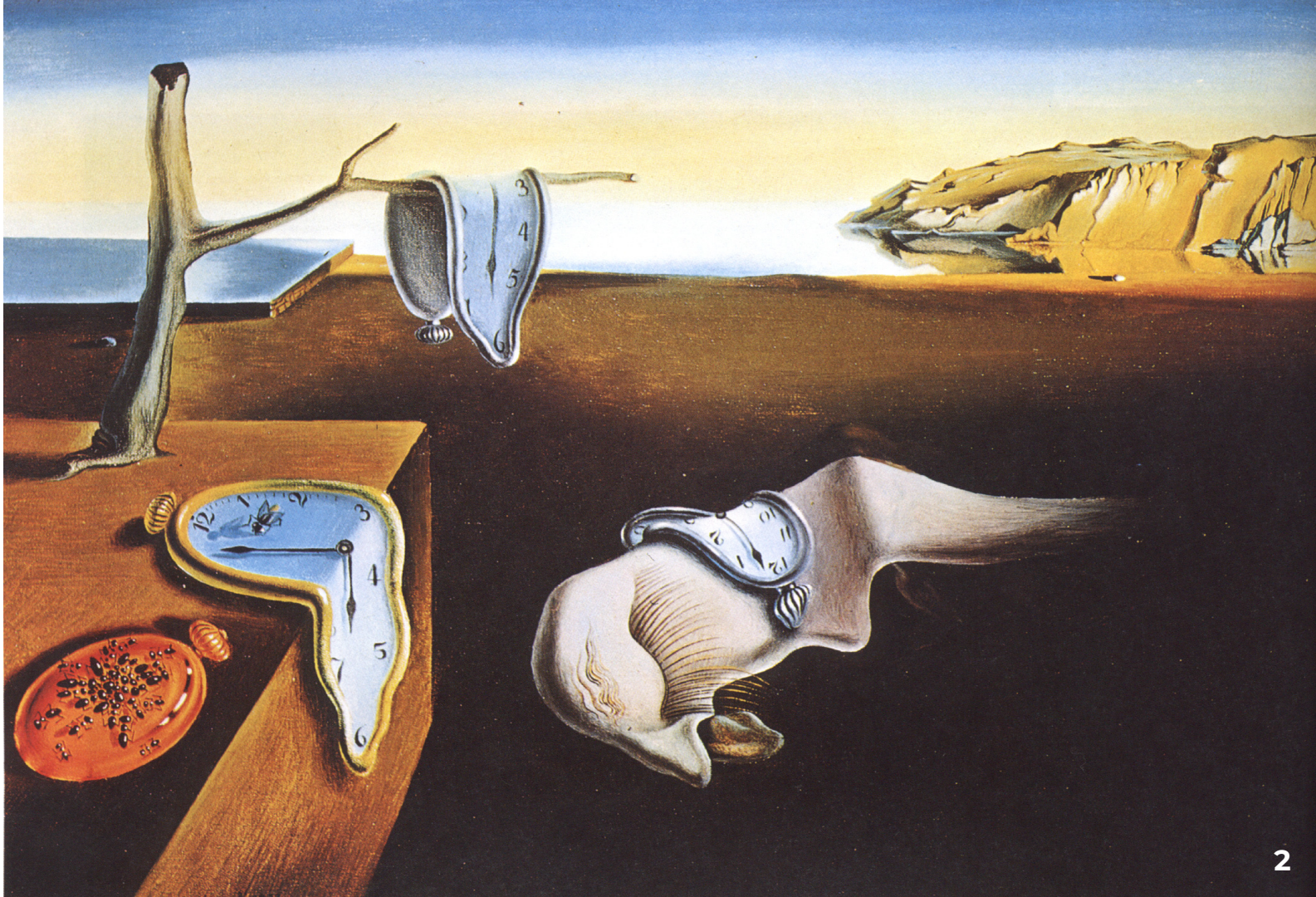
CHRONOBIOLOGY: The Healing Power of Circaseptan

The Persistence of Memory

Salvatore Dali



“

To every **thing** there is a season,
and a **time** to every purpose
under the heaven

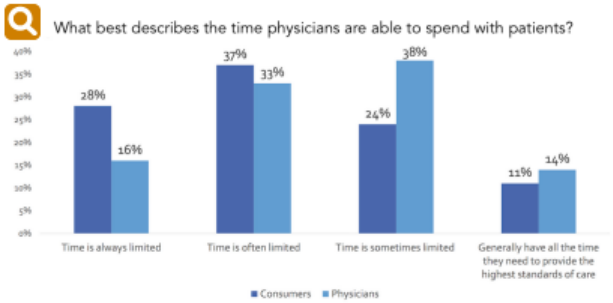
Ecclesiastes 3:1

Friday Oct 06, 2017

Patients and physicians agree: not enough time for care

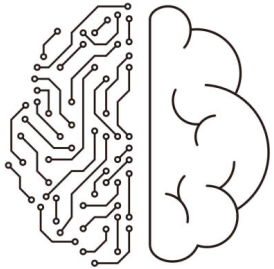
If you don't feel you're spending enough time with your patients during appointments to provide the best care, it's likely your patients agree with you.

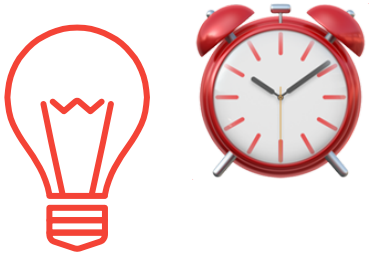
In a national survey released by The Physicians Foundation (www.physiciansfoundation.org), only 11 percent of patients and 14 percent of physicians said they felt that their visits offered all the time needed to provide the highest standards of care.



Among patients, 53 percent said they felt physicians were at capacity while 31 percent said physicians were overwhelmed and overworked. Physicians were slightly more optimistic, with 52 percent saying they were at capacity and 28 percent saying they were overwhelmed and overworked.

The perception of a lack of time for high-quality care is concerning as 90 percent of patients said they felt a solid patient-physician relationship was the most essential element of a quality health care system.





TIME

Time Periods

1 DAY = Rotation of earth on its axis

Genesis 1:5

And God called the light **Day**, and the darkness he called **Night**. And the evening and the morning were the first day.

Time Periods

1 DAY = Rotation of earth on its axis

1 MONTH = Orbit of the moon around the earth

1 YEAR = Orbit of the earth around the sun

How do we derive **1 week**?


7


Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
saturday

Attempts to change the week

France (October 1789)

- Adopted French Republican Calendar of 12 months, 30 days each
- Workers stayed on the job nine days and rested on tenth (*decadi*)
- After 13 years this calendar was discontinued
- They tried the 5 day week (*quintidi*), but it too was rejected

Couderc 1993, Bourgoing 2000

Russia (1830s)

- Bolshevik revolution
- 5 day week with 1 day rest (20% at a time)
- After 11 years (1929-1940), Stalin return the nation to 7 day week


4-DAY
WORK WEEK
PRODUCTIVITY
EFFICIENCY
HEALTH
SATISFACTION
WORK-LIFE BALANCE
DISCIPLINE
RESULT
COMPETITION


7
REMEMBER

Circaseptan in Animals

- Activity levels of Beech Beetle *(Chaerodes trachyscelides)*[1]
- Survival and growth of *Acetabularia mediterranea* cell (algae seaweed) [2]
- Survival of face fly *(Musca autumnalis)*[2]
- Haemolymph of worker honey bees in Brazil[3]
- Melatonin levels in rats

[1]Meyer-Rochow & Brown, 1998

[2]Schweiger et al 1986

[3]Mikulecky & Bounias, 1997

"Franz Halberg proposes that **body rhythms of about seven days**, far from being passively driven by the social cycle of the calendar week, **are innate, autonomous**, and perhaps the reason why the calendar week arose in the first place.“

Jeremy Campbell, Winston Churchill’s Afternoon Nap, (New York: Simon and Schuster, 1986), pp. 75-79

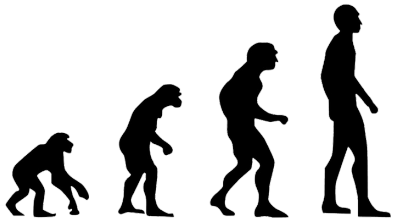
Human Body Rhytms

- Circadian (about a day):
  - Temperature, Blood Pressure, Sleep/Wake cycle (eg. cortisol, melatonin)
- Circatrigintan (about a month):
  - Menstrual cycle
- Circaannual (about a year):
  - Seasonal depression

Does our body have a **circaseptan** (weekly cycle)?

Evolution?

- “Circadian (~24 h), circatrigintan (~30 d) and circannual (~1 y) rhythms are viewed as genetically based features of life forms that during ***evolution*** conferred significant **functional advantage** to individual organisms and survival value to species
- No such advantages are apparent for **endogenous** 7 day rhythms, raising several questions….”



Creation
?

GENESIS 2:1-3

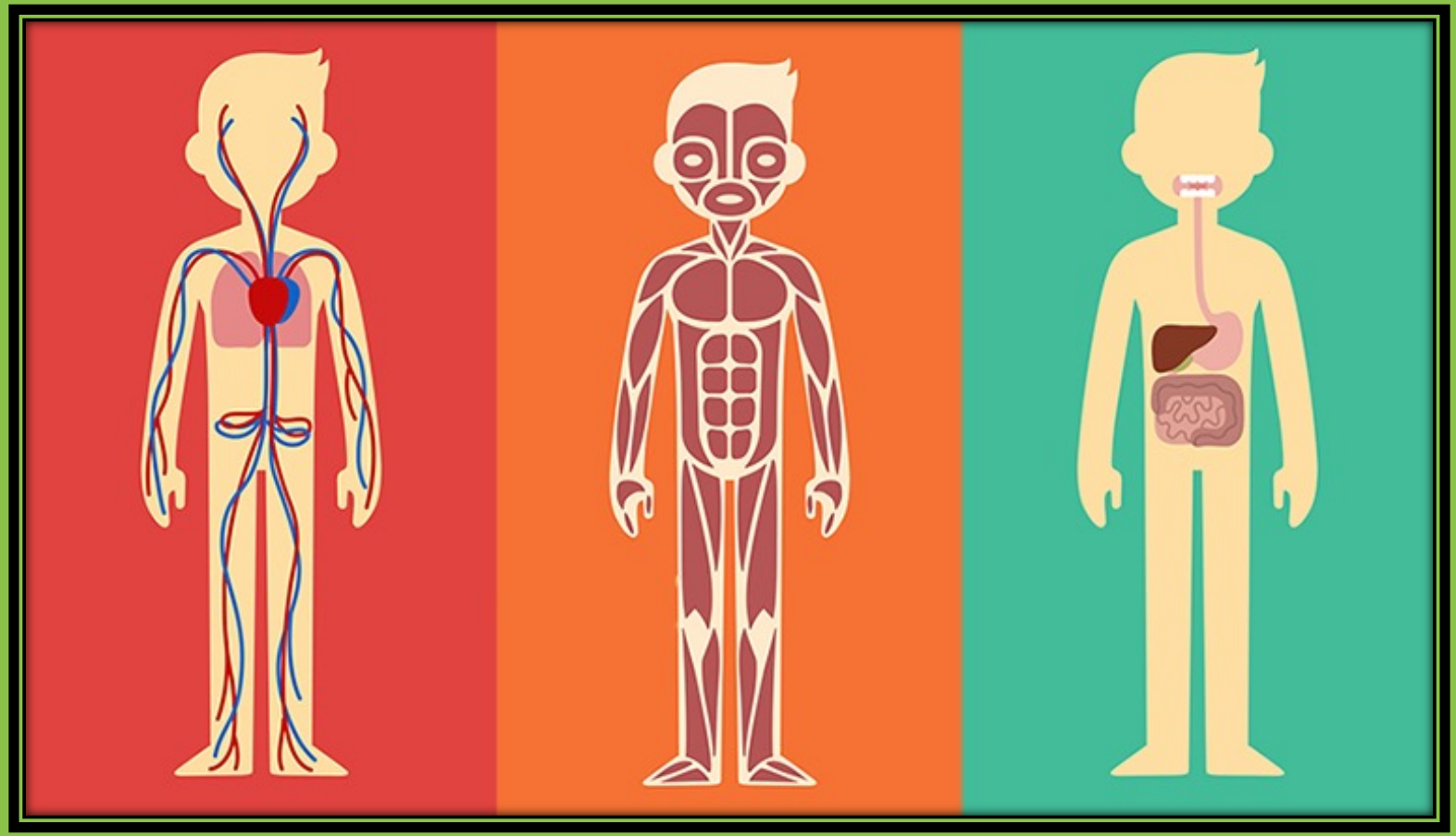
“Thus the heavens and the earth were finished, and all the host of them. And on the **seventh** day God ended his work which he had made; and he rested on the **seventh** day from all his work which he had made.

And God blessed the **seventh** day, and sanctified it: because that in it he had rested from all his work which God created and made.”

7 Day Cycles - Questions

- **What is the significance of the 7 d activity/rest cycle,**
  - i.e. week, storied in the Book of Genesis and adopted by the Hebrews and thereafter the residents of nearby Mediterranean countries and ultimately the world?
- **Why do humans require 1 d off per 7 d span?**
- **Do 7 d rhythms bestow functional advantage to organisms?**
- **Is the magic ascribed to the number 7 of relevance?”**

Reinberg et al, Seven-day human biological rhythms: An expedition in search of their origin, synchronization, functional advantage, adaptive value and clinical relevance. Chronobiology International: The Journal of Biological and Medical Rhythm Research, Volume 34, 2017 - Issue 2



7 Day Cycles

- Observation on Body Systems:
  - Blood clotting mechanism[1]
  - Inflammatory responses[1]
  - Blood pressure, resting heart rate and body weight gain of neonates[2]
  - Blood pressure variations during pregnancy[3]

[1]Haus 2007
[2]Cornelissen et al 2001
[3]Ayala & Hermida, 1995

Evidence of Innate Body Rhythms

- Observation on Body Functions
  - Cognitive function in school aged children & adolescents[1]
  - Nighttime sleep duration in adults[2]
  - Physical activity level in adults[3]
  - Total calories and dietary constituent consumption[4]
  - Evening/night-time eating behaviour[5]

[1]Leconte 2011
[2]Paine & Gander 2016
[3]Otsuka *et al* 1994
[4]An 2016
[5]Huh *et al* 2015

Circumcision

- Genesis 17:12 – And he that is eight days old shall be circumcised among you, every man child in your generations, he that is born in the house, or bought with money of any stranger, which *is* not of thy seed.

- After **7 days** baby's prothrombin and Vitamin K levels are highest in body

The Journal of International Medical Research
2011; 39: 2281 – 2287 [first published online as 39(6) 10]

Characteristics of Infradian and Circadian Rhythms in the Persistent Vegetative State

J Guan[1,2], C You[1], Y Liu[3], Y Liu[4], R Zhang[5] and Z Wang[4]

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This retrospective study investigated the circadian and infradian characteristics of blood pressure and heart rate in 26 patients with traumatic head injury in a persistent vegetative state (PVS). Systolic and diastolic blood pressures and heart rate were measured every hour for the first 240 h (10 days) following hospital admission. These data were analysed for the presence of circadian and infradian rhythms using the least-squares fit of the cosine function with the single cosinor method. Infradian rhythms were defined as biological rhythms with a period of approximately 7 days (circaseptan rhythms). All the patients studied had circadian and circaseptan rhythms of systolic and diastolic blood pressures and heart rate. The amplitudes of all the circaseptan rhythms were significantly greater than those of the corresponding circadian rhythms. It was concluded that there was an altered association between circadian and infradian blood pressure and heart rate rhythms in patients in a PVS. Circadian and infradian rhythms were present, but the infradian rhythm had a greater amplitude than the circadian rhythm.

KEY WORDS: Circadian; Circaseptan; Infradian; Persistent vegetative state (PVS); Traumatic head injury; Amplitude; Cosinor

Social Isolation

- Circadian and infradian rhythms change and **compensate** when in temporal social isolation
- However, circaseptan rhythms ***remain the same***
- (eg. Geomagnetic pulsations in Antartica)
  Lucas et al 1985

The week - inherited in neonatal human twins

- “Circaseptan components, found at different levels of organization, notably in relation to growth, regeneration, repair and development, **are often viewed as reflecting no more than the 7-day societal schedule, ample evidence for a built-in feature notwithstanding.”**
- Human physiological data, showed that the circaseptan period of heart rate, diastolic blood pressure and body weight is more similar between same-gender twins than among twin pairs, lending additional support for the **endogenicity** of circaseptans

Cornelissen *et al*, Biomed Pharmacother. 2001;55 Suppl 1:32s-50s.

External Factors & Amplification

- Inflammation following jaw surgery
- Fever patterns in scarlet fever
- Reticulocyte count after high altitude exposure
- Acute renal allograft rejection events (kidney, heart, pancreas)

Pollman et al 1979, Hildebrandt 1977, Klemp, 1976, Halberg 1982

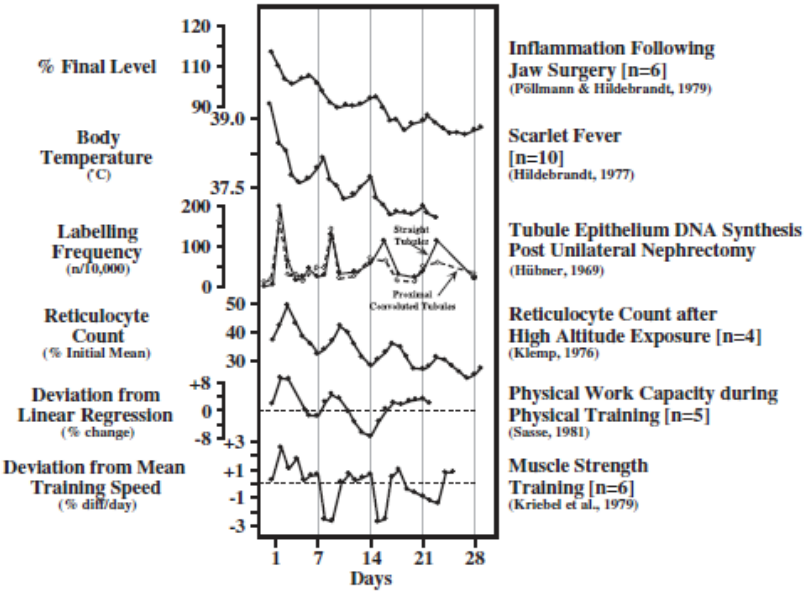


Figure 3. Examples in humans and laboratory animals of 7 d cycles triggered by major maxillo-facial and renal surgery, serious infection, high-altitude (low-oxygen) partial pressure exposure, and physical and strength training. Time along the *x*-axis is referenced to the 1st day of the specified trigger. Evident in all examples is the prominent induced 7 d cycle, sometimes superimposed on a declining linear trend line (see Hildebrandt, 1984 for referenced findings; figure content modified and redrawn after Hildebrandt, 1984).

Reinberg et al, 2017

Evidence of Innate Body Rhythms

- Observation on Occurrence of Diseases:
  - Infectious
  - Gastrointestinal
  - Lung
  - Mood / Suicide
  - Haemostatic
  - Neurological (seizures, migraine)
  - Cardiac events
  - Vascular events (subarachnoid haemorrhage, stroke)
  - SIDS

Karoly et al 2018
Ajdacic-Gross 2015, Beauchamp 2014,
Kao 2014, Manfredini 2015, Walker 2007

Evidence of Innate Body Rhythms

- Observation on Cardiac Diseases:
  - Heart Attack/Cardiac Arrest
  - Cardiomyopathies
  - Hypertension
  - Severe angina
  - Transient ischaemic attack
  - Stroke

HIGHEST ON MONDAY, least on Saturday

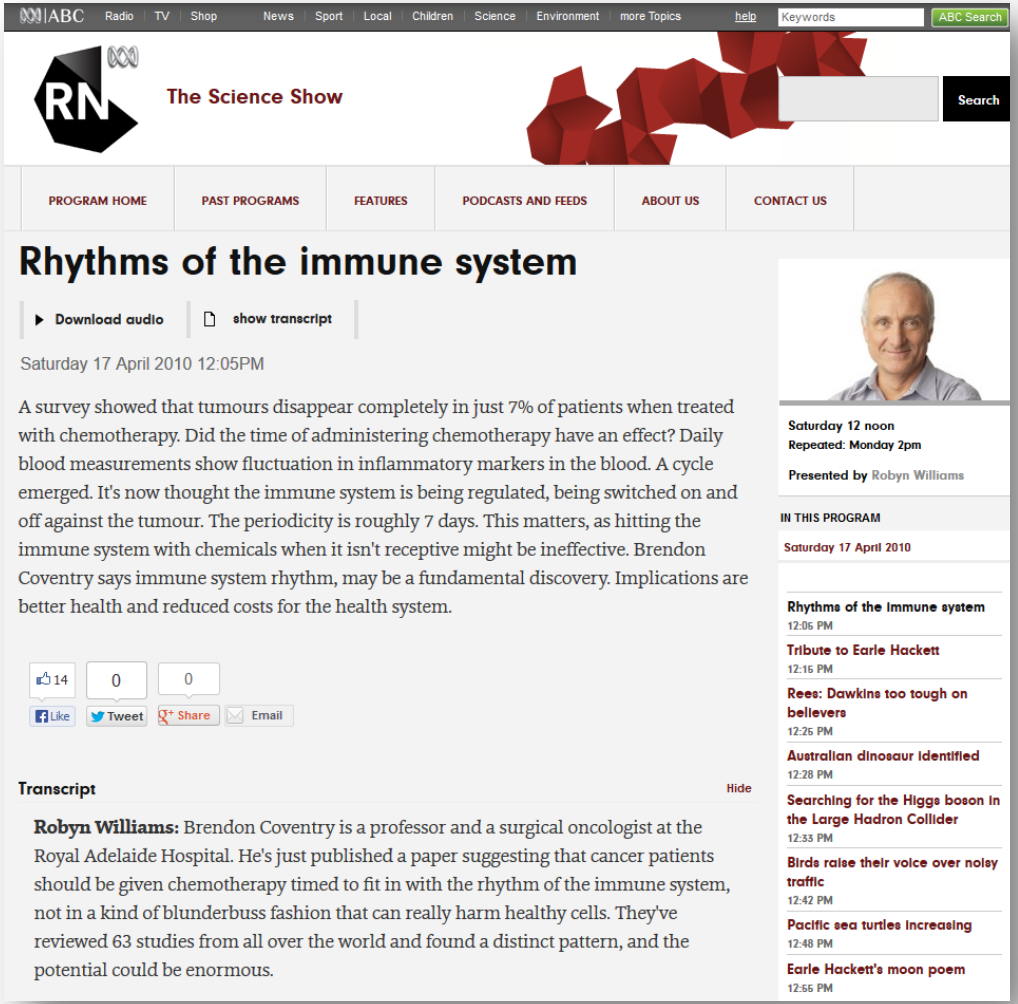
Nordenskjold et al 2019
Mohammad 2018
Gallerani 2017
Arntz 2000
Boari 2011
Cantwell 2015
Manfredini 2011
Vitale 2015
Witte 2005

Health Searches

- Most health information searches on **Monday**
- Most initiation of quitting behaviour by addicted tobacco smokers on Monday
- Fewest how to be healthy searches on **Saturday**

Gabarron *et al*, 2015

Ayers et al 2014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RN
The Science Show
Search
PROGRAM HOME
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Rhythms of the immune system
Download audio
show transcript
Saturday 17 April 2010 12:05PM
A survey showed that tumours disappear completely in just 7% of patients when treated with chemotherapy. Did the time of administering chemotherapy have an effect? Daily blood measurements show fluctuation in inflammatory markers in the blood. A cycle emerged. It's now thought the immune system is being regulated, being switched on and off against the tumour. The periodicity is roughly 7 days. This matters, as hitting the immune system with chemicals when it isn't receptive might be ineffective. Brendon Coventry says immune system rhythm, may be a fundamental discovery. Implications are better health and reduced costs for the health system.
14
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Robyn Williams: Brendon Coventry is a professor and a surgical oncologist at the Royal Adelaide Hospital. He's just published a paper suggesting that cancer patients should be given chemotherapy timed to fit in with the rhythm of the immune system, not in a kind of blunderbuss fashion that can really harm healthy cells. They've reviewed 63 studies from all over the world and found a distinct pattern, and the potential could be enormous.
Saturday 12 noon
Repeated: Monday 2pm
Presented by Robyn Williams
IN THIS PROGRAM
Saturday 17 April 2010
Rhythms of the immune system 12:05 PM
Tribute to Earle Hackett 12:15 PM
Rees: Dawkins too tough on believers 12:25 PM
Australian dinosaur identified 12:28 PM
Searching for the Higgs boson in the Large Hadron Collider 12:33 PM
Birds raise their voice over noisy traffic 12:42 PM
Pacific sea turtles increasing 12:48 PM
Earle Hackett's moon poem 12:55 PM

PLOS ONE

RESEARCH ARTICLE

Circadian onset and prognosis of myocardial infarction with non-obstructive coronary arteries (MINOCA)

Anna M. Nordenskjöld[1]*, Kai M. Eggers[2], Tomas Jernberg[3], Moman A. Mohammad[4], David Erlinge[4], Bertil Lindahl[2]

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OPEN ACCESS

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Editor: Giuseppe Andò, University of Messina, ITALY

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Abstract

Background

Many acute cardiovascular events such as myocardial infarction (MI) follow circadian rhythms. Myocardial infarction with non-obstructive coronary arteries (MINOCA) is a newly noticed entity with limited data on onset pattern and its impact on prognosis.

Material and methods

In this observational study of Swedish MINOCA patients registered in the SWEDEHEART registry between 2003–2013 and followed until December 2013 we identified 9,092 unique patients with MINOCA out of 199,163 MI admissions in total. Incidence rate ratios (IRR) were calculated for whole hours, parts of the day, weekdays, months, seasons and major holidays.

Results

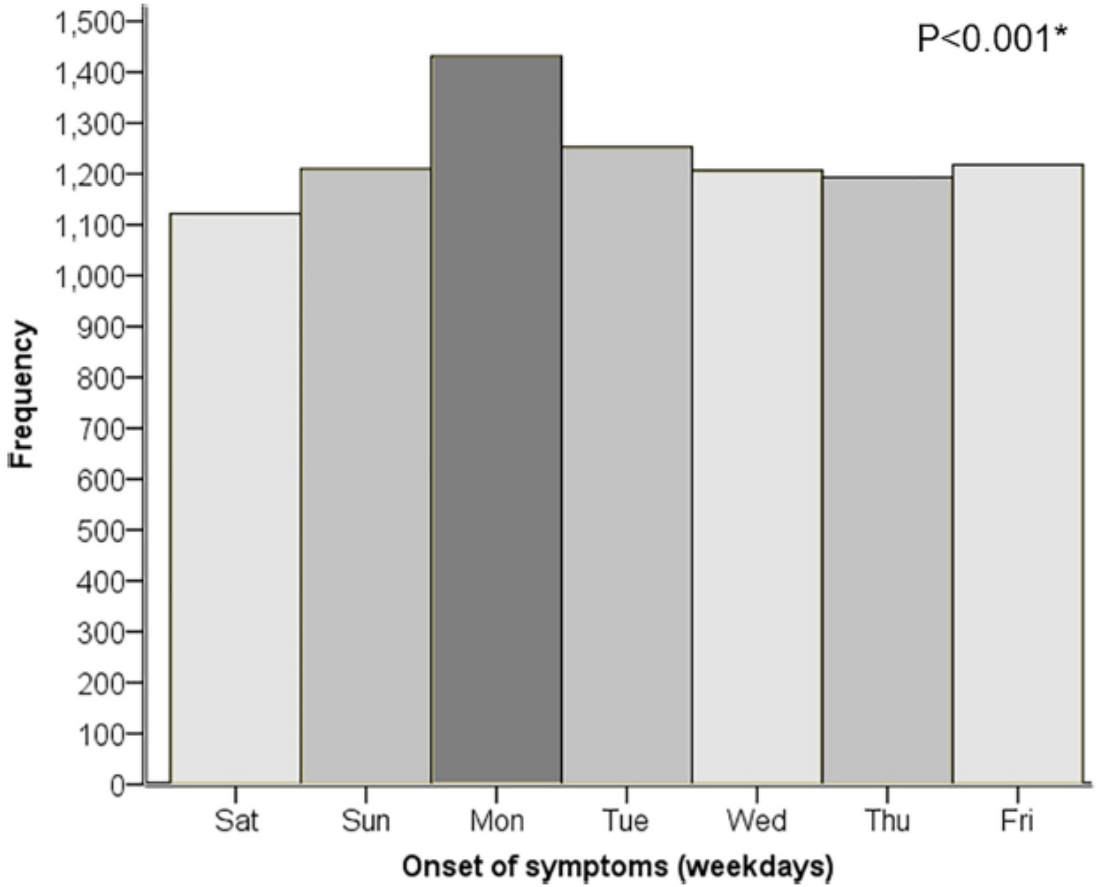

Fig 3. Onset of symptoms by weekday. A prominent increased risk for MINOCA was detected at Mondays. *The presence of a circaseptian variation was confirmed with an overall likelihood ratio Chi-Square significance test, p<0.001.

Weekend migraine

KB Alstadhaug[1], R Salvesen[1] & S Bekkelund[2]

[1]Department of Neurology, Nordlandssykehuset, Bodø, and [2]Department of Neurology, University Hospital of North Norway and Institution of Clinical Medicine, University of Tromsø, Tromsø, Norway

Cephalalgia

Alstadhaug KB, Salvesen R & Bekkelund S. Weekend migraine. Cephalalgia 2007; 27:343–346. London. ISSN 0333-1024

It is a general belief that migraine attacks are prone to occur on days off. Only a few studies, however, have addressed this issue. The objective of this study was to investigate the periodicity of migraine with respect to weekly (circaseptan) variations. Eighty-nine females of fertile age who had participated in a previous questionnaire-based study volunteered to record in detail every migraine attack for 12 consecutive months. Eighty-four patients completed recordings for a mean of 311 days (S.D. = 95.9, range 30–365). A total of 2314 attacks were recorded. Migraine occurrence was almost equally distributed during the week, except on Sundays, when there were significantly fewer attacks ($t = -4.42$, d.f. = 83, $P < 0.001$). A Mantel-Haenszel estimate of the relative risk of having an attack on a holiday vs. another day, not Sundays included, was 0.64 (95% CI 0.49–0.85). Our study suggests that days off protect against migraine.

☐*Migraine, temporal pattern, weekend headache*

Karl Bjørnar Alstadhaug, Department of Neurology, Nordlandssykehuset, 8092 Bodø, Norway. Tel. + 47 755 340 23, fax + 47 755 347 37, e-mail alstadhaug@operamail.com

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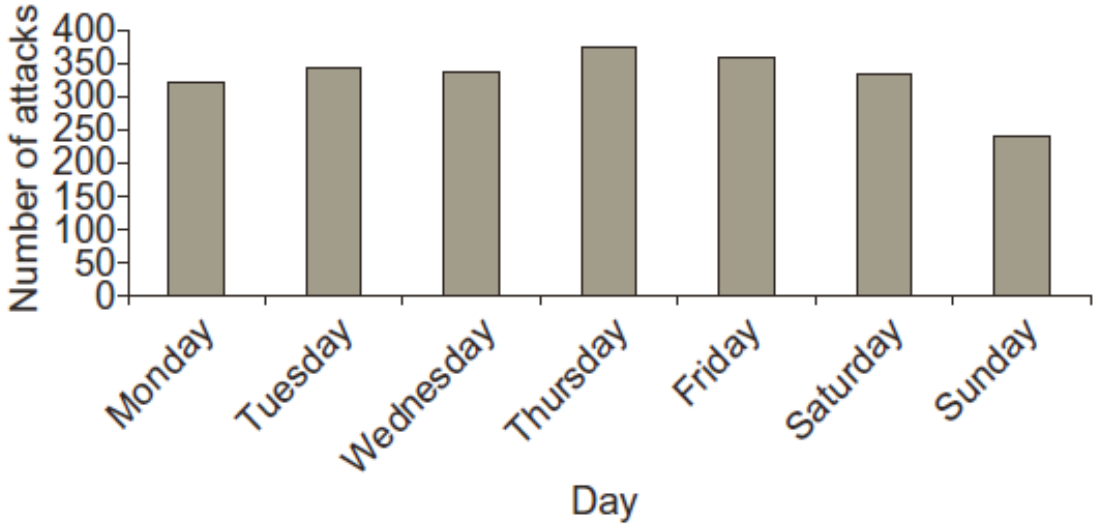
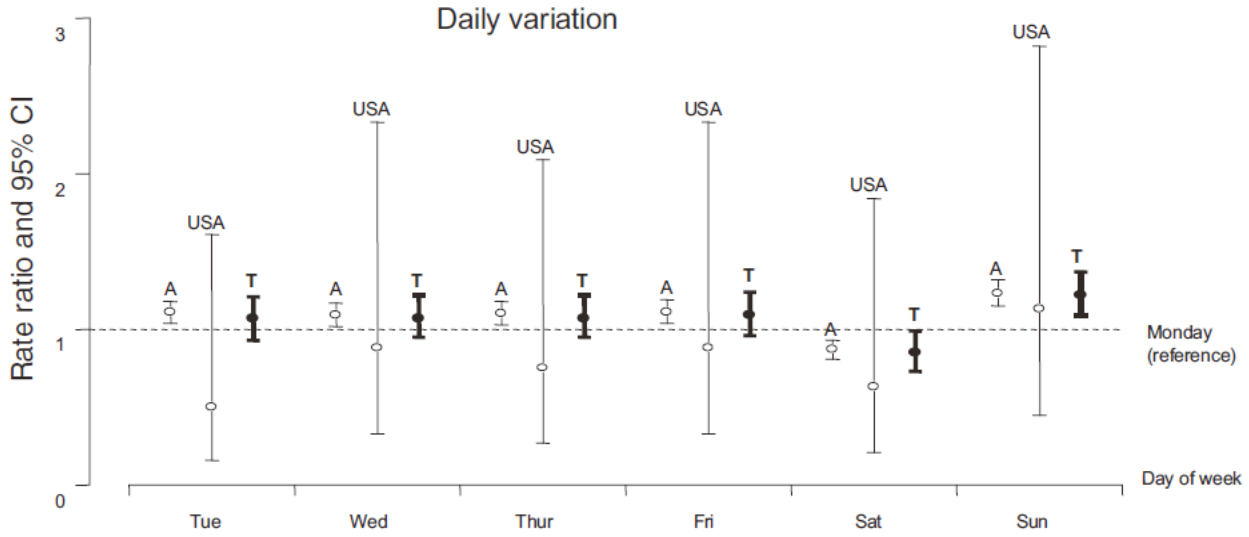


Figure 2 Histogram of the weekly variation in migraine onset.

Cornelissen et.al, ***“Mapping of circaseptan and circadian changes in mood”*****,** Scripta Medica (BRNO), April 2005 – 78 (2): 89–98


Daily variation
Rate ratio and 95% CI
3
2
1
0
USA
A
T
Monday
(reference)
Day of week
Tue
Wed
Thur
Fri
Sat
Sun

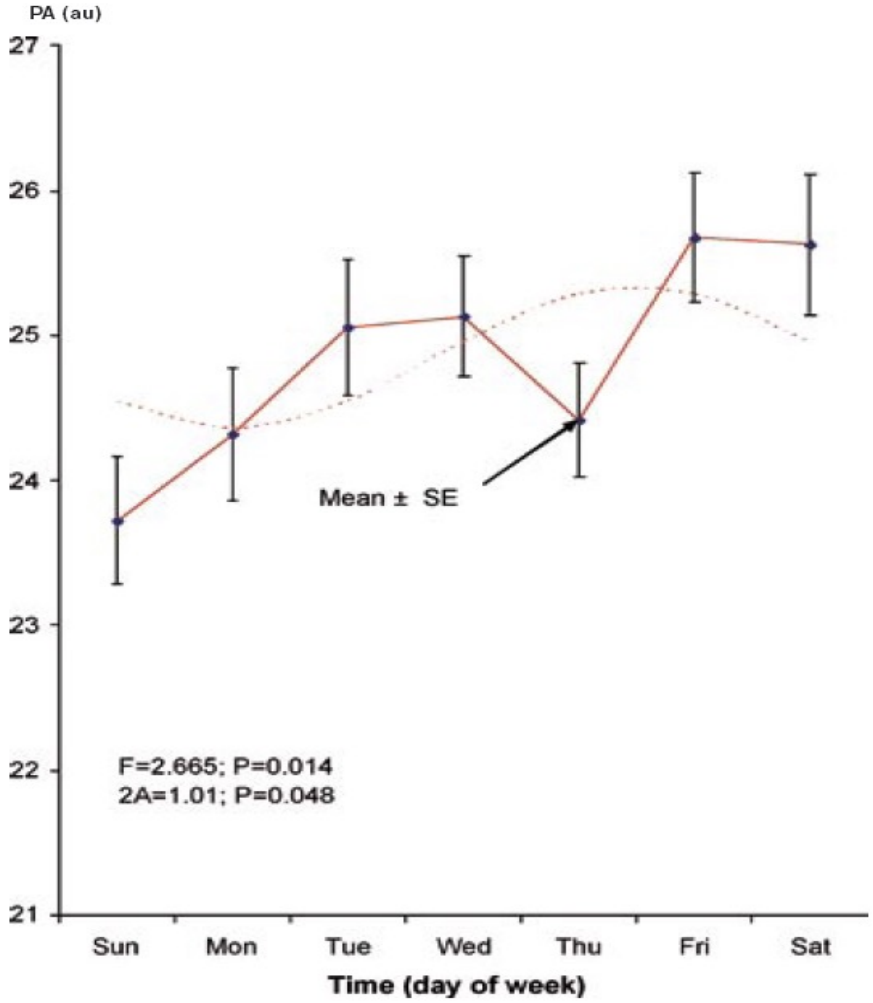


Fig. 3
Circaseptan rhythm in positive affect

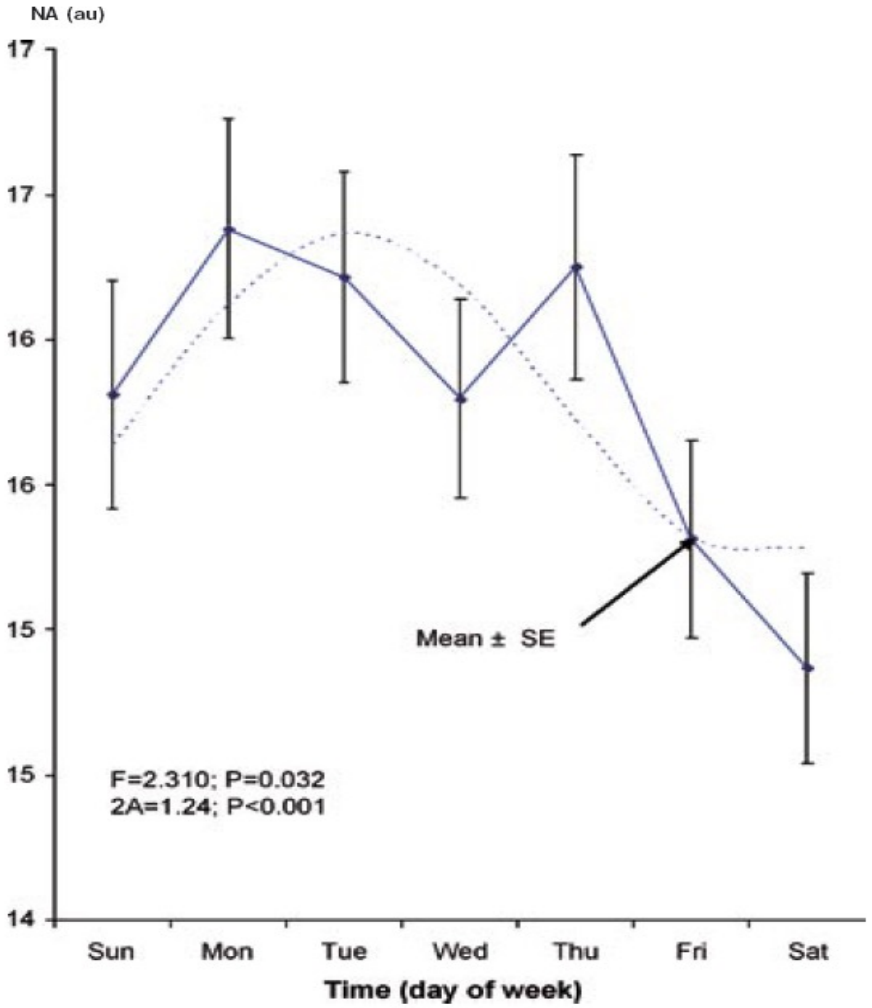


Fig. 4
Circaseptan rhythm in negative affect

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Biomedicine & Pharmacotherapy 57 (2003) 126s–135s
& BIOMEDICINE PHARMACOTHERAPY
www.elsevier.com/locate/biopha

Original article

Chronoecoepidemiology of "strain": infradian chronomics of urinary cortisol and catecholamines during nightly exposure to noise

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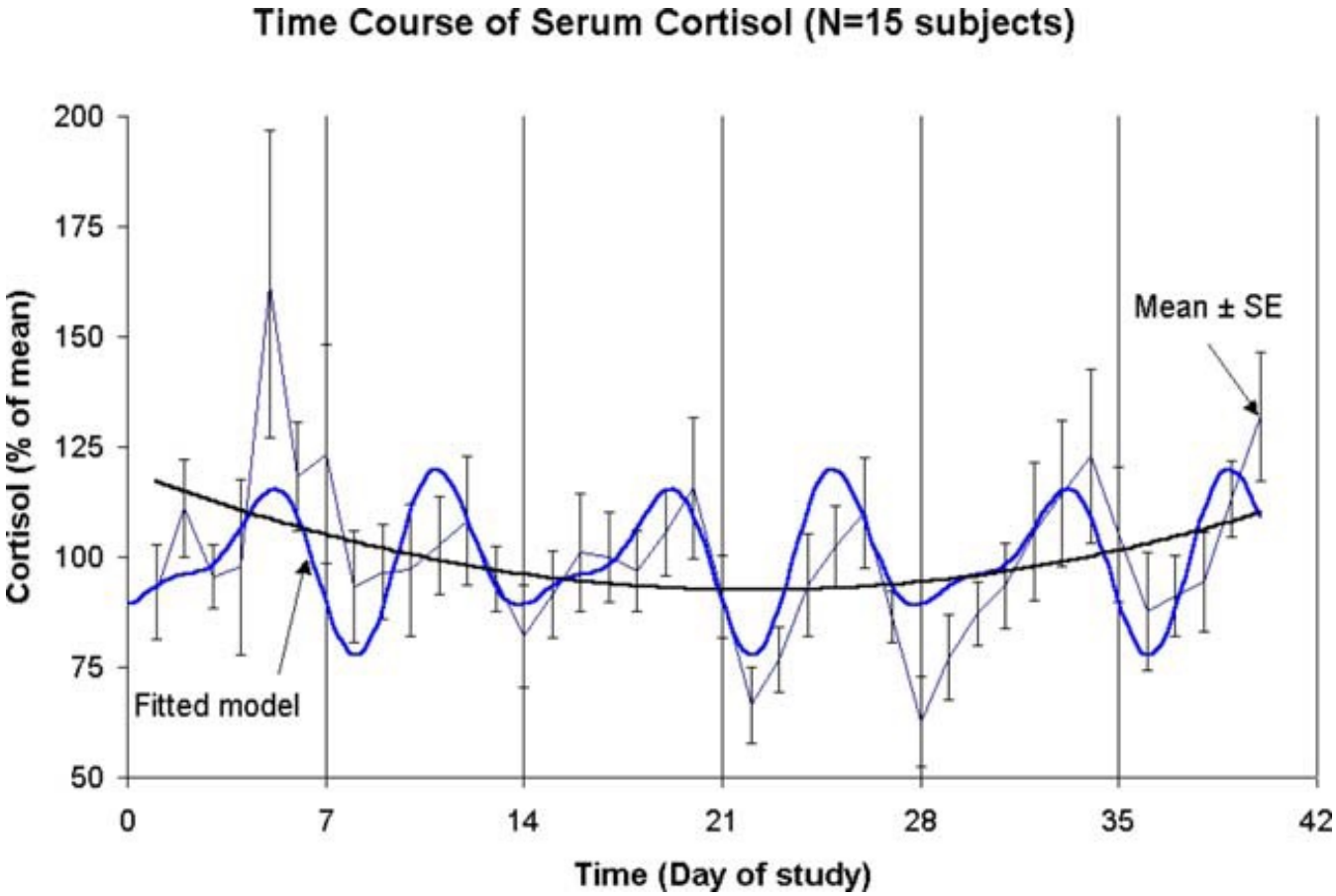
Received 30 July 2003

Abstract

This meta-analysis of published data (Noise Health 5 (2002) 35 and 47) summarizing a survey for 40 days of the nightly excretion of urinary free cortisol, epinephrine and norepinephrine validates a circaseptan cortisol pattern anticipated and reported earlier for cortisol, here not detected for the catecholamines. We also quantify a circadecan (about 10-day) variation in nightly norepinephrine excretion, but not in the excretion of the other two hormones examined. About 4.2-day variations, common to norepinephrine and epinephrine, and an about 4.7-day variation in cortisol await further scrutiny, since these components were not anticipated. Infradian characteristics are quantified time-microscopically and differences among infradian aspects of the spectral element of endocrine chronomes (time structures; from chronos, time and nomos, rule) are demonstrated. Chronomics, the cartography of chronomes, reveals that "stress hormones" need to be examined separately in a budding chronoepidemiology seeking to detect how humans interact, mostly for better, sometimes for worse, with the undesirable features of the technology they create and of its consequences, such as aircraft noise.

Keywords: Aircraft noise; Chronome; Circaseptan (biologic week); Steroid metabolism; Stress; Strain


Time Course of Serum Cortisol (N=15 subjects)
Cortisol (% of mean)
200
175
150
125
100
75
50
0
7
14
21
28
35
42
Time (Day of study)
Mean ± SE
Fitted model

Which is it?

Conclusion

- “We hypothesize the 7 d time structure of human beings is **endogenous in origin** – a hypothesis that is affirmed by a wide array of evidence – and synchronized by sociocultural factors linked to the … holy day of rest.
- We also hypothesize they are representative, at least in part, of the **biological requirement for rest and repair 1 d each 7 d**, just as the circadian time structure is representative, in part, of the biological need for rest and repair each 24 h.”

Reinberg et al, Seven-day human biological rhythms: An expedition in search of their origin, synchronization, functional advantage, adaptive value and clinical relevance. Chronobiology International: The Journal of Biological and Medical Rhythm Research, Volume 34, 2017 - Issue 2

“

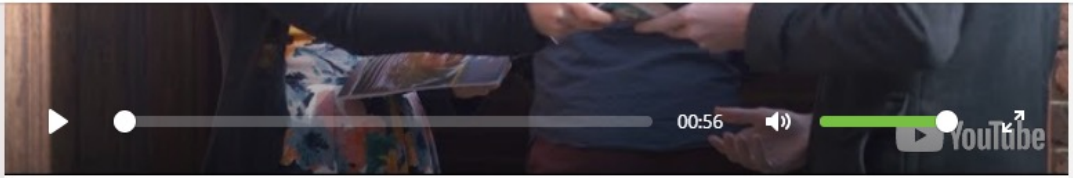
Remember the sabbath day, to keep it holy. Six days shalt thou labour, and do all thy work:

But the seventh day *is* the sabbath of the LORD thy God: *in it* thou shalt not do any work, thou, nor thy son, nor thy daughter, thy manservant, nor thy maidservant, nor thy cattle, nor thy stranger that *is* within thy gates:

For *in* **six days** the LORD made heaven and earth, the sea, and all that in them *is,* and **rested** the **seventh day**: wherefore the LORD blessed the sabbath day, and hallowed it.

Mark 2:27

And he said unto them, The sabbath was made for man, and not man for the sabbath: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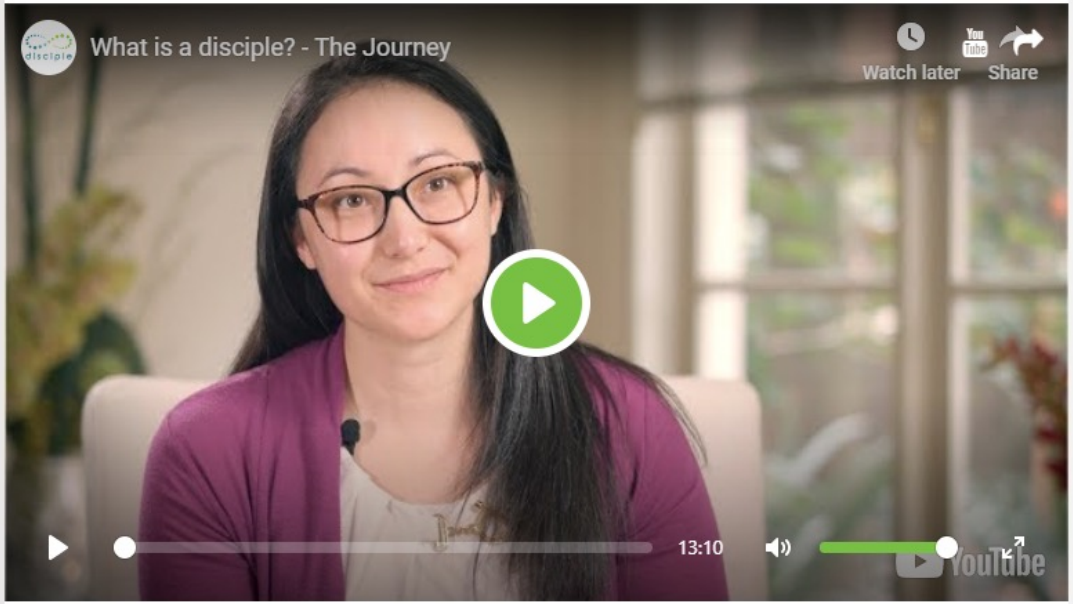
FULL CLIP


What is a disciple? - The Journey
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