

# How Infra Sound and Low Frequencies are considered in France ?



*FED : National Group of Victims*

*Patrick Dugast, Engineer  
acoustic and vibrations.*



Glasgow 2017 WT Noise Seminar

# Plan

- Which is Infrasound and LF noise from wind turbine ?
- Academia of Medicine
- New French Norm : Low Frequency measurement
- ANSES National Agency of Health Risk - new report
- Works of Paul Schomer
  - ◆ US Navy
- Works of Alec Salt
  - ◆ Outer Hair cells specific sensitivity
- Conclusion – Perspectives

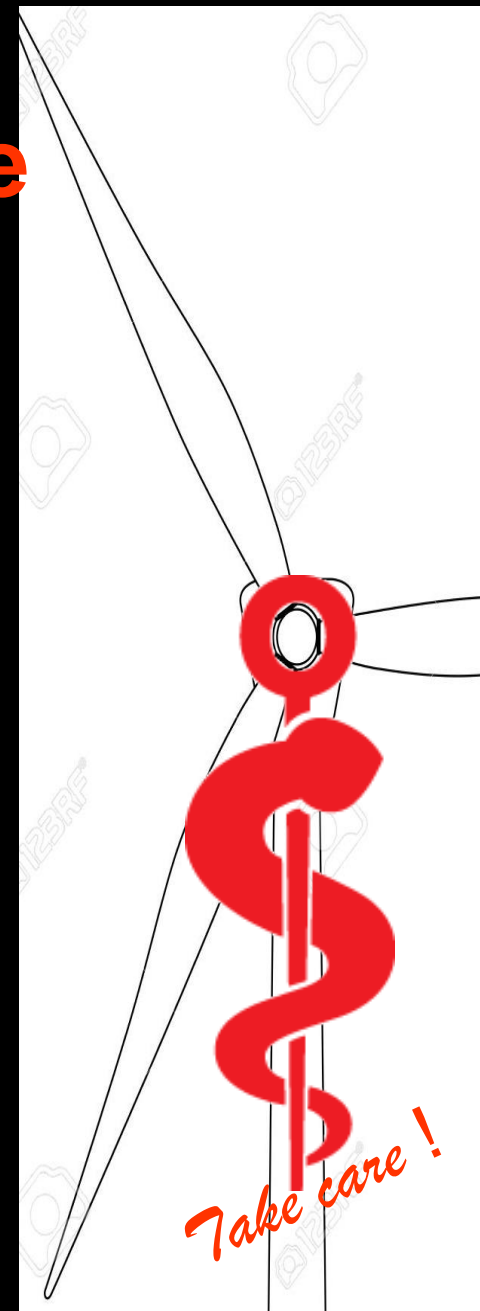
# French Academy of Medicine

- Audible threshold 107 dB à 5 Hz

Fréquences en Hz	1	2	4	8	12	16	20
Seuils d'audibilité en dB	120	115	107	98	90	82	75
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*Tableau 1. Seuils d'audibilité d'après Watanabe et Möller [6]*

- Advise 1500 m for wind turbine > 2,5 MW
- Report March 2006 : Infrasound too low to affect the health. Demand of an epidemiologic study correlated to distance.
- New report 9 May 2017 : necessity to make an epidemiological study
- “Resentment and opposition can affect the health”
- Necessity to control more often the wind farms.



# Expression of Suffering

In January 2016, the French FED (association for victims) has made a large inquiry concerning 1000 persons.



Expression of claims and distress:

Wind turbine annoyance is classified in categories :

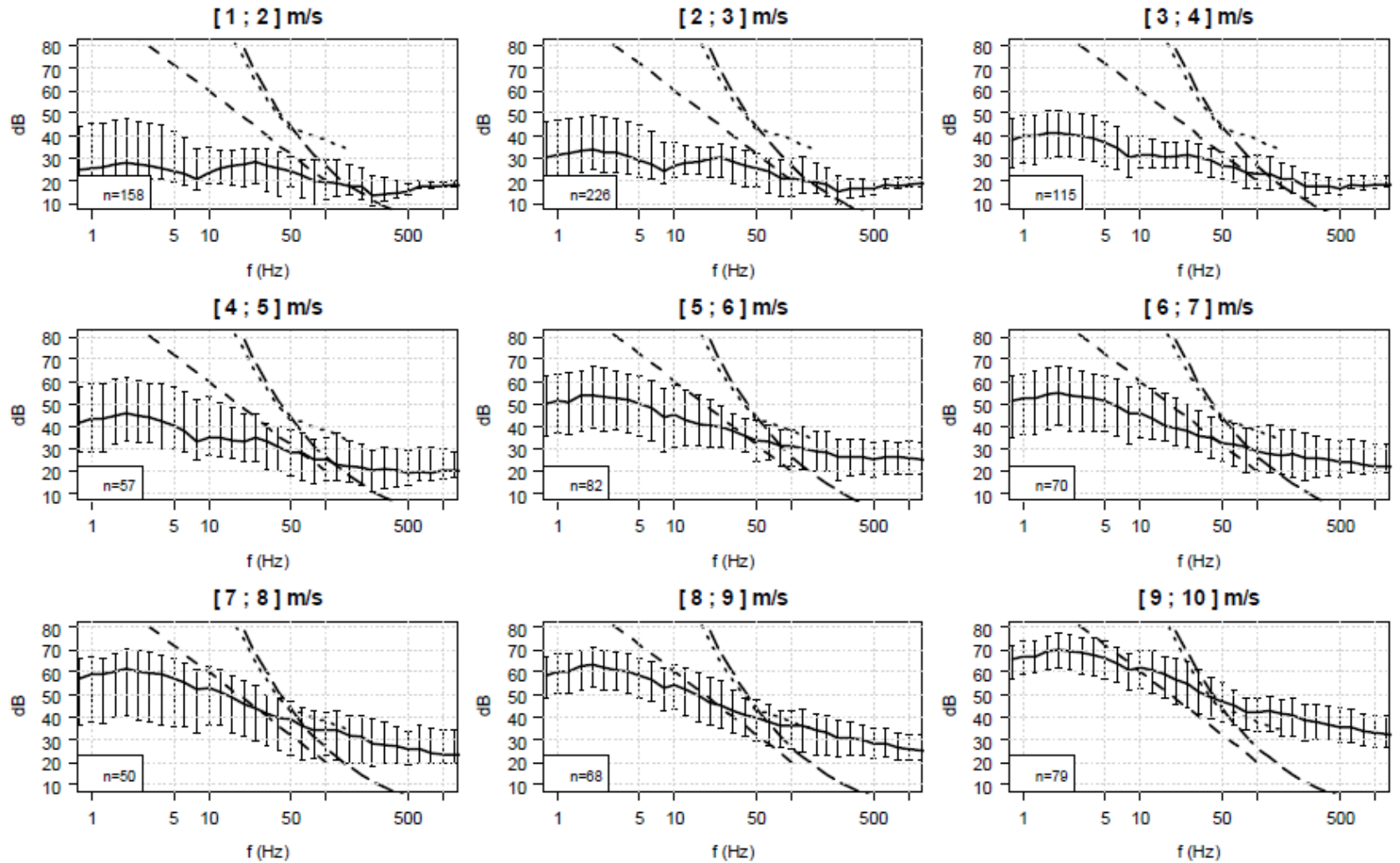
- Noise
- Infrasound and Low frequencies.
- Others (visual, ...)

- This inquiry was Presented at the ANSES in March 2016, but not really taken in consideration

# ANSES

- New report January 2017:
- Threshold Salt and Hullar in question.
- ANSES Recommendation :
  - ◆ more continuous measurement as for airports
  - ◆ Epidemiological study

Exterieur - ON et OFF

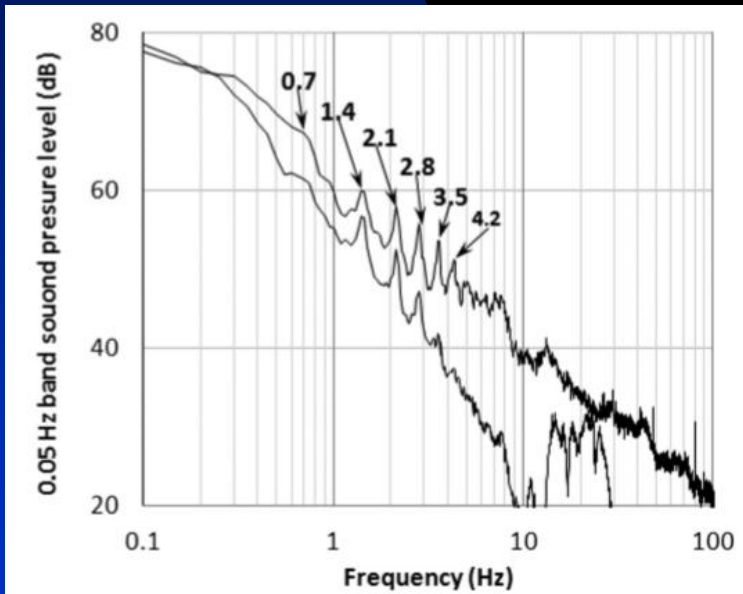


# Théory of physiologic effects of infrasounds from wind farm

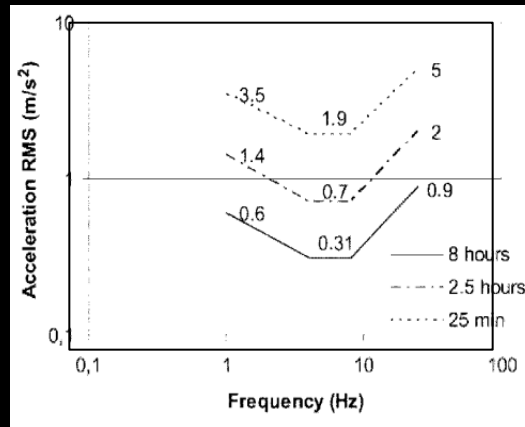
**Paul SCHOMER**

*A Cooperative Measurement Survey and Analysis of low frequency and infrasound at the Shirley Wind Farm in Brown County, Wisconsin.*

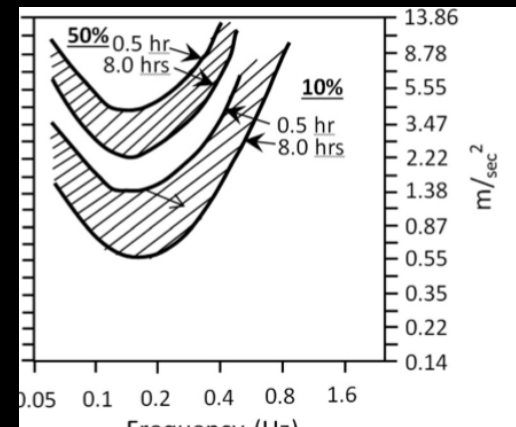
- 275 peoples living near Shirley Wind farm – 50 peoples have distress
- Vibration sensitivity
- US NAVY sea sickness



*Spectrum inside and outside at 335 m dfrom the turbine*



*Vibration sensitivity versus exposure time From ISO2631.*



*Sea – nauseagenic criteria - US NAVY Exposure time and neausa %*

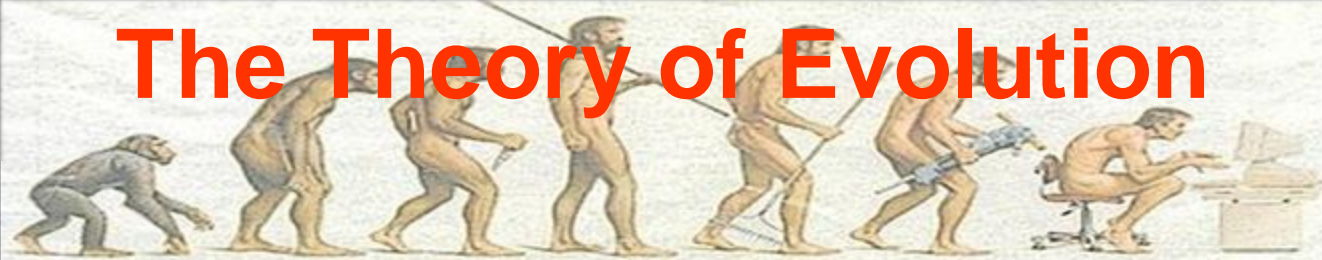
# Norms and Regulation

## New French AFNOR NF-S 31 135

- Frequency domain : 1-25 Hz
- With usual sound meter, first 1/3 octave at 1 Hz (Rion, Norsonic ?, others ?)
- Impulse sounds and periodic sounds analysed separately
- Both Inside home and outside
- Synchronized Vibration measuring is advised



# The Theory of Evolution



Wind turbine more powerfull

Bigger !

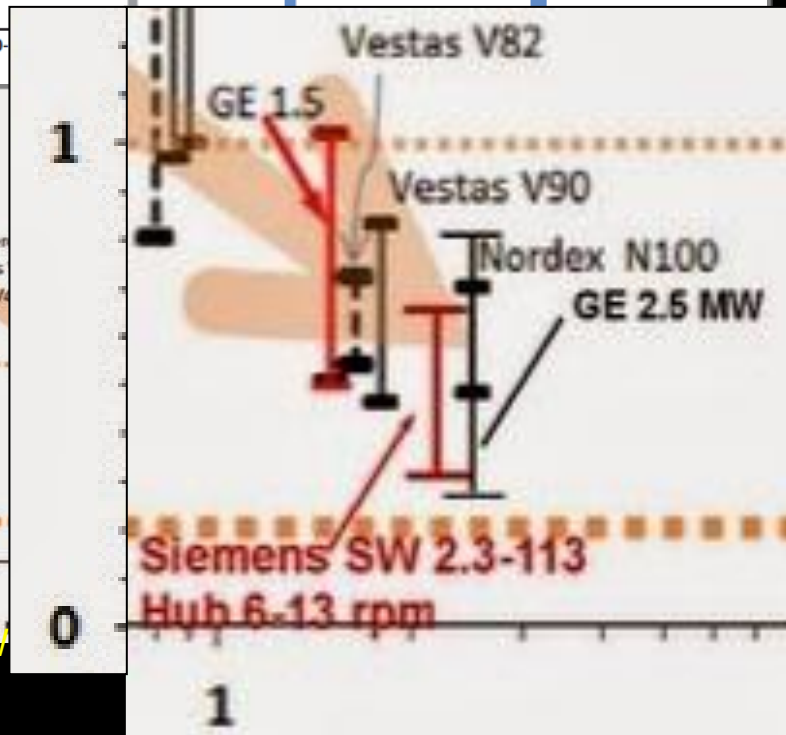
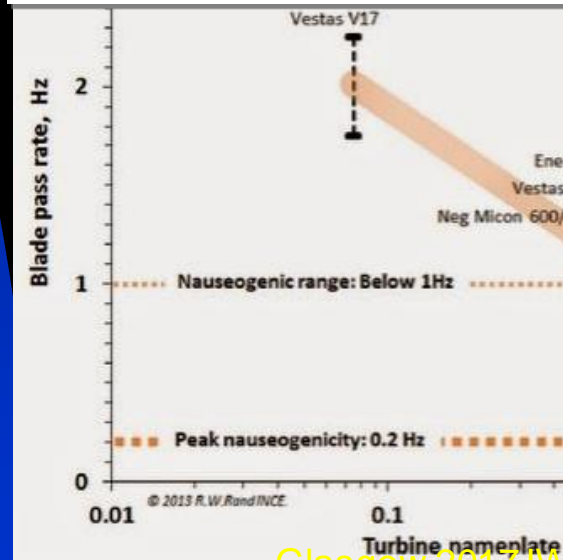
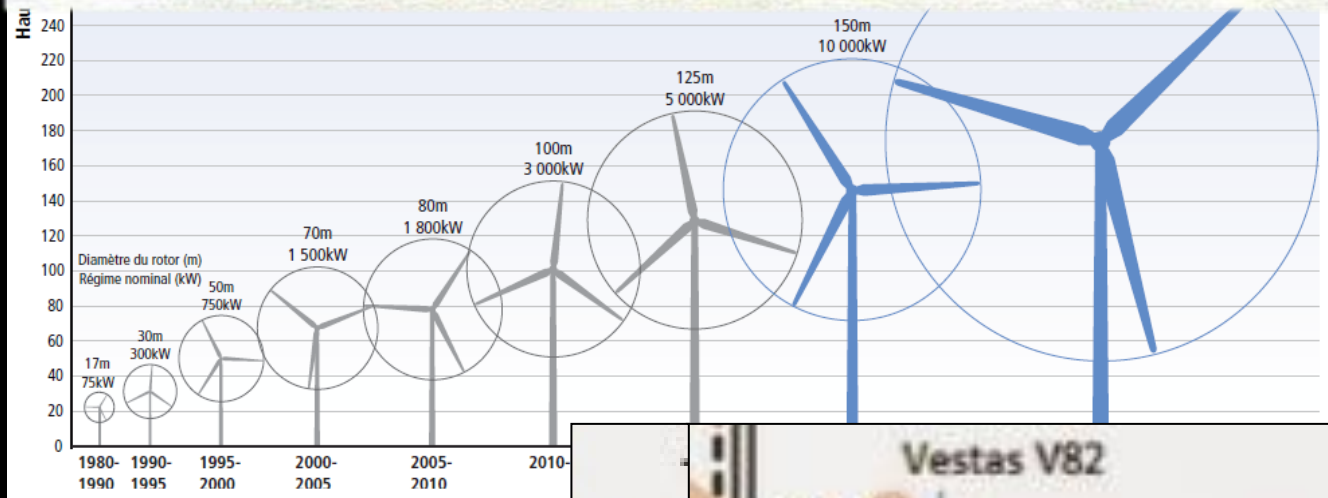
Quieter ...?

Slower !

Lower frequencies !

More infrasound...

More "nauséagénic" !  
(Paul Schomer)

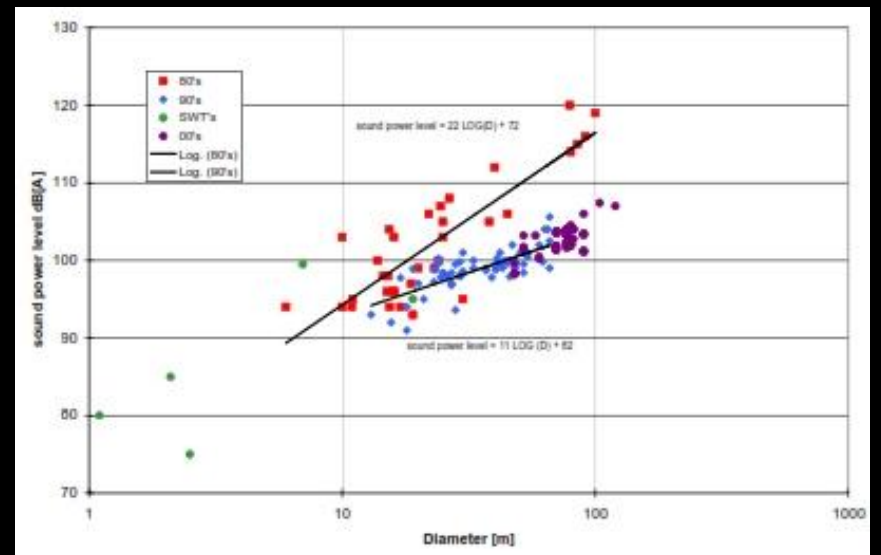
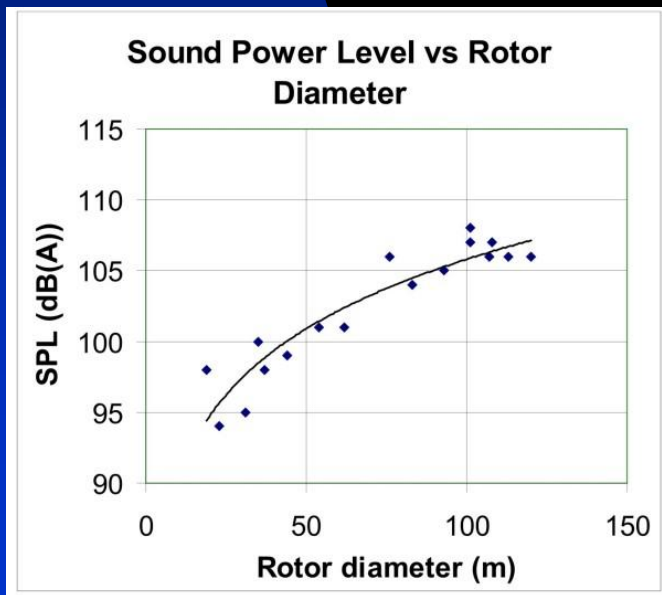
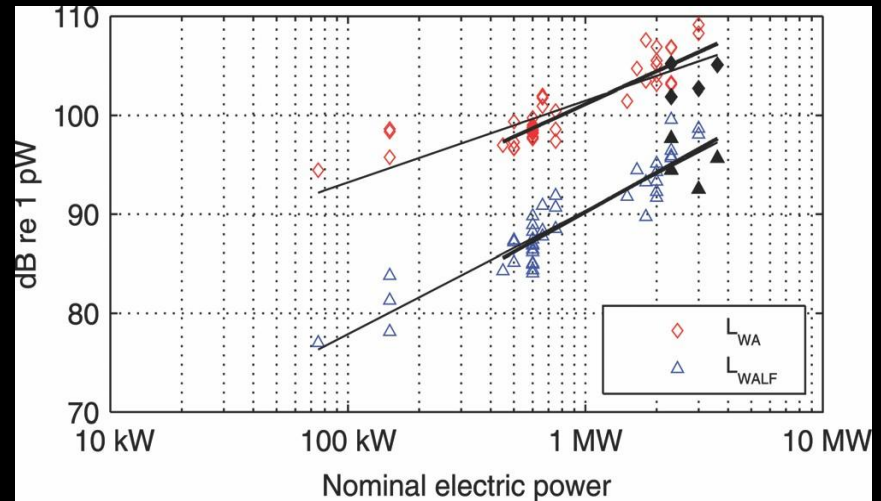


# Noise versus turbine power and size

Wind turbine more powerfull.

More silent ?  
NOT AT ALL !

Source: Stefan Oerlemans, Peter Fuglsang, "Low-noise wind turbine design", Siemens Wind Power A/S, Siemens AG, at EWEA Noise Workshop, Oxford, 2012, p 11.

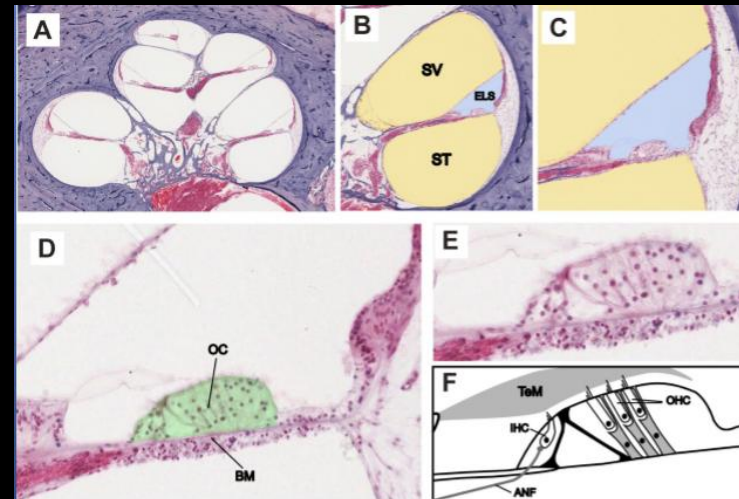
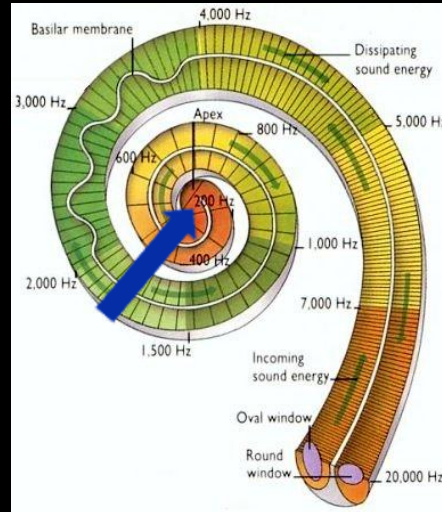
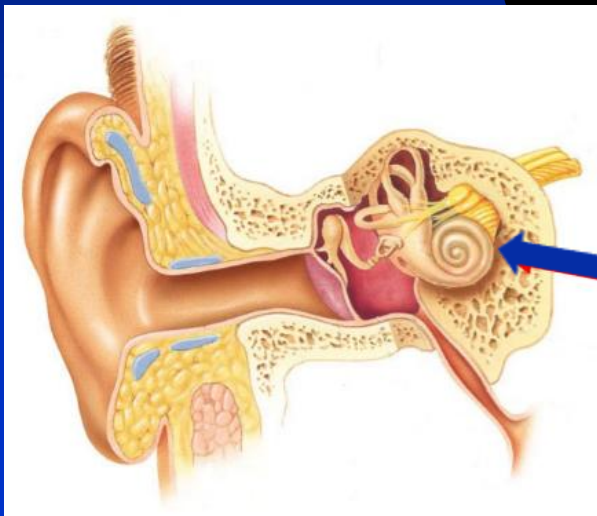
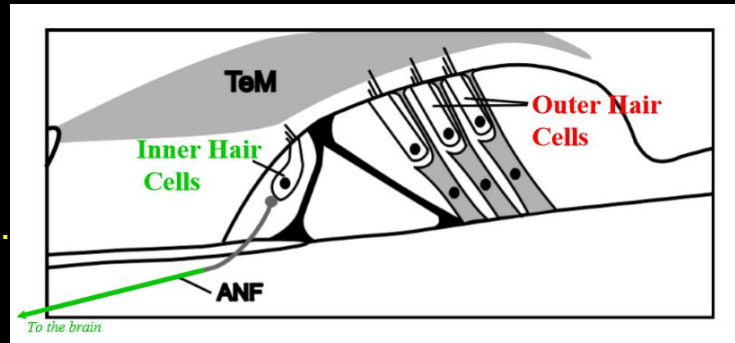


# Alec SALT : Infrasound: Your ears “hear” it but they don't tell your brain. Why ?

## ■ Alec N. Salt, *Département ORL*

*Washington University School of Medicine, St Louis, USA*

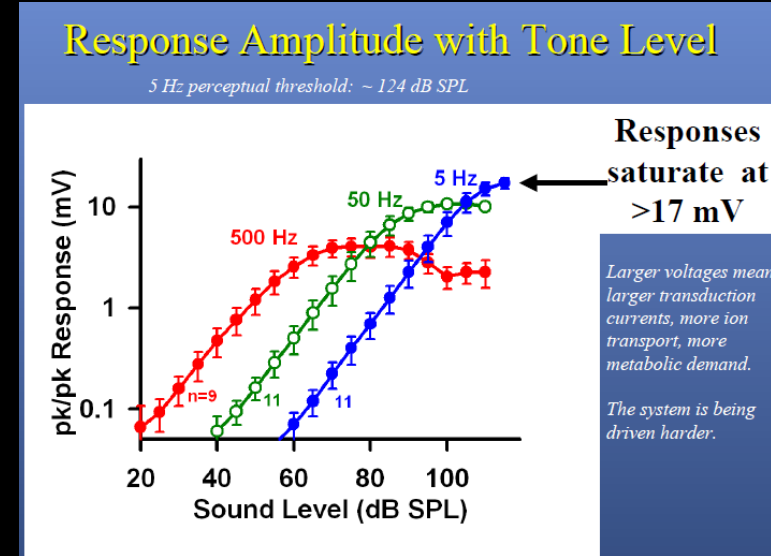
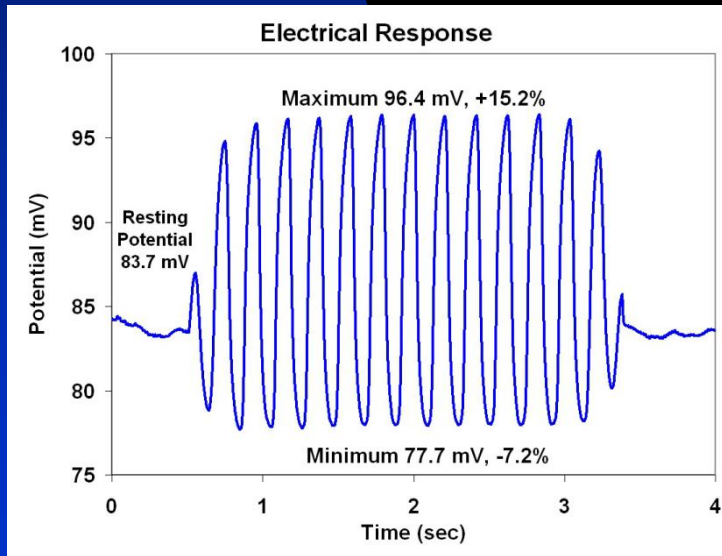
- 16 000 cells inside Cochlea:
- sensitivity to specific frequency range
  - ◆ Inner Hair Cells (IHC) sensitive to speed,
  - ◆ Outer Hair Cells (OHC), more sensitive to displacement.



# Action on Outer Hair Cells

## ■ Alec N. Salt, *Département ORL*

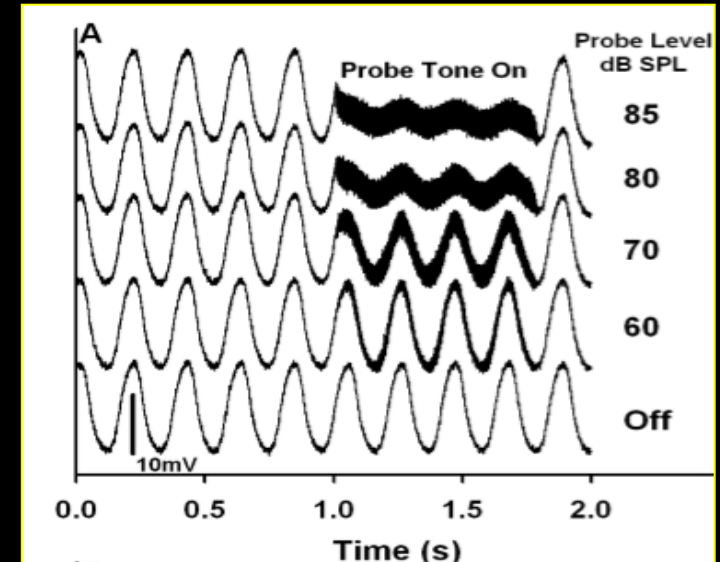
- Guniéa Pig
- électrod placed inside endolymph liquid, in the 3<sup>rd</sup> cochlear turn
- Infrasound 5 Hz generated at 120 dB
- Recording of electric response of Cells





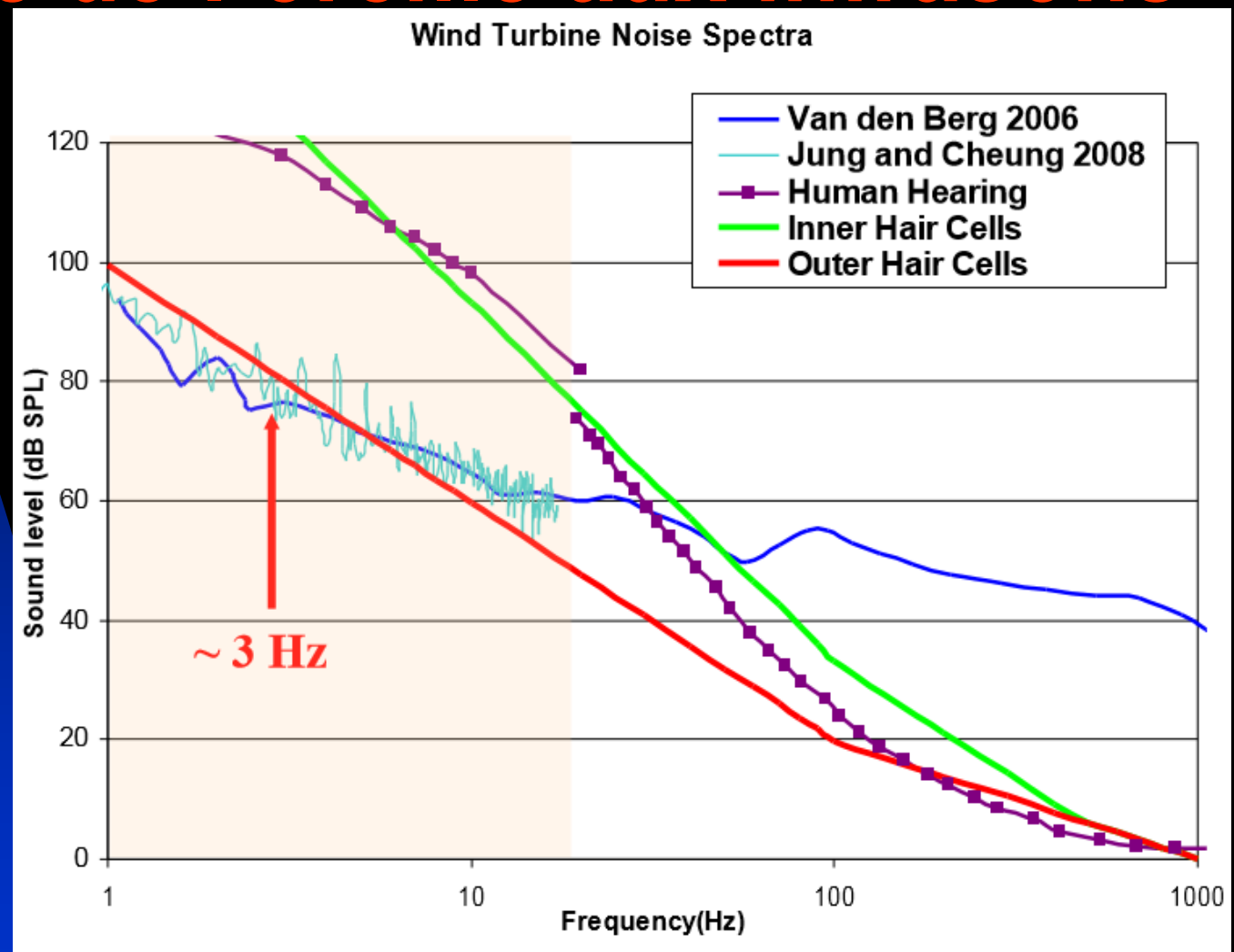
# Conclusion du docteur Salt

1. Infra sound 5 Hz at level 109 dB cannot be “heard”, but inner ear resent an impulse higher than from audible sound.
2. Additional audible sound at 500 Hz acts as an attenuator on infrasound ear response.



# Sensibilité de l'oreille aux infrasons

- Sensibilité de l'oreille
    - 100 dB à 10 Hz,
    - 109 dB à 5 Hz,
    - 120 dB à 3 Hz
  - Seuil Inner Hair Cells (IHC),
    - 120 dB à 5 Hz
  - Seuil Outer Hair cells (OHC),
    - 72 dB à 5 Hz
  - Bruit d'une éolienne (Van den Berg 2006)
    - 75 dB à 5 Hz
- Dépassement du seuil des cellules externes dès 3 Hz



# Conclusions

- Alec Salt Threshold is seen as a possible alternative to Audible threshold.
  - ANSES stays “sceptic”, speaks “nocebo”, and did not do any serious study.
    - The new regulation NF S 31 135 for an accurate measurement
- Academy of Medecine does not recognise a dangerous risk on health;
  - but recognize physiopathology, and recommends an epidemiological study
    - SALT and Hullar threshold is not rejected.
      - Some progress, but Slow