

Wood in Hospitals - Health and Hygiene

Kristiansund, 14th February 2019

Maximilian Moser

and the Team of the

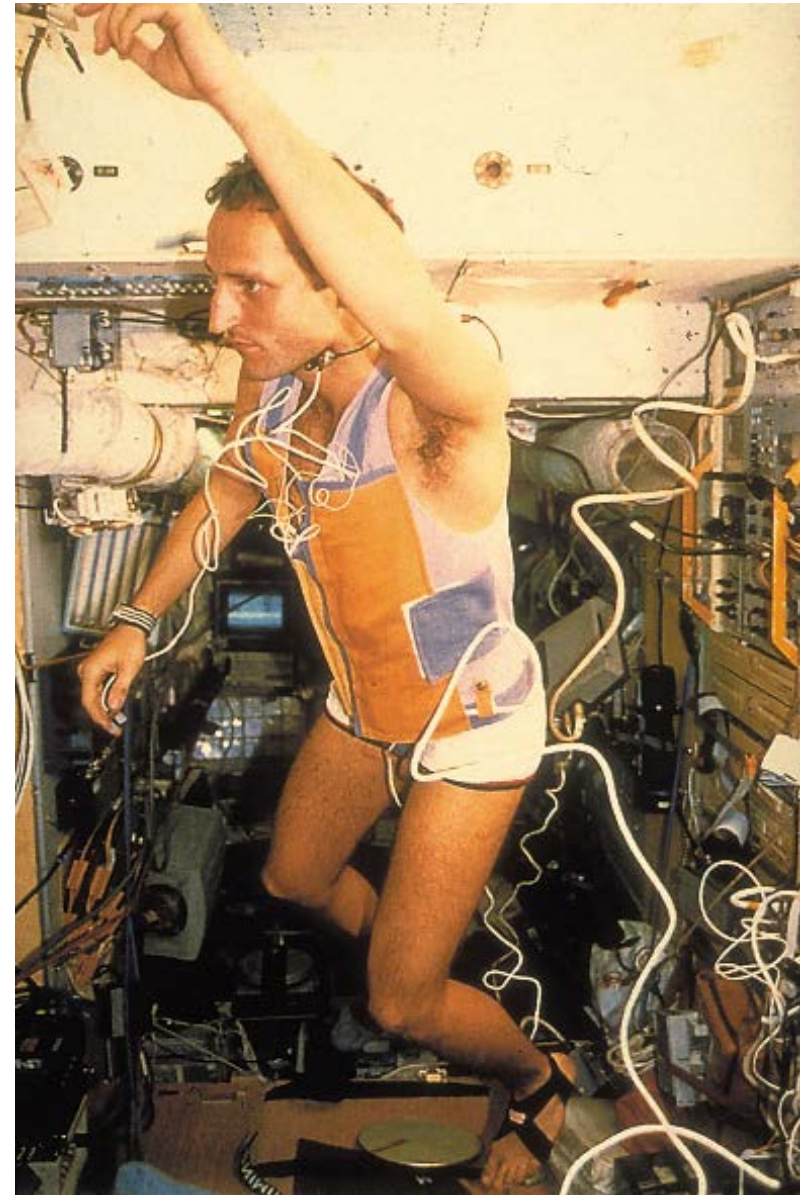
Human Research Institute for Health Technology and Prevention
Research (www.humanresearch.at)

Medical University of Graz

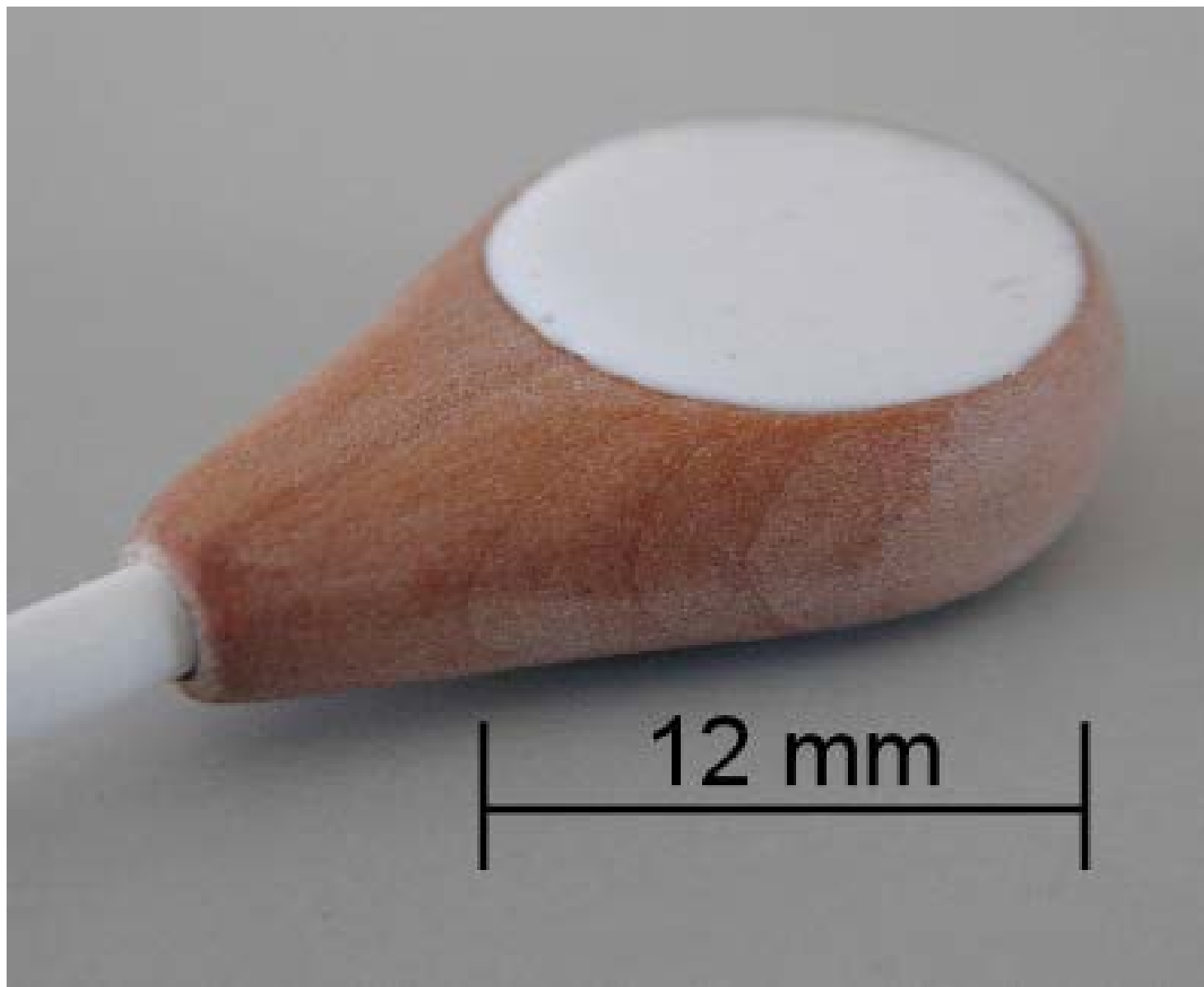
Human subjects have been familiar to wood for over a million of years. This familiarity might be one of the reasons why wood may be considered “healthy” as a domestic material. Our first experience with wood derived from the search for a sensor housing material for physiological sensors in contact with the skin. After trying different materials from aluminium and titan to nylon® and teflon®, we finally decided to use apple-wood as housing for pulse sensors used in the Russian MIR station during our space-medical research program 1991-2001. We got excellent feedback from the cosmonauts using these sensors.



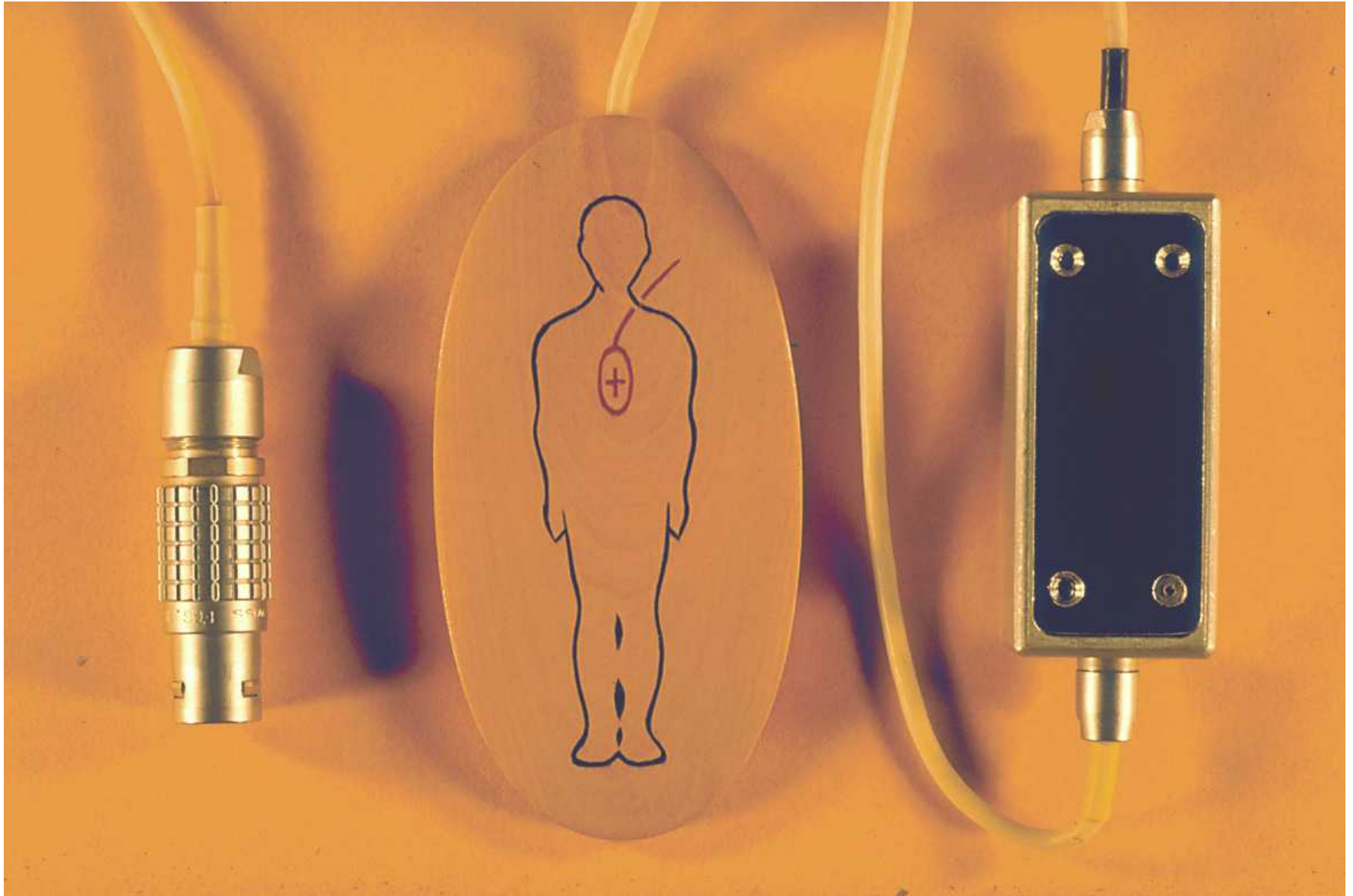
The Space-Medical Wearable Kymo with Sensor Jacket



Sensor-Housing Made from Apple Wood



Space-Suitable (Hawthorn) Wood

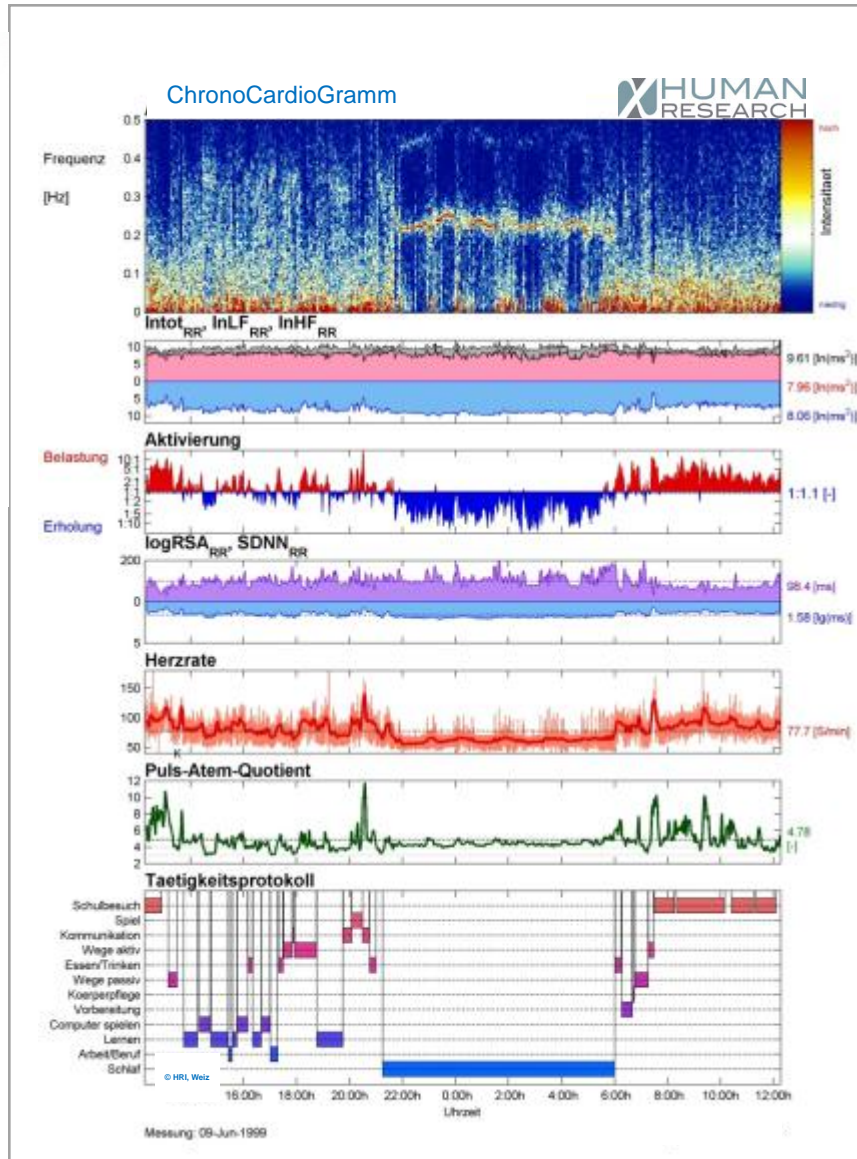
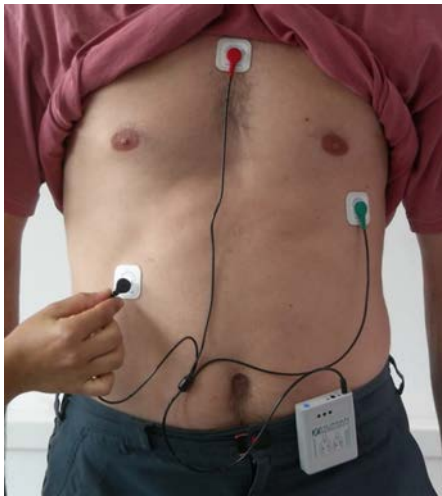


In our studies with different kinds of mainly coniferous-wood we have found several indications that the health effects of wood have to do with its influence on the autonomic nervous system. The autonomic nervous system is the central regulatory organ influencing not only well-being and sleep, but also our over-all organ function and health. We used highly sensitive and accurate heart rate variability recording devices for all our studies (ChronoCord®, www.humanresearch.at).

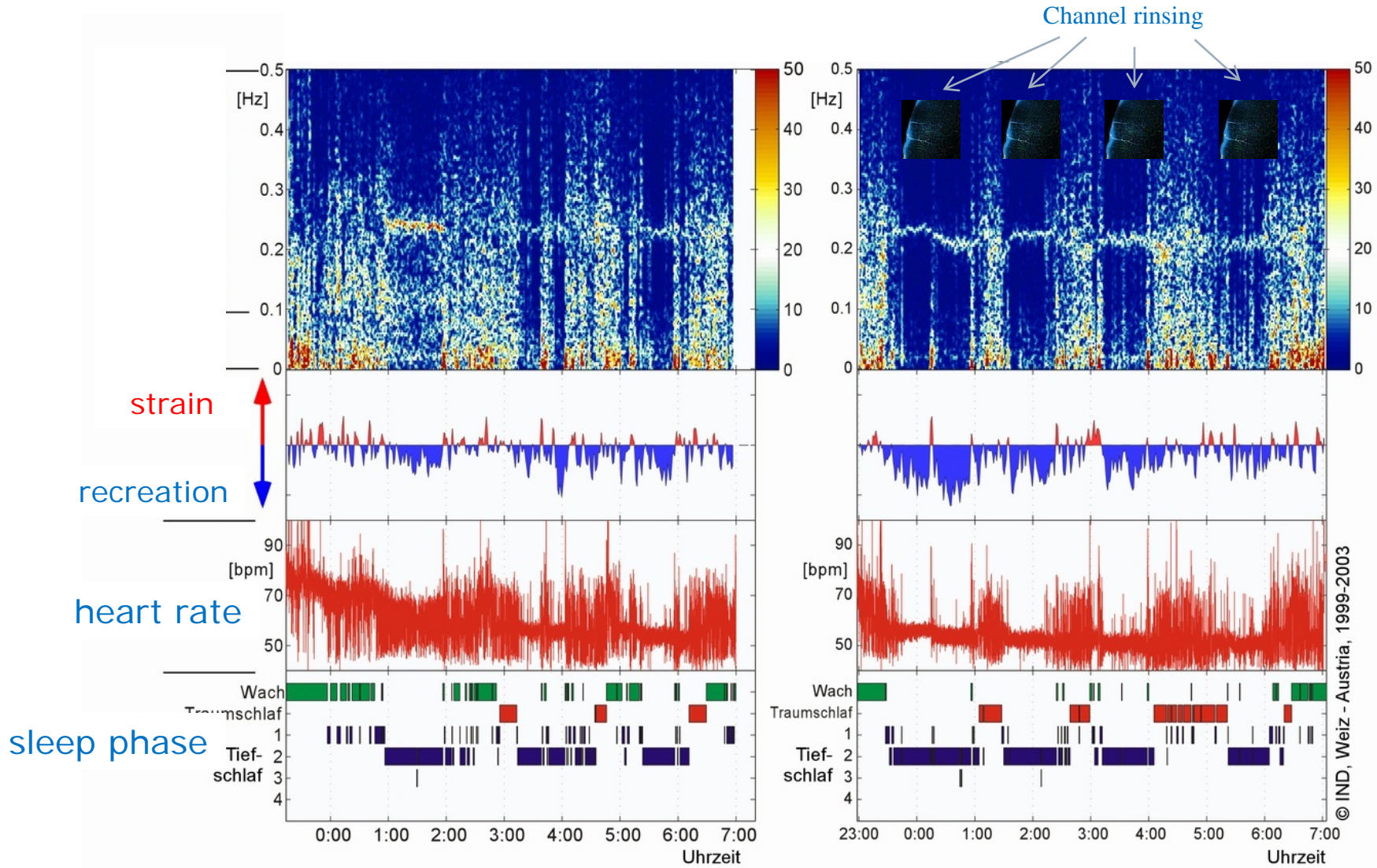
The Autonomic Nervous System



Measurement of Heart Rhythm Flexibility



Good or Bad Sleep?



Stone Pine Wood: Health-Promoting Effects of the „Queen of the Alpes“



In a study investigating stone-pine wood as construction material for beds we found an improvement of sleep quality and also a significant reduction of heart rate compared to sleep in conventional chipboard beds decorated by wood decor. Two studies investigating the effect of wood as an office material resulted in a similar reduction of heart rate without loss of vigilance. This points to an improved biological efficiency of a subject in a real wood surrounding compared to other materials.

Wood Imitation and Real-Wood Bed



wood imitation
chip board



stone pine

EEG derived sleep phases show a marked prolongation of the 1st (and usually best) slow wave sleep phase compared to sleep structure of the same persons in a wood imitation bed. This first slow wave sleep phase is important for immune function, as growth hormone stimulating the immune cells is almost exclusively produced during this time.

Most pronounced differences were observed in the „Sleep Profit“. You rise easier from a stone pine bed.

Heart rate was reduced by 3400 beats per day (1 hour of heartbeat).

Vagal tone increased in the stone pine bed. (Vagal tone is very important to resolve inflammations)

Signifikant differences were found in social extraversion, which was higher after sleep in the stonepine bed. This dimension is represented by the following items: *Likes to talk, sociable, seeks social contacts, uninhibited;*

1993 Pelotas (Brazil) birth cohort study

4,452 children, born in Pelotas, Rio Grande do Sul State, Brasilien, 1993 :

Results 2010 (Hallal et al):

- increased heart-rate in youth highly connected to juvenile hypertension (high blood pressure)
- both variables are risk factors of later chronic diseases.

aus: Hallal et al. Cad Saude Publica 2010

- Carpenters restart working with Stonepine Wood all over Austria and Germany
- Tourism – Stonepine Regions in Styria, Carinthia, Tirolia
- Stonepine Theme Paths
- Stonepine hotels, Stonepine guest houses
- Stonepine exhibitions and Design competitions
- Stonepine accessoires, Bed and Health Products
- Quadruppling of Stonepine Wood prices since 2004 (year, the study was finished)

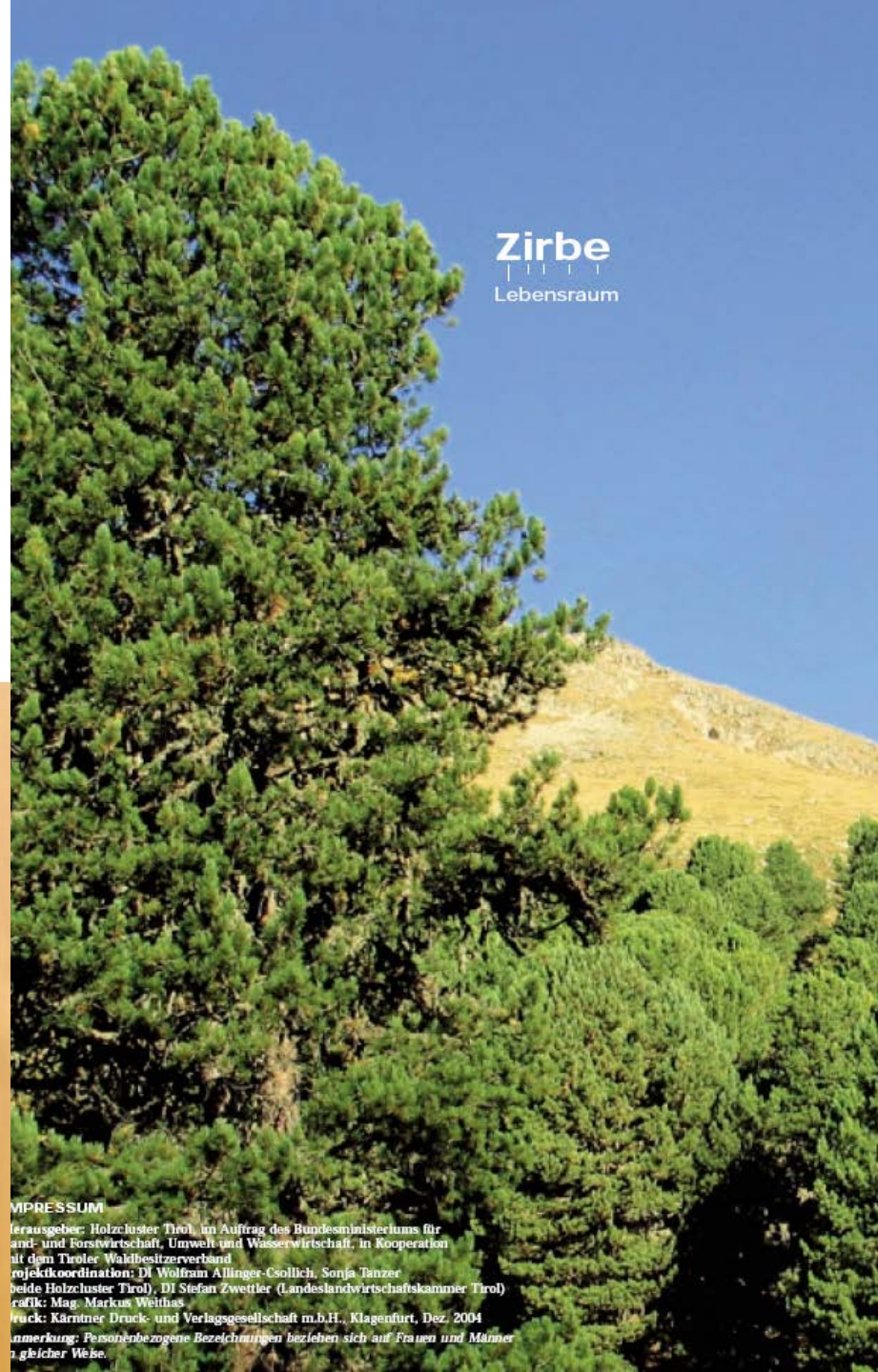


lebensministerium.at

Zirbe

für Holzgenießer

www.zirbe.info



Zirbe
Lebensraum

IMPRESSUM

Herausgeber: Holzcluster Tirol, im Auftrag des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, in Kooperation mit dem Tiroler Waldbesitzerverband
Projektkoordination: DI Wolfram Allinger-Csollich, Sonja Tanzer (beide Holzcluster Tirol), DI Stefan Zweggler (Landeslandwirtschaftskammer Tirol)
Grafik: Mag. Markus Weithas
Druck: Kärntner Druck- und Verlagsgesellschaft m.b.H., Klagenfurt, Dez. 2004
Anmerkung: Personenbezogene Bezeichnungen beziehen sich auf Frauen und Männer in gleicher Weise.



wettbewerbssauslobung



design-in-zirbe



Stone Pine Room Compared to Wood Imitation

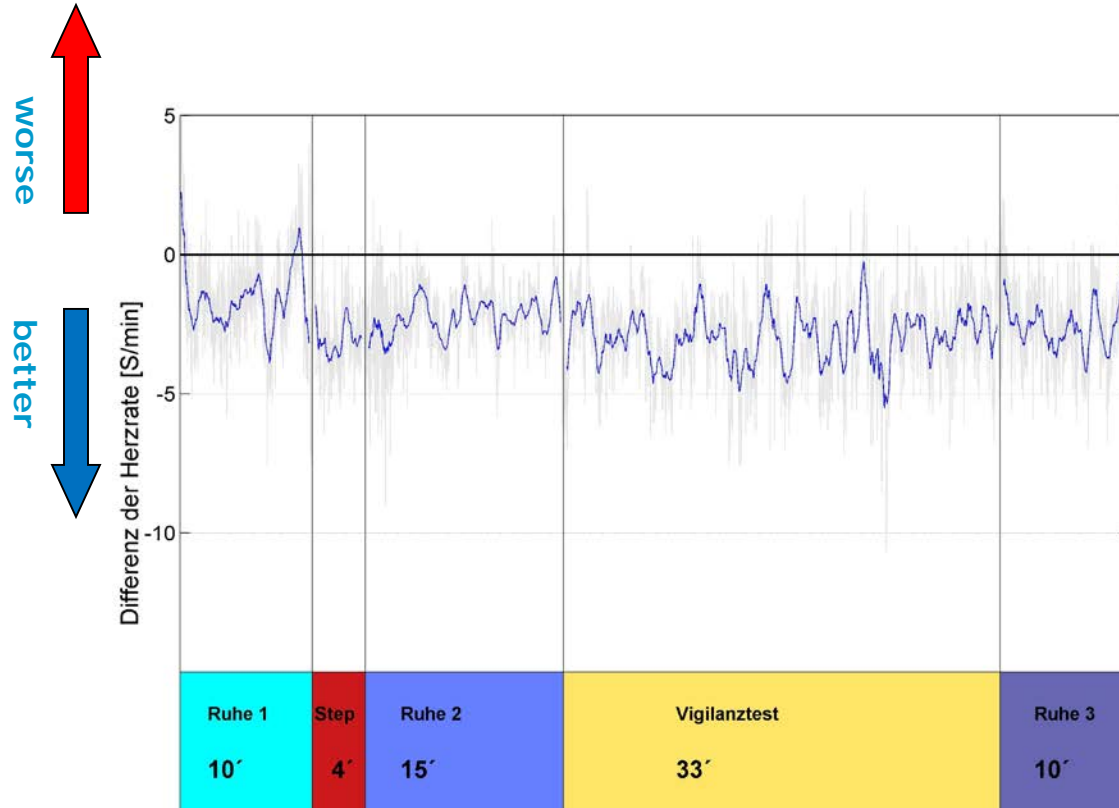
Stone Pine



Imitation



Effect of Stone Pine Wood: Decrease of Heart Rate



differences(stone pine vs. imitation)

men (n=11):
 $t = -1,661$; $p=0,102$

women (n=16):
 $t = -3,322$; $p=0,001$

total:
 $t=-3,629$; $p=0,000$

Heart Rate and Survival in Adults

6101 healthy men, medium age

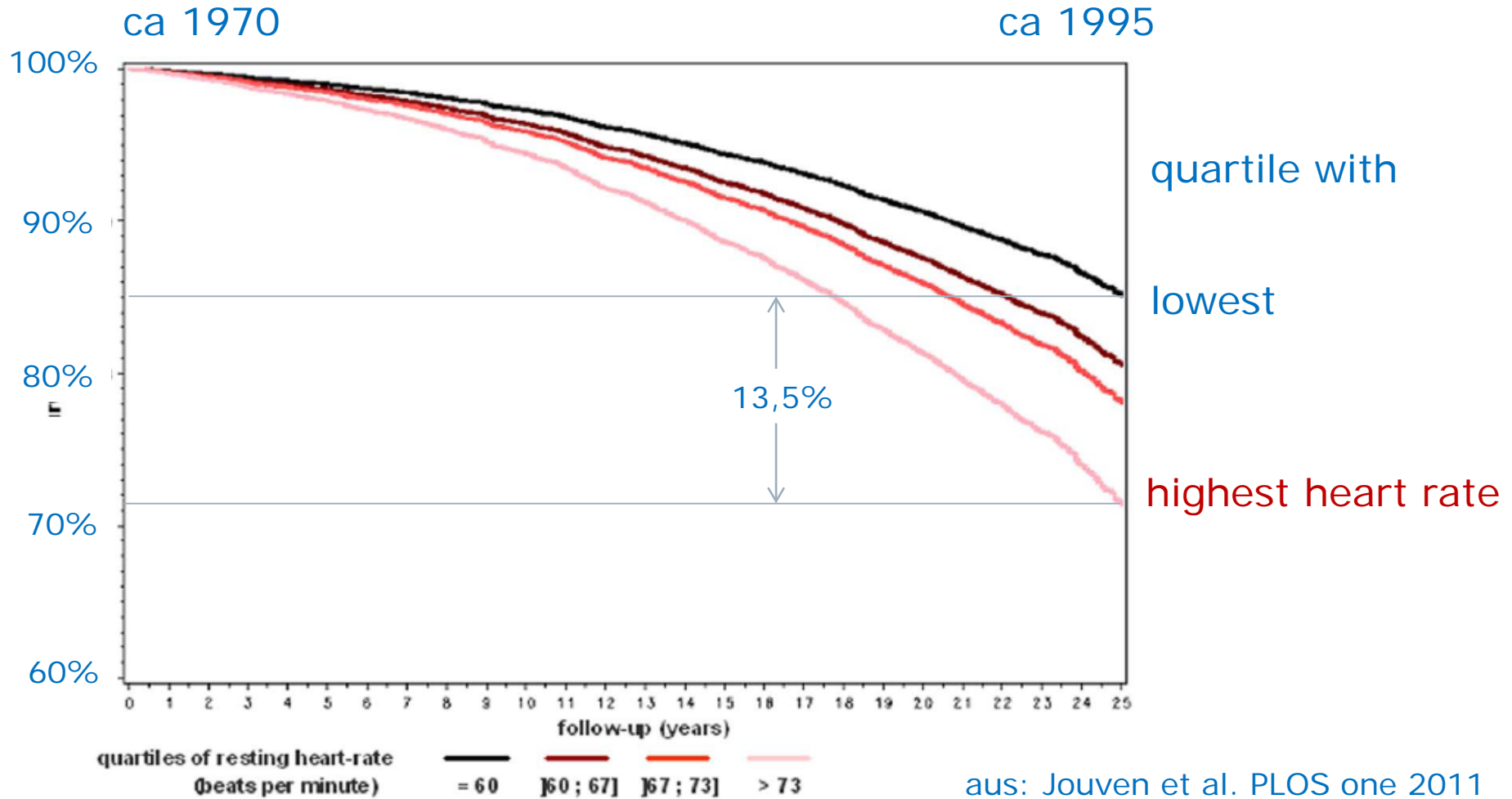


Figure 1. Multivariate adjusted overall survival rate by quartile of resting heart-rate. The Paris Prospective Study I.
doi:10.1371/journal.pone.0021310.g001

A final study with school childrens resulted in an even more pronounced difference between two school classrooms using mainly wood (fir, spruce, oak, stone pine) compared to two conventional school classrooms (plasterboard, plastic, linoleum). Wood classrooms lowered the heart-rate and increased vagal tone (an autonomic nervous system indicator of relaxation) without changing concentration or school marks. These effects started every morning when entering the school and lasted until the evening. Questionnaires revealed, that the pupils in both wood classrooms experienced their teachers less stressing than pupils in the other classes. The teachers found the wood classrooms children calmer and more pleasant. No cases of vandalism were reported in the wood classrooms for over two years.

Study: School Without (ohne) Stress (SOS)



School without Stress : Classrooms

solid wood class



standard class



School without Stress:

Summary

The observed **reduction of heart-rate** and the **increase in vagal tone** during wakefulness combined with a stable vagal activity during the night. This results in a **reduced strain balance** and a **better regeneration, making additional strain better compensable**.

Stress and strain of everyday school life (e.g. social strain through teachers or unsolved conflicts) **can be easier compensated**.

The **school grades** of the pupils **were comparable in both classroom types**, in spite of reduced heart rate and more recuperation in the solid wood classrooms.

Is wood a preferred material?
(Studies from other labs)

YES

Much better physiological values
if touching wood
than
touching plastic, metal or stone

How much Wood should be used in interior design?

40-50% wood: Highest score in

“I like the interior in this patient room”

“The interior is
well suited for a patient room”

“I would like to work in this room”

This room was also seen as most pleasant, natural, calming, and secure, and was rated as the least boring room.



PATIENT ROOMS WITH DIFFERENT DEGREES OF WOOD: A
PREFERENCE STUDY CONDUCTED AMONG HOSPITAL
STAFF

Tina Bringslimark¹, Anders Q. Nyrud²

Which wood finish is pleasant?

Uncoated Wood is most pleasant,
Followed by
Oil finish




And much worse:
Urethane finish
Vitrous finish
Mirror finish



International Journal of
*Environmental Research
and Public Health*

Article

Physiological Effects of Touching Coated Wood

Harumi Ikei ^{1,2,†} , Chorong Song ^{2,†}  and Yoshifumi Miyazaki ^{2,*} 

Hygienic Aspects of Wood

Trees: tallest organisms on Earth (up to 140 m)
Resisting for 100 to 5000 years to microorganisms, insects, open weather conditions, moisture, wind, heat and frost



Tree strategies to cope with microorganisms:

Conifers

(pine, spruce, larch,...)
essential oils (ca 800-2000 synergistic terpenes), resins, glycosids

Deciduous (leave) trees

(oak, birch, beech, ash-tree,...)
Tannic acid, flavonoids, cumarins, betulins, essential oils ...

Wood

Fibrous structure
Surface dries rapidly
actively absorbs water
no living ground for bacteria



1. Bacteriostatic rather than bactericide!
Calming hyperactive genes – instead of killing microorganisms.
- No selection pressure

2. multitarget action of substances (>20 genes, proteins) –
Classical fungogenic antibiotics are single-gene oriented

- **No resistance formation.**

Bacteriostatic action of different materials

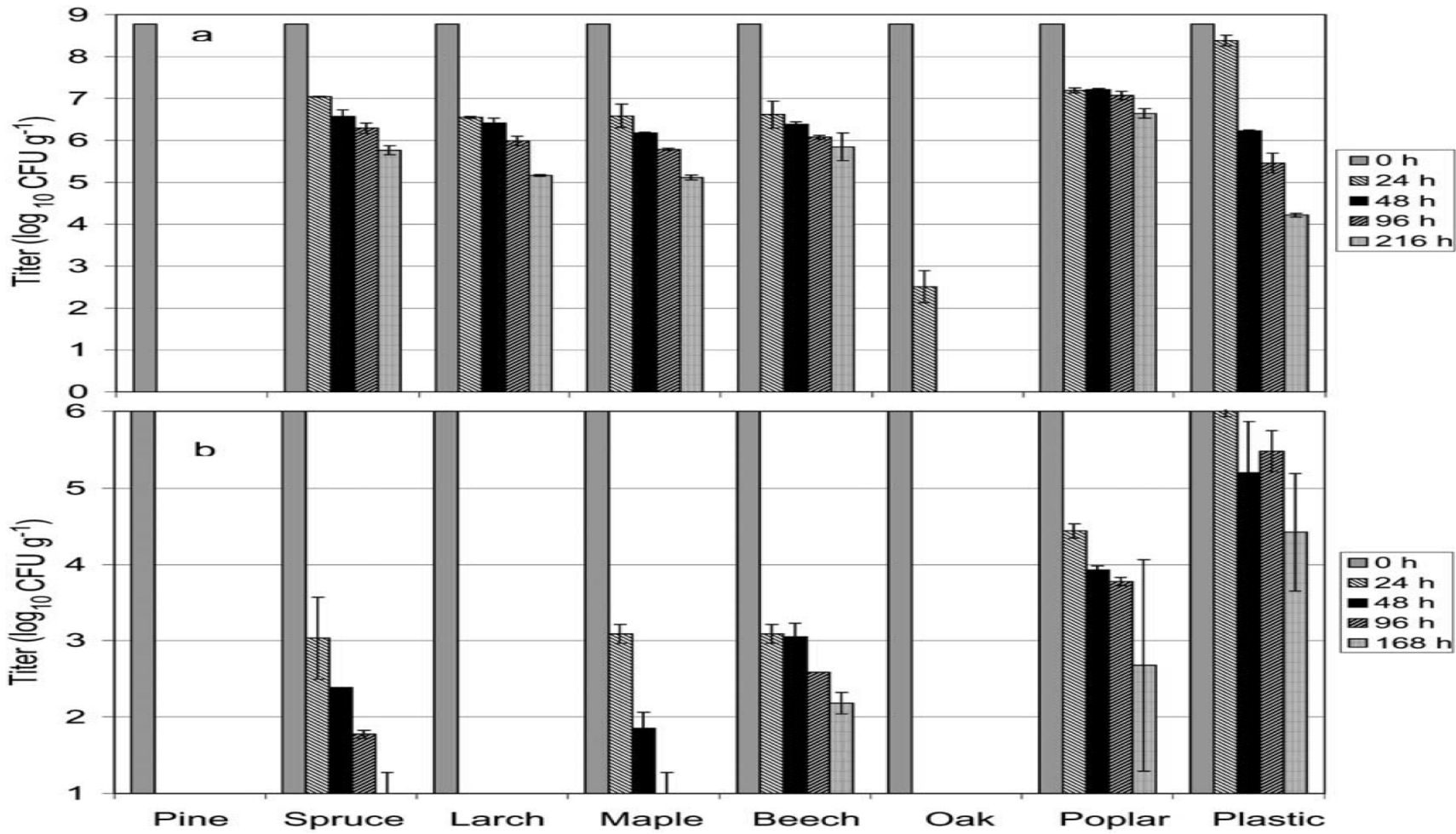


Figure 1 Survival of *E. coli* pLE639 (a) and *E. faecium* (b) on wooden sawdust and plastic chips. Initial inoculum size: *E. coli*, 5×10^8 CFU g⁻¹; RT: 21°C; relative humidity (RH) 55%; *E. faecium*, 1×10^6 CFU g⁻¹; RT: 21°C; RH 55%.

Bacteriostatic effect of oak wood
confirmed in
Methicillin-resistant
staphylococcus aureus
(MRSA)
by H el ene Pailhori es et al.
infection control &
hospital epidemiology, 2016

Investigating bacterial growth in surgical theatres:
establishing the effect of laminar airflow on bacterial
growth on plastic, metal and wood surfaces

ALEX RODRIGUES DA COSTA, AMI KOTHARI, GORDON C BANNISTER, ASHLEY W BLOM

Avon Orthopaedic Centre, Southmead Hospital, Westbury-on-Trym, Bristol, UK

Multisensory Wood Effects

Smell: essential oils, tannins, ..

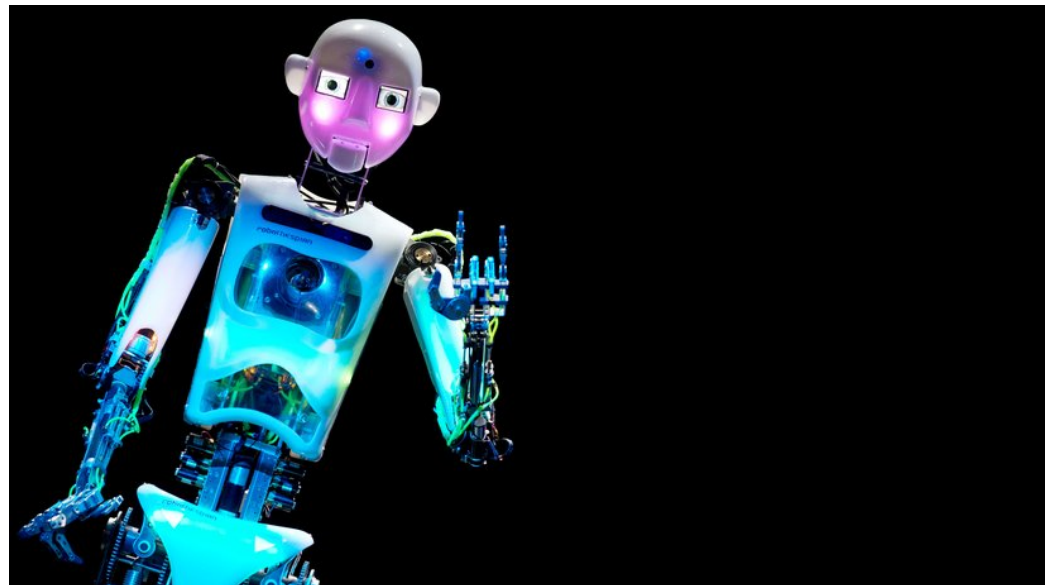
Vision: „natural“ color, texture

Hearing: music material (violins, organ, xylophon)

Haptic: texture, warmth, lightness

Technical materials „Strange“ Uncle

„Mother“ Nature



Maximilian Moser
& Erwin Thoma

2015

DIE SANFTE MEDIZIN DER BÄUME

Gesund leben mit altem
und neuem Wissen



DIE KRAFT DER ZIRBE

April 2019



Example: Filder Clinic, Germany

Location: Filderstadt-Bonlanden
Stuttgart, Germany

Architects : Christoph Klein and Wilfried Ogilvie
Finished: 1975

ca 219 beds, ca 630 employees

Departments for

- > Anesthesia
- > Surgery and Surgical Orthopedy
- > Gynecology
- > Internal Medicine and Gastroenterology
- > Center for Integrative Oncology
- > Pediatrics
- > Intensive Care
- > Radiology
- > Palliative Medicine
- > Psychosomatic Medicine

Filder Clinic, Germany





Filder Clinic, Mensa for Patients and Doctors





Filder Clinic, Patient Room





Filder Clinic, Patient Room



Quo Vadis Wood Research ?

- Is it sufficient, to characterize poisonous VOCs (volatile organic components) in wood?
- We think, No !
- positive health aspects should be increasingly investigated.
- a visionary application of wood should be investigated
- large research programs are necessary and make sense
- the wood industry is asked to provide funding for this, research can no more provide it