugh SM, and Nagy KA (1989) Annual cycle of energy and time expenditure in a golden-mantled ground squirrel population. *Oecologia* 78: 269-282.
- Khidas K and Hansell MH (1995) Burrowing behaviour and burrow architecture in *Apodemus sylvaticus* (Rodentia). *Z Säugetierkunde* 60: 246-250.
- Kilduff TS, Radeke CM, Randall TL, Sharp FR, and Heller HC (1989) Suprachiasmatic nucleus: phase-dependent activation during the hibernation cycle. *Am J Physiol* 257: R605-R612.
- King DP and Takahashi JS (2000) Molecular genetics of circadian rhythms in mammals. *Ann Rev Neurosci* 23: 713-742.
- Kirkwood JK (1983) A limit to metabolisable energy intake in mammals and birds. *Comp Biochem Physiol* 75A: 1-3.
- Klerman EB, Rimmer DW, Dijk D-J, Kronauer RE, Rizzo III JF, and Czeisler CA (1998) Nonphotic entrainment of the human circadian pacemaker. *Am J Physiol* 274: R991-R996.
- Körtner G and Geiser F (1998) Ecology of natural hibernation in the marsupial mountain pygmy-possum (*Burramys parvus*). *Oecologia* 113: 170-178.
- Körtner G and Geiser F (2000) The temporal organisation of daily torpor and hibernation: circadian and circannual rhythms. *Chronobiol Internat* 17: 103-128.
- Körtner G, Song X, and Geiser F (1998) Rhythmicity of torpor in a marsupial hibernator, the mountain pygmy-possum (*Burramys parvus*), under natural and laboratory conditions. *J Comp Physiol B* 168: 631-638.
- Kramm KK and Kramm DA (1980) Photoperiodic control of circadian activity rhythms in diurnal rodents. *Int J Biometeor* 24: 65-76.
- Krillowicz BL, Edgar DM, and Heller HC (1989) Action potential duration increases as body temperature decreases during hibernation. *Brain Res* 498: 73-80.
- Krillowicz BL, Glotzbach SF, and Heller HC (1988) Neuronal activity during sleep and complete bouts of hibernation. *Am J Physiol* 255: R1008-R1019.
- Kronauer RE and Czeisler CA, (1993) Understanding the use of light to control the circadian pacemaker in humans. In: Light and biological rhythms in man. Wettenberg L (ed.) Pergamon press, Oxford.
- Kruisbrink J, Mirmiran M, Van der Woude TP, and Boer GJ (1987) Effects of enhanced cerebrospinal fluid levels of vasopressin, vasopressin antagonist or vasoactive intestinal polypeptide on circadian sleep-wake rhythm in the rat. *Brain Res* 419: 76-86.
- Krüff F, Demmelmeier H, and Rammert H (1985) On the circadian rhythm of animals in high polar latitudes. *Naturwissenschaften* 72: 197-203.
- Kurumiya S and Kawamura H (1988) Circadian oscillation of the multiple unit activity in the guinea pig suprachiasmatic nucleus. *J Comp Physiol A* 162: 301-308.

- Lee TM and Labyak SE (1997) Free-running rhythms and light-dark-pulse phase response curves for diurnal *Octodon degus* (Rodentia). *Am J Physiol* 273: R278-R286.
- Lehman U and Sommersberg C (1980) Activity patterns of the common vole, *Microtus arvalis* - automatic recording of behavior in an enclosure. *Oecologia* 47: 61-75.
- Lovegrove BG (1988) Colony size and structure, activity patterns and foraging behaviour of a colony of the social mole-rat *Cryptomys damarensis* (Bathyergidae). *J Zool* 216: 391-402.
- Lythgoe JN (1979) The ecology of vision. Clarendon Press, Oxford, UK.
- Maclean GS (1981) Factors influencing the composition of respiratory gases in mammal burrows. *Comp Biochem Physiol* 69A: 373-380.
- Maier EJ (1994) Das UV-Sehen der Vögel: Neue Ergebnisse über den spektralen Sehbereich der Vögel. *J Ornithologie* 135: 179-192.
- Marchant EG and Mistlberger RE (1996) Entrainment and phase shifting of circadian rhythms in mice by forced treadmill running. *Physiol Behav* 60: 657-663.
- Marimuthu G, Rajan S, and Chandrasekaran MK (1981) Social entrainment of the circadian rhythm in the flight activity of the Microchiropteran bat *Hipposideros speoris*. *Behav Ecol Sociobiol* 8: 147-150.
- Martin P and Bateson P (1994) Measuring behaviour: an introductory guide. Second edition, Cambridge university press, Cambridge, UK.
- McArthur MD and Milsom WK (1991a) Ventilation and respiratory sensitivity of euthermic Columbian and Golden-mantled Ground Squirrels (*Spermophilus columbianus* and *Spermophilus lateralis*) during the summer and winter. *Physiol Zool* 64: 921-939.
- McArthur MD and Milsom WK (1991b) Changes in ventilation and respiratory sensitivity associated with hibernation in Columbian (*Spermophilus columbianus*) and Golden-Mantled (*Spermophilus lateralis*) Ground Squirrels. *Physiol Zool* 64: 940-959.
- McGuire RA, Rand WM, and Wurtman RJ (1973) Entrainment of body temperature rhythm in rats: Effect of color and intensity of environmental light. *Science* 181: 956-957.
- McIlveen R (1992) Radiation and global climate. In: Fundamentals of weather and climate. Chapman & Hall, London, pp 244-285.
- Meerlo P, Van den Hoofdakker RH, Koolhaas JM, and Daan S (1997) Stress-induced changes in circadian rhythms of body temperature and activity in rats are not caused by pacemaker changes. *J Biol Rhythms* 12: 80-92.
- Meijer JH and Rietveld WJ (1989) The neurophysiology of the suprachiasmatic circadian pacemaker in rodents. *Physiol Rev* 69: 671-707.
- Meijer JH, Rusak B, and Gänshirt G (1992) The relation between light-induced discharge in the suprachiasmatic nucleus and phase shifts of hamster circadian rhythms. *Brain Res* 598: 257-263.
- Menaker M (1959) Endogenous rhythms of body temperature in hibernating bats. *Nature* 184: 1251-1252.
- Menaker M (1961) The free running period of the bat clock; seasonal variations at low body temperature. *J Cell Comp Physiol* 57: 81-86.
- Merker E (1934) Die sichtbarkeit ultravioletten Lichtes. *Biol Rev* 9: 49-78.
- Michener GR (1992) Sexual differences in over-winter torpor patterns of Richardson's ground squirrels in natural hibernacula. *Oecologia* 89: 397-406.
- Michener GR and Lockear L (1990) Differential costs of reproductive effort for male and female Richardson's ground squirrels. *Ecology* 71: 855-868.
- Miller JD, Cao VH, and Heller HC (1994) Thermal effects on neuronal activity in suprachiasmatic nuclei of hibernators and nonhibernators. *Am J Physiol* 266: R1259-R1266.
- Millesi E, Huber S, Dittami JP, Hoffmann IE, and Daan S (1998) Parameters of mating effort and success in male European ground squirrels, *Spermophilus citellus*. *Ethology* 104: 298-313.
- Millesi E, Huber S, Dittami J, Hoffmann IE, and Daan S (1999a) Reproductive decisions in female European ground squirrels: factors affecting reproductive output and maternal investment. *Ethology* 105: 163-175.
- Millesi E, Strijkstra AM, Hoffmann IE, Dittami JP, and Daan S (1999b) Sex and age difference in mass, morphology and annual cycle in European ground squirrels, *Spermophilus citellus*. *J Mammal* 80: 218-231.
- Minnaert MGJ (1974) De natuurkunde van het vrije veld. I. Licht en kleur in het landschap. BVWJ Thieme & Cie, Zutphen, the Netherlands.
- Minnaert MGJ (1993) Light and color in the outdoors. Springer verlag, New York, USA.
- Minors DS, Waterhouse JM, and Wirz-Justice A (1991) A human phase response curve to light. *Neurosci Lett* 133: 36-40.
- Moore RY (1998) Entrainment pathways in the mammalian brain. In: Biological clocks; mechanisms and applications. Touitou Y (ed.). Proc Int Congr Chronobiol, 1997. Elsevier, Amsterdam, the Netherlands, p 3-14.
- Moore RY and Eichler VB (1972) Loss of a circadian adrenal corticosterone rhythm following suprachiasmatic lesions in the rat. *Brain Res* 42: 201-206.

- Mrosovsky N (1993) Tau changes after single nonphotic events. *Chronobiol Internat* 10: 271-276.
- Mrosovsky N, Reebbs SG, Honrado GI, and Salmon PA (1989) Behavioural entrainment of circadian rhythms. *Experientia* 45: 696-702.
- Mrosovsky N, Salmon PA, Menaker M, and Ralph MR (1992) Nonphotic phase shifting in hamster clock mutants. *J Biol Rhythms* 7: 41-49.
- Naka KI and Rushton WAH (1966) S-potentials from luminosity units in the retina of fish (*Cyprinidae*). *J Physiol* 185: 587-599.
- Navaneethakannan K and Chandrashekar MK (1986) Light and dark pulse response curves in a day active palm squirrel *Funambulus palmarum*. *J Exp Biol* 45: 267-273.
- Nelson DE and Takahashi JS (1991) Sensitivity and integration in a visual pathway for circadian entrainment in the hamster (*Mesocricetus auratus*). *J Physiol* 439: 115-145.
- Nelson RJ and Zucker I (1981) Absence of extraocular photoreception in diurnal and nocturnal rodents exposed to direct sunlight. *Comp Biochem Physiol* 69A: 145-148.
- Ney V, Avramut M, Blank JL, Tardiff SD, and Glass JD (1998) Behavioral and serotonergic circadian clock resetting in a diurnal monkey, the common marmoset. Poster abstract 190a, sixth meeting of the Society for Research on Biological Rhythms, Amelia Island, Florida, USA.
- Nubner JFW, Van Nuys WM, and Van Steenberg JC (1983) Colour changes in a light regimen as synchronizers of circadian activity. *J Comp Physiol A* 151: 359-366.
- Oklejewicz M, Daan S, and Strijkstra AM (2000) Temporal organisation of hibernation in wild-type and tau mutant Syrian hamsters. *J Comp Physiol B*
- Okudaira N, Kripke DF, and Webster JB (1983) Naturalistic studies of human light exposure. *Am J Physiol* 245: R613-R615.
- Pavlidis T (1967) A mathematical model for the light affected system in the *Drosophila eclosion* rhythm. *Bull Math Biophysics* 29: 291-310.
- Pittendrigh CS (1960) Circadian rhythms and the circadian organisation of living systems. Cold Spring Harbor Symp Quant Biol 25: 159-184.
- Pittendrigh CS (1981a) Circadian systems: entrainment. In: Biological Rhythms. Aschoff J (ed.) Plenum press, New York and London, pp 95-124.
- Pittendrigh CS (1981b) Circadian systems: general perspective. In: Biological rhythms. Aschoff J (ed.) Plenum press, New York, USA, pp 57-80.
- Pittendrigh CS (1981c) Circadian organisation and the photoperiodic phenomena. In: Biological clocks in seasonal reproductive cycles. Follett BK and Follett DE (eds.) Wright, Bristol, UK.
- Pittendrigh CS (1993) Temporal organisation: reflections of a Darwinian clock-watcher. *Annu Rev Physiol* 55: 17-54.
- Pittendrigh CS and Daan S (1976a) A functional analysis of circadian pacemakers in nocturnal rodents. I. The stability and lability of spontaneous frequency. *J Comp Physiol A* 106: 223-252.
- Pittendrigh CS and Daan S (1976b) A functional analysis of circadian pacemakers in nocturnal rodents. IV. Entrainment: pacemaker as clock. *J Comp Physiol A* 106: 291-331.
- Pittendrigh CS and Daan S (1976c) A functional analysis of circadian pacemakers in nocturnal rodents. V. Pacemaker structure: a clock for all seasons. *J Comp Physiol A* 106: 333-355.
- Pohl H (1961) Temperaturregulation und Tagesperiodik des Stoffwechsels bei Winterschläfern (Untersuchungen an *Myotis myotis* Borkh., *Glis glis* L. und *Mesocricetus auratus* Waterh.). *Z vergl Physiol* 45: 109-153.
- Pohl H (1967) Circadian rhythms in hibernation and the influence of light. In: Mammalian Hibernation III. Oliver & Boyd, Edinburgh, pp 140-151.
- Pohl H (1981) Temporal structure of hibernation behaviour of the Turkish hamster, *Mesocricetus brandti*, under controlled laboratory conditions. *Acta Universitatis Carolinae - Biologica* 1979: 177-180.
- Pohl H (1982) Characteristics and variability in entrainment of circadian rhythms to light in diurnal rodents. In: Vertebrate Circadian Systems. Aschoff J, Daan S, and Groos G (eds.) Springer-Verlag, Berlin-Heidelberg, pp 339-346.
- Pohl H (1987) Circadian pacemaker does not arrest in deep hibernation. Evidence for desynchronisation from the light cycle. *Experientia* 43: 293-294.
- Pohl H (1992) Ultraviolet radiation: A zeitgeber for the circadian clock in birds. *Naturwissenschaften* 79: 227-229.
- Pohl H (1996) Circadian and circannual rhythmicity of hibernation in the Turkish hamster, *Mesocricetus brandti*. In: Adaptations to the Cold: Tenth International Hibernation Symposium. Geiser F, Hulbert AJ, and Nicol SC (eds.) University of New England Press, Armidale, pp 87-93.
- Pohl H (1998) Temperature cycles as zeitgeber for the circadian clock of two burrowing rodents, the normothermic Antelope ground squirrel and the heterothermic Syrian hamster. *Biol Rhythm Res* 29: 311-325.

- Provencio I and Foster RG (1995) Circadian rhythms in mice can be regulated by photoreceptors with cone-like characteristics. *Brain Res* 694: 183-190.
- Rajaratnam SMW and Redman JR (1998) Entrainment of activity rhythms to temperature cycles in diurnal palm squirrels. *Physiol Behav* 63: 271-277.
- Ralph MR, Foster RG, Davis FC, and Menaker M (1990) Transplanted suprachiasmatic nucleus determines circadian period. *Science* 247: 975-978.
- Rawson KS (1960) Effects of tissue temperature on mammalian activity rhythms. Cold Spring Harbor Symp Quant Biol 25: 105-113.
- Redlin U and Mrosovsky N (1997) Exercise and human circadian rhythms: what we know and what we need to know. *Chronobiol Internat* 14: 221-229.
- Reebs SG (1989) Acoustical entrainment of circadian activity rhythms in house sparrows: constant light is not necessary. *Ethology* 80: 172-181.
- Reebs SG and Doucet P (1997) Relationship between circadian period and size of phase shifts in Syrian hamsters. *Physiol Behav* 61: 661-666.
- Reebs SG and Mrosovsky N (1989) Effects of induced wheel running on the circadian activity rhythms of Syrian hamsters: entrainment and phase response curve. *J Biol Rhythms* 4: 39-48.
- Reiter RJ, Reiter MN, Hattori A, Yaga K, Herbert DC, and Barlow-Walden L (1994) The pineal melatonin rhythm and its regulation by light in a subterranean rodent, the valley pocket gopher (*Thomomys bottae*). *Journal of Pineal Research* 16: 145-153.
- Reuss S, Hurlbutt EC, Speh JC, and Moore RY (1989) Immunohistochemical evidence for the presence of neuropeptides in the hypothalamic suprachiasmatic nucleus of ground squirrels. *Anatom Rec* 225: 341-346.
- Richter CP (1967) Sleep and activity: their relation to the 24-hour clock. *Res Publ Assoc Res Nerv Ment Dis* 45: 8-29.
- Roenneberg T and Foster RG (1997) Twilight times: Light and the circadian system. *Photochem Photobiol* 66: 549-561.
- Ruby NF and Heller HC (1996) Temperature sensitivity of the suprachiasmatic nucleus of Ground squirrels and rats in vitro. *J Biol Rhythms* 11: 126-136.
- Rusak B, Mistlberger RE, Losier B, and Jones CH (1988) Daily hoarding opportunity entrains the pacemaker for hamster activity rhythms. *J Comp Physiol A* 164: 165-171.
- Rusak B, Robertson HA, Wisden W, and Hunt SP (1990) Light pulses that shift rhythms induce gene expression in the suprachiasmatic nucleus. *Science* 248: 1237-1240.
- Ružič A (1978) *Citellus citellus* (Linnaeus, 1766) Der oder das Europäische Ziesel. In: Handbuch der Säugetiere Europas; Nagetiere. Niethammer J, Krapp F (eds.) Akademische Gesellschaft, Wiesbaden, Germany, p 122-144.
- Sato T and Kawamura H (1984) Circadian rhythms in multiple unit activity inside and outside the suprachiasmatic nucleus in the diurnal chipmunk (*Eutamias sibiricus*). *Neurosci Res* 1: 45-52.
- Savides TJ, Messin S, Senger C, and Kripke DF (1986) Natural light exposure of young adults. *Physiol Behav* 38: 571-574.
- Scheer G (1952) Beobachtungen und Untersuchungen über die Abhängigkeit des Frühgesanges der Vögel von inneren und äusseren Faktoren. *Biol Abhandl* 3/4: 1-68.
- Schindler CU and Nürnberger F (1990) Hibernation-related changes in immunoreactivity of neuropeptide systems in the suprachiasmatic nucleus of the ground squirrel, *Spermophilus richardsonii*. *Cell Tissue Res* 262: 293-300.
- Schooley RL, Horne BV, and Burnham KP (1993) Passive integrated transponders for marking free-ranging Townsend's ground squirrels. *J Mammal* 74: 480-484.
- Schwartz WJ (1991) Further evaluation of the tetrodotoxin-resistant circadian pacemaker in the suprachiasmatic nuclei. *J Biol Rhythms* 6: 149-158.
- Schwartz WJ, Gross RA, and Morton MT (1987) The suprachiasmatic nuclei contain a tetrodotoxin-resistant circadian pacemaker. *Proc Nat Acad Sci USA* 84: 1694-1698.
- Schwartz WJ, Reppert SM, Eagan SM, and Moore-Ede MC (1983) In vivo metabolic activity of the suprachiasmatic nuclei: a comparative study. *Brain Res* 274: 184-187.
- Sharma VK (1999) Ultraviolet light-induced phase response curve for the locomotor activity rhythm of the field mouse *Mus booduga*. *Naturwissenschaften* 86: 96-97.
- Sharma VK, Chandrashekar MK, Singaravel M, and Subbaraj R (1998) Ultraviolet-light-evoked phase shifts in the locomotor activity rhythm of the field mouse *Mus booduga*. *J Photochem Photobiol B* 45: 83-86.
- Sheldon BC, Anderson S, Griffith SC, Örnborg J, and Sendecka J (1999) Ultraviolet colour variation influences blue-tit sex ratios. *Nature* 402: 874-877.

- Shibata S and Moore RY (1993) Tetrodoxin does not affect circadian rhythms in neuronal activity and metabolism in rodent suprachiasmatic nucleus in vitro. *Brain Res* 606: 259-266.
- Shimomura K, Kornhauser JM, Wisor JP, Umesu T, Yamazaki S, Ihara NL, Takahashi JS, and Menaker M (1998) Circadian behavior and plasticity of light-induced c-fos expression in SCN of tau mutant hamsters. *J Biol Rhythms* 13: 305-314.
- Smale L, Blanchard J, Moore RY, and Morin LP (1991) Immunocytochemical characterization of the supra chiasmatic nucleus and the intergeniculate leaflet in the diurnal ground squirrel, *Spermophilus lateralis*. *Brain Res* 563: 77-86.
- Snapp BD and Heller HC (1981) Suppression of metabolism during hibernation in ground squirrels (*Citellus lateralis*). *Physiol Zool* 54: 297-307.
- Sokolove PG and Bushell WN (1978) The chi square periodogram: its utility for analysis of circadian rhythms. *J Theor Biol* 72: 131-160.
- Spoelstra K, Srijckstra AM, and Daan S (2000) Ground squirrel activity during the solar eclipse of August 11, 1999. *Z. Säugetierk.* 65: 307-308.
- Stephan FK and Zucker I (1972) Circadian rhythms in drinking behavior and locomotor activity of rats are eliminated by hypothalamic lesions. *Proc Nat Acad Sci USA* 69: 1583-1586.
- Srijckstra AM (1999) Periodic euthermy during hibernation in the European ground squirrel: causes and consequences. PhD thesis, University of Groningen, the Netherlands.
- Srijckstra AM and Daan S (1997) Sleep during arousal episodes as a function of prior torpor duration in hibernating European ground squirrels. *J Sleep Res* 6: 36-43.
- Strumwasser F (1959) Factors in the pattern, timing and predictability of hibernation in the squirrel, *Citellus beecheyi*. *Am J Physiol* 196: 8-14.
- Swade RH (1969) Circadian rhythms in fluctuating light cycles: toward a new model of entrainment. *J Theor Biol* 24: 227-239.
- Szél A and Röhlich P (1988) Four photoreceptor types in the ground squirrel retina as evidenced by immunocytochemistry. *Vision Res* 28: 1297-1302.
- Takahashi JS, DeCoursey PJ, Bauman L, and Menaker M (1984) Spectral sensitivity of a novel photoreceptive system mediating entrainment of mammalian circadian rhythms. *Nature* 308: 186-188.
- Thomas DW (1992) Lack of evidence for a biological alarm clock in bats (*Myotis* spp.) hibernating under natural conditions. *Can J Zool* 71: 1-3.
- Twente JW and Twente JA (1968) Progressive irritability of hibernating *Citellus lateralis*. *Comp Biochem Physiol* 25: 467-474.
- Twente JW and Twente J (1987) Biological alarm clock arouses hibernating big brown bats, *Eptesicus fuscus*. *Can J Zool* 65: 1668-1674.
- Van den Pol AN and Gorcs T (1986) Synaptic relationships between neurons containing vasopressin, gastrin-releasing peptide, vasoactive intestinal polypeptide, and glutamate decarboxylase immunoreactivity in the suprachiasmatic nucleus: dual ultrastructural immunocytochemistry with gold-substituted silver peroxidase. *J Comp Neurol* 252: 507-521.
- Van der Zee EA, Jansen K, and Gerkema MP (1999) Severe loss of vasopressin-immunoreactive cells in the suprachiasmatic nucleus of aging voles coincides with reduced circadian organisation of running wheel activity. *Brain Res* 816: 572-579.
- Van Norren D (1991) Photochemical damage to the eye. *News Physiol Sci* 6: 232-234.
- Van Reeth O, Sturis J, Byrne MM, Blackman JD, L'Hermite-Balériaux M, Leproult R, Oliner C, Refetoff S, Turek FW, and Van Cauter E (1994) Nocturnal exercise phase delays circadian rhythms of melatonin and thyrotropin secretion in normal men. *Am J Physiol* 266: E964-E974.
- Viitala J, Korpimäki E, Palokangas P, and Koivula M (1995) Attraction of kestrels to vole scent marks visible in ultraviolet light. *Nature* 373: 425-427.
- Vitaterna MH, King DP, Chang A-M, Kornhauser JM, Lowrey PL, McDonald JD, Dove WF, Pinto LH, Turek FW, and Takahashi JS (1994) Mutagenesis and mapping of a Mouse gene, Clock, essential for circadian behavior. *Science* 264: 719-725.
- Von Schantz M, Argamaso-Hernan S, Szél A, and Foster RG (1997) Photopigments and photoentrainment in the Syrian golden hamster. *Brain Res* 770: 131-138.
- Voûte AM, Sluiter JW, and Grimm MP (1974) The influence of the natural light-dark cycle on the activity rhythm of pond bats (*Myotis dasycneme* Boie, 1825) during summer. *Oecologia* (Berl.) 17: 221-243.
- Vos DR (1995) The development of sex recognition in the zebra finch; sexual imprinting from an evolutionary perspective. PhD thesis, University of Groningen, the Netherlands.

- Walls GL and Judd HD (1933) The intra-ocular colour-filters of vertebrates. *Br J Ophthalmol* 17: 641-675; 705-725.
- Wang LCH (1972) Circadian body temperature of Richardson's ground squirrel under field and laboratory conditions: a comparative radio-telemetric study. *Comp Biochem Physiol* 43A: 503-510.
- Wang LCH (1979) Time patterns and metabolic rates of natural torpor in the Richardson's ground squirrel. *Can J Zool* 57: 149-155.
- Waßner T (1998) Die zeitliche Organisation des Winterschlafs beim Europäischen Feldhamster (*Cricetus cricetus* L.). PhD thesis, University of Konstanz. Herbert Utz Verlag Wissenschaft, München, Germany.
- Waßner T and Wollnik F (1997) Timing of torpor bouts during hibernation in European hamsters (*Cricetus cricetus* L.). *J Comp Physiol B* 167: 270-279.
- Wechselberger E (1995) Charakteristika und Mechanismen der Synchronisation der Circadianperiodik des Weissbüscheläffchens, *Callithrix j. jacchus*. PhD thesis, Eberhard-Karls-Universität Tübingen, Germany.
- Wechselberger E and Erkert HG (1994) Characteristics of the light-induced phase response curve of circadian activity rhythms in common marmosets, *Callithrix j. jacchus* (primates-Cebidae). *Chronobiol Internat* 11: 275-284.
- Weisgerber D, Redlin U, and Mrosovsky N (1997) Lengthening of circadian period in hamsters by novelty-induced wheel running. *Physiol Behav* 62: 759-765.
- Wever RA (1966) Ein mathematisches Modell für die circadiane Periodik. *Zeitschrift für angewandte Mathematik und Mechanik Sonderheft* 46: 148-157.
- Wever RA (1967) Zum Einfluss der Dämmerung auf die circadiane Periodik. *Ztschr f verg Physiol* 55: 255-277.
- Wilson KJ and Kilgore DLJ (1978) The effects of location and design on the diffusion of respiratory gases in mammal burrows. *J Theor Biol* 71: 73-101.
- Winfree A (1972) Slow dark-adaptation in *Drosophila*'s circadian clock. *J Comp Physiol* 77: 418-434.
- Withers PC (1978) Models of diffusion-mediated gas exchange in animal burrows. *Am Nat* 112: 1101-1112.
- Wollnik F and Bihler S (1996) Strain differences in the distribution of arginine-vasopressin- and neuropeptide Y-immunoreactive neurons in the suprachiasmatic nucleus of laboratory rats. *Brain Res* 724: 191-199.
- Wollnik F and Schmidt B (1995) Seasonal and daily rhythms of body temperature in the European hamster (*Cricetus cricetus*) under semi-natural conditions. *J Comp Physiol B* 165: 171-182.
- Yolton RL, Yolton DP, Renz J, and Jacobs GH (1974) Preretinal absorbance in sciurid eyes. *J Mammal* 55: 14-20.
- Young PJ (1990) Hibernating patterns of free-ranging Columbian ground squirrels. *Oecologia* 83: 504-511.
- Young III WS, Kovács K, and Lolait SJ (1993) The diurnal rhythm in vasopressin V1a receptor expression in the suprachiasmatic nucleus is not dependent on vasopressin. *Endocrinology* 133: 585-590.
- Zar JH (1999) Biostatistical analysis. 4th edition, Prentice Hall, London, UK.