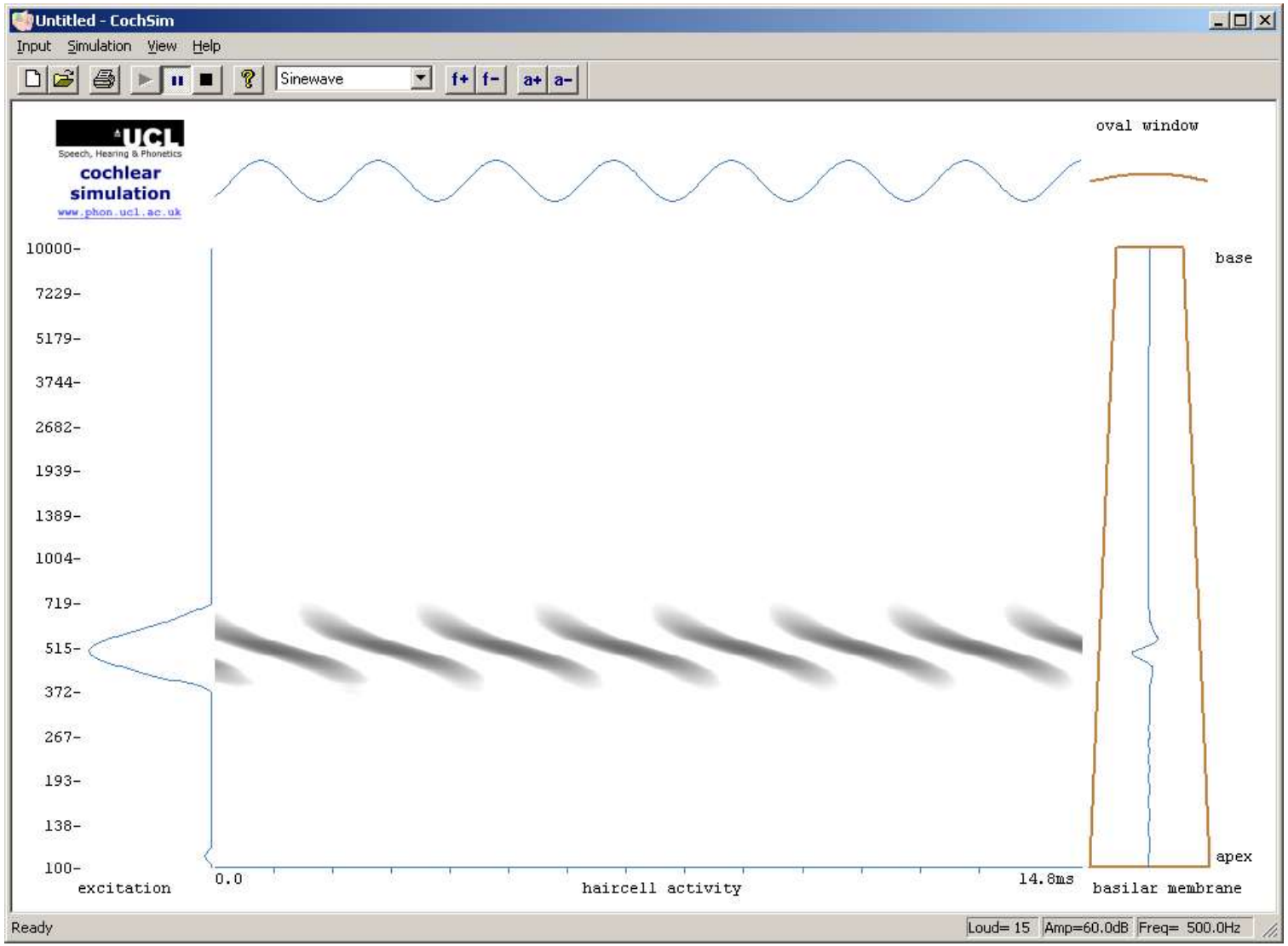
# Signals, systems, acoustics and the ear

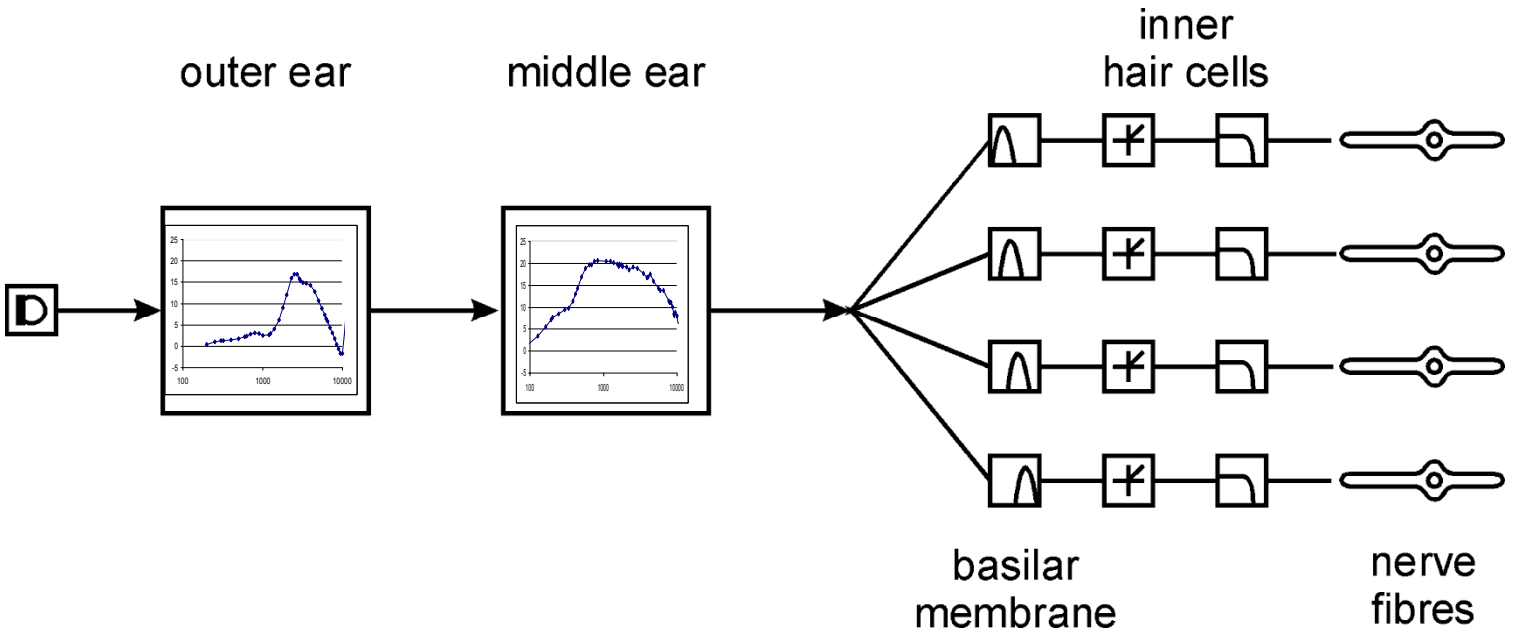
## Week 6

### Interpreting a cochlear simulation

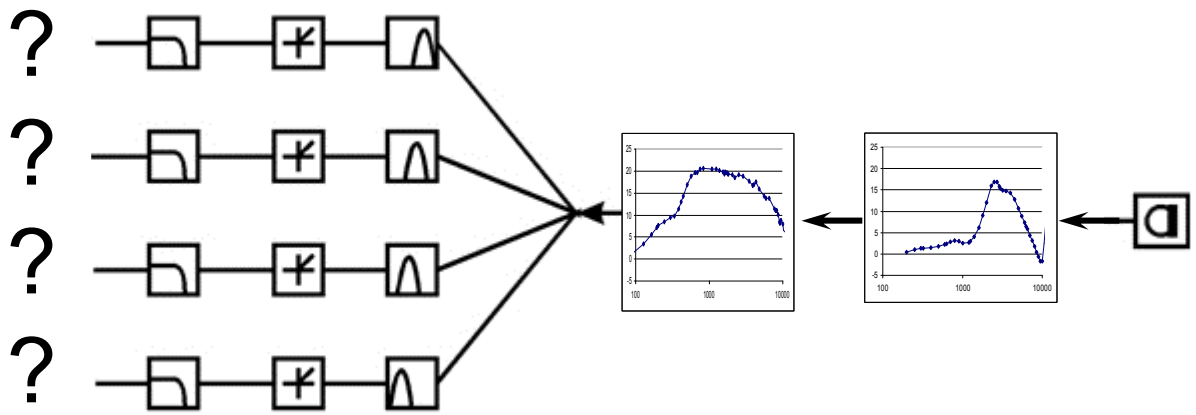
# Today's lab: A cochlear simulation



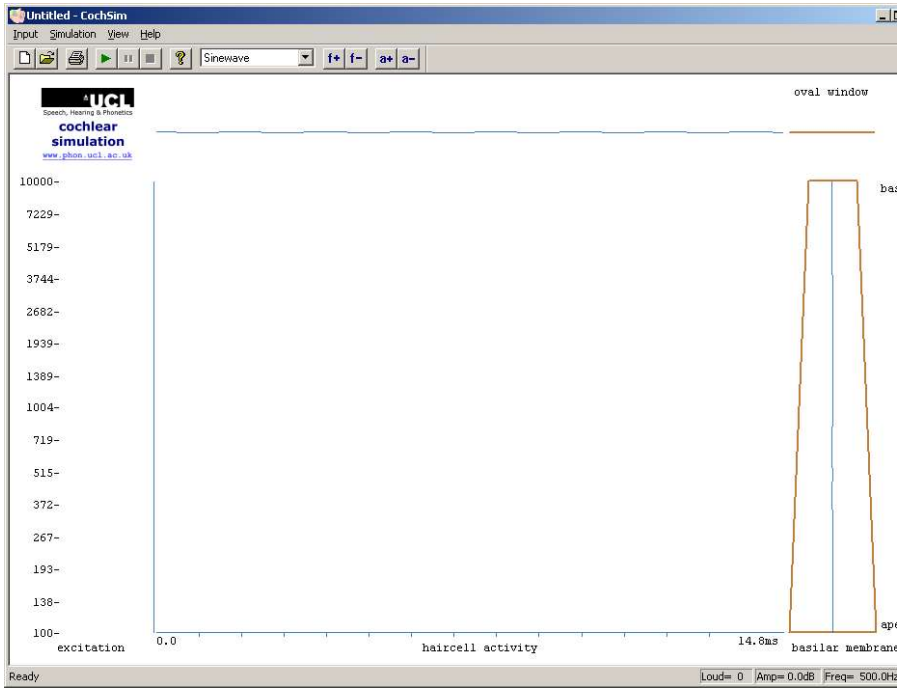
# A computer implementation of this model

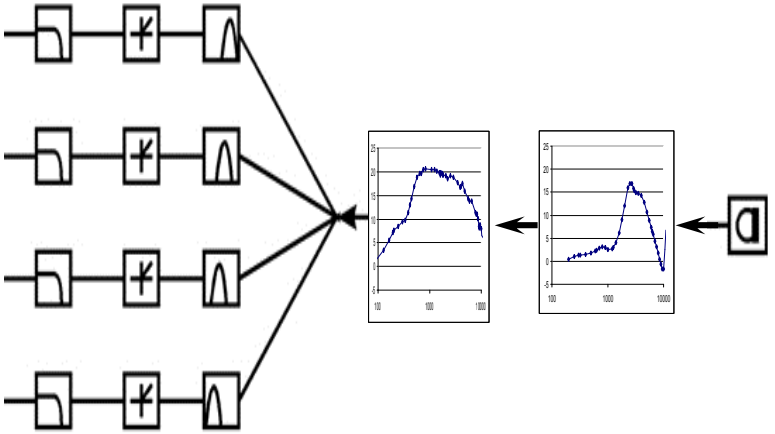


# Flip it around



# A cochlear simulation

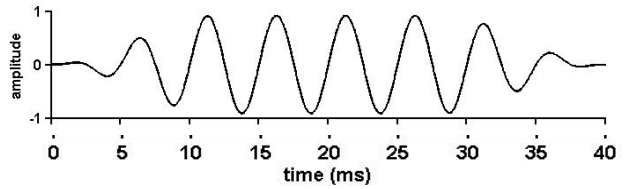


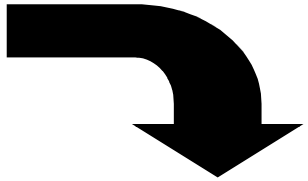



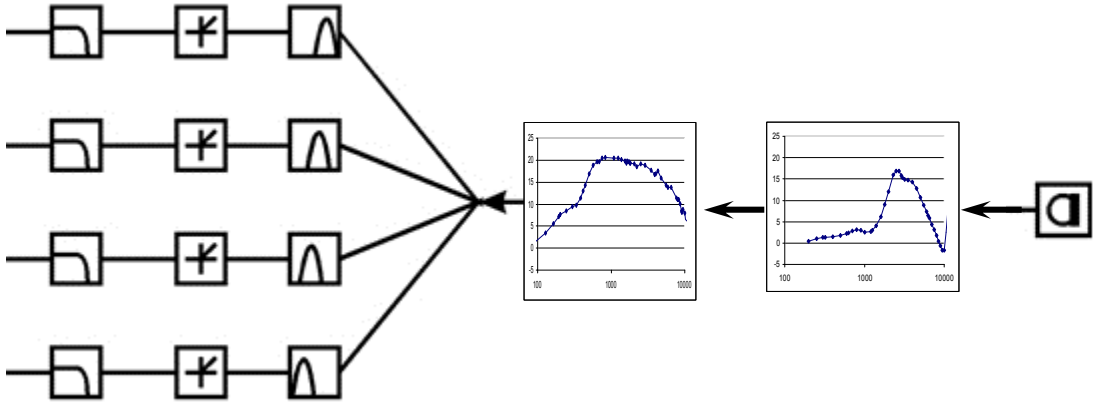
How should we look at the output of the model?

# Could look at the output waveforms

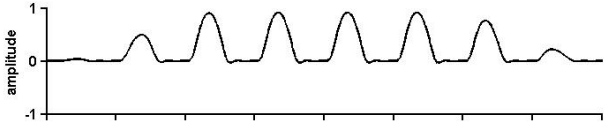
input signal



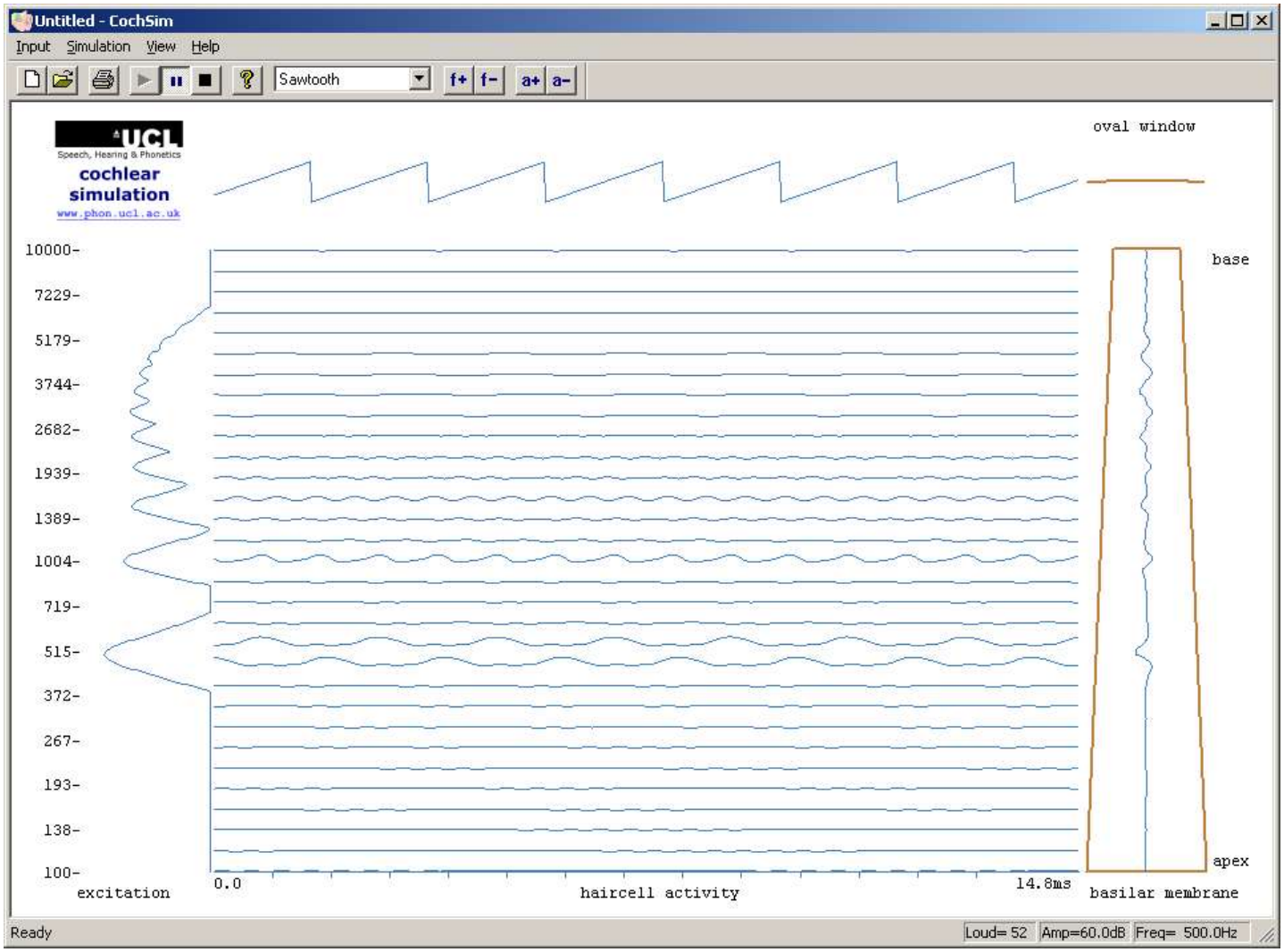





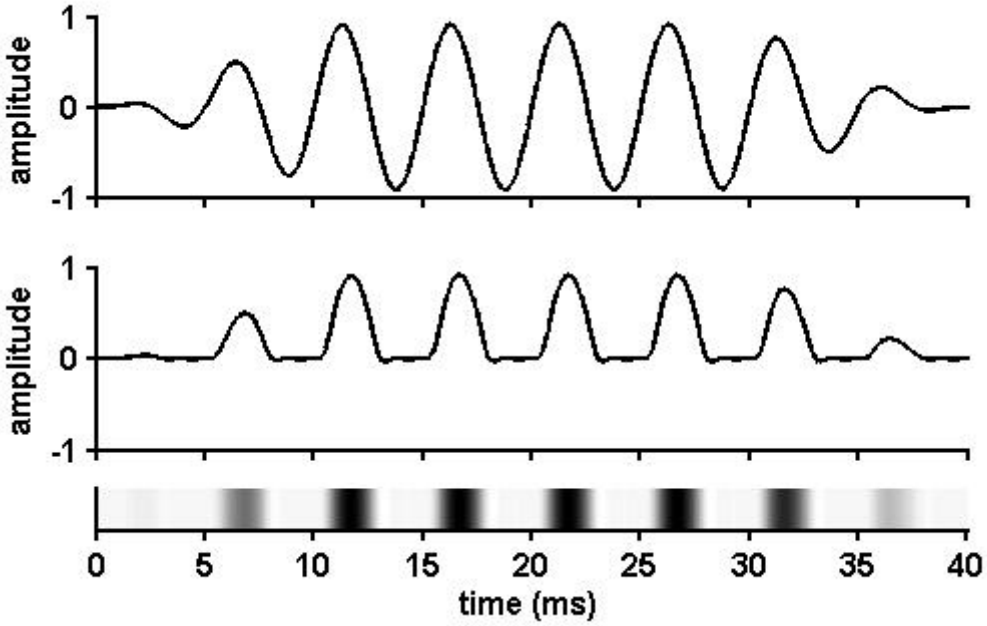
output signal



# But hard to see what is going on (especially for complex waves)



# Solution: encode wave amplitude in a different way



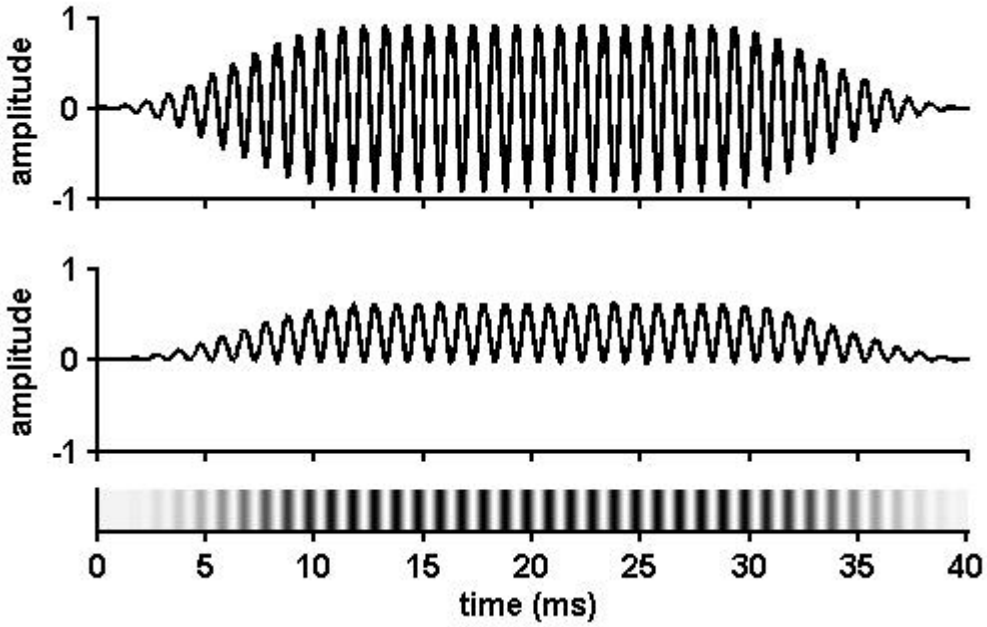

waveform at 200 Hz

rectified & smoothed

spectrographic

waveform amplitude is recoded as
the darkness of the trace

# Encode wave amplitude as trace darkness

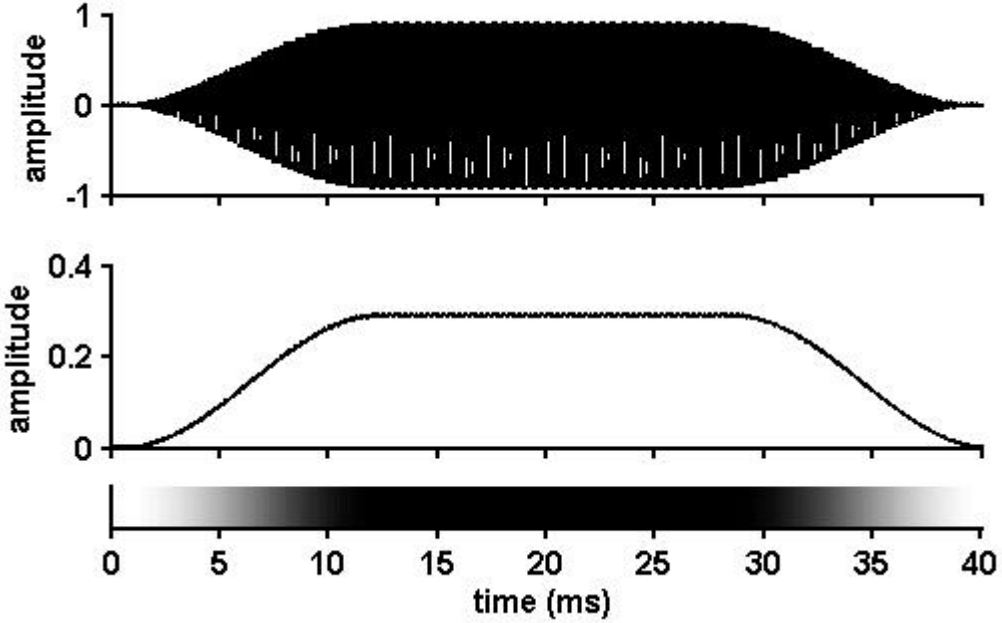



waveform at 1 kHz

rectified & smoothed

spectrographic

# Encode wave amplitude as trace darkness



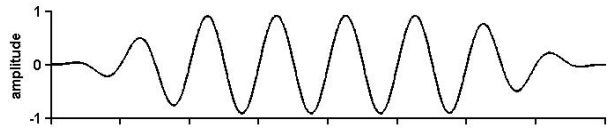

waveform at 4 kHz

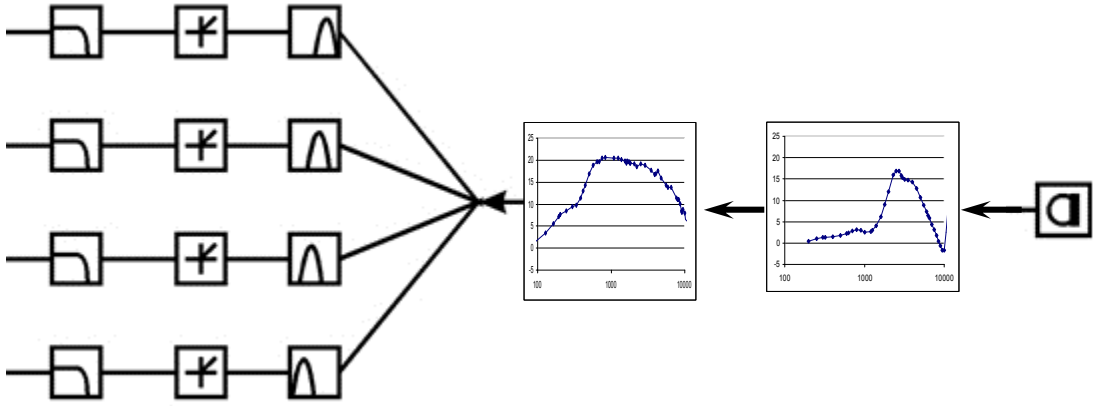
rectified & smoothed

spectrographic

# Construct the output display one strip at a time

input signal at 200 Hz

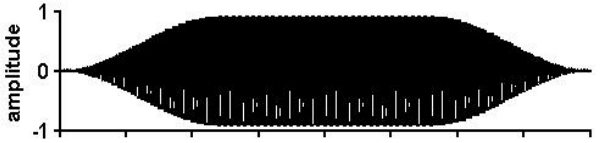


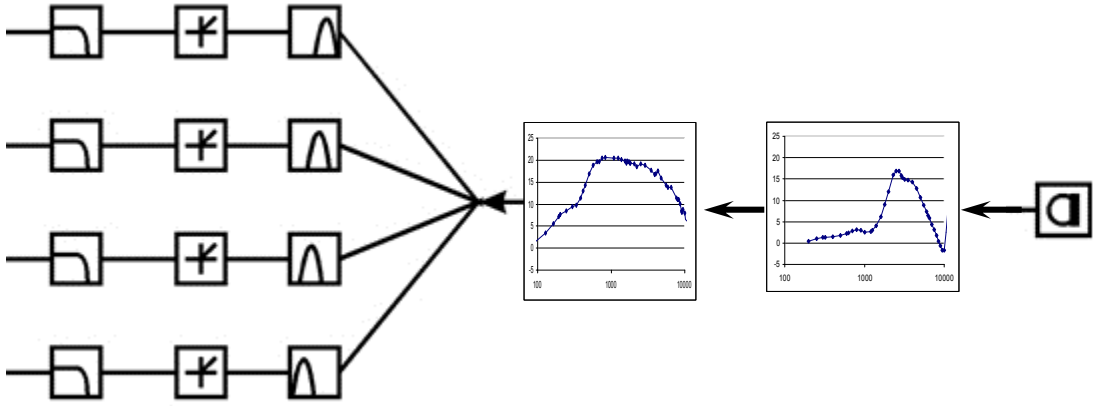



output display

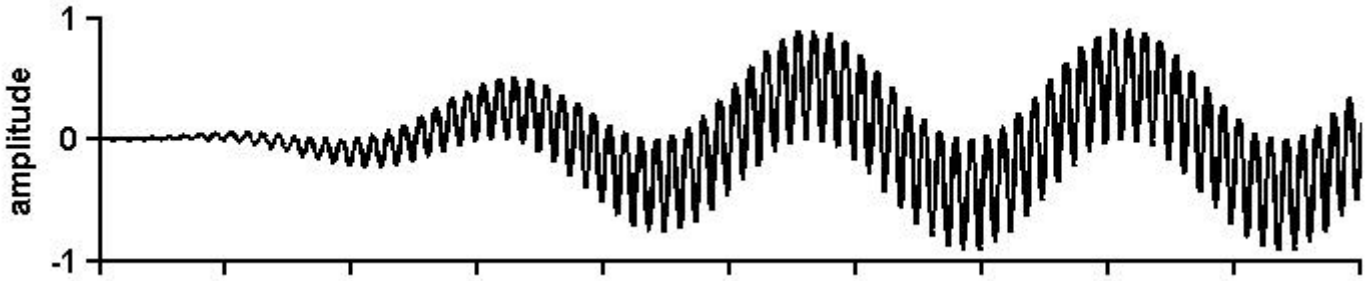
# Construct the output display one strip at a time

input signal at 4 kHz



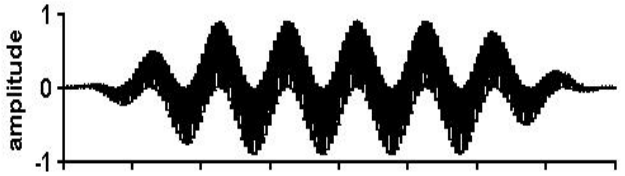



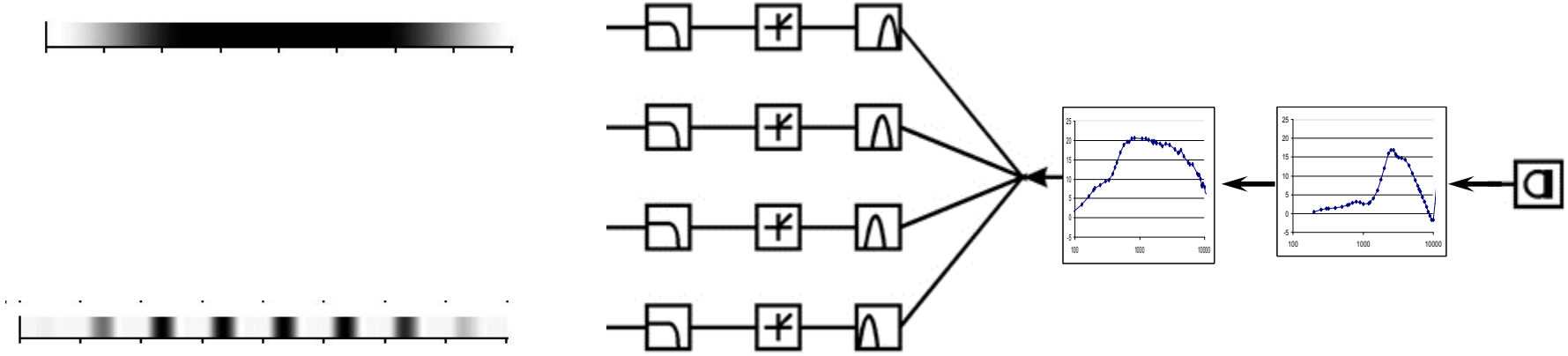
output display




input signal

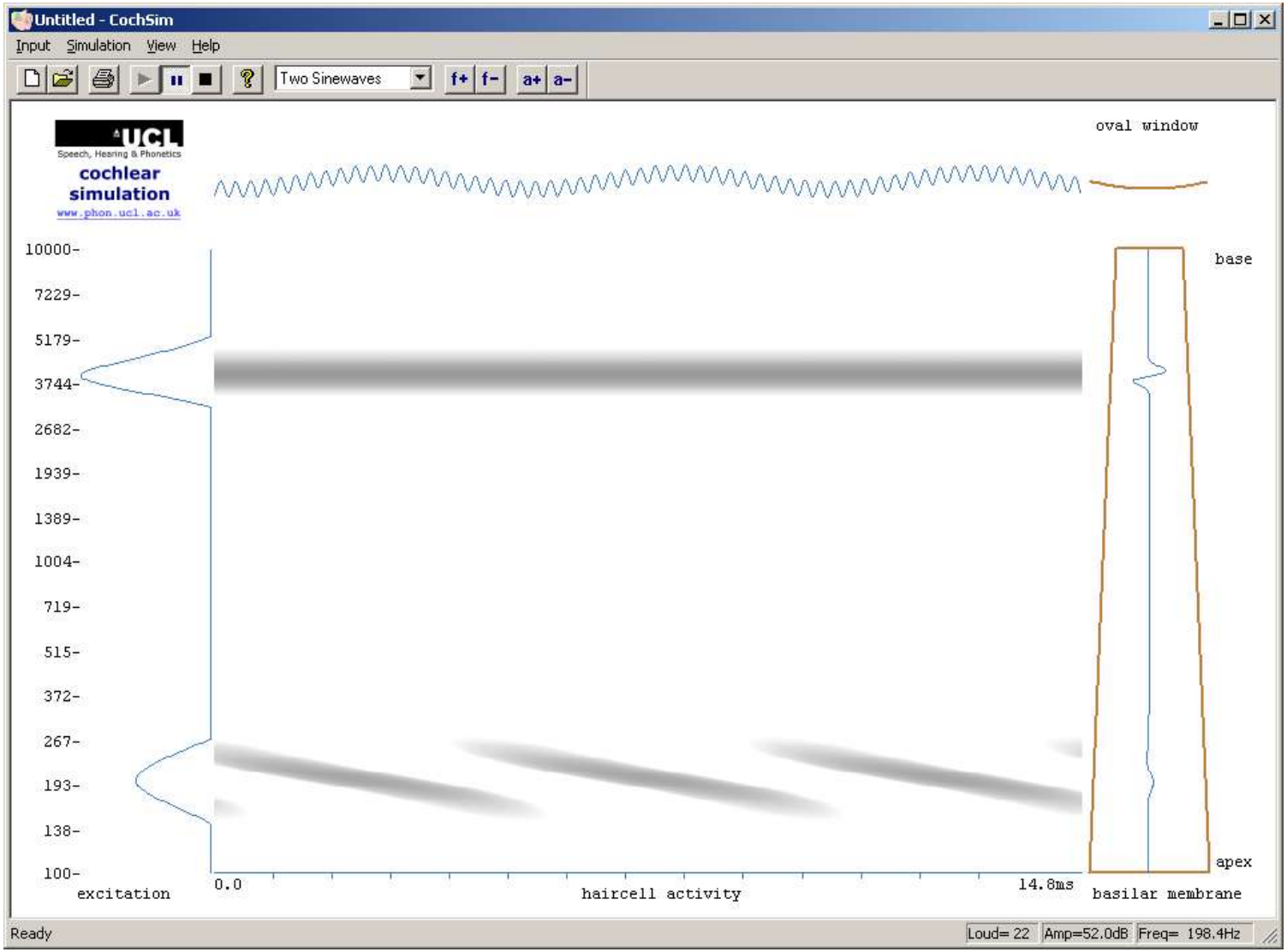
4 kHz + 200 Hz



output display

# 4 kHz + 200 Hz


Untitled - CochSim
Input Simulation View Help
Two Sinewaves
f+ f- a+ a-
UCL
Speech, Hearing & Phonetics
cochlear simulation
www.phon.ucl.ac.uk
oval window
10000-
7229-
5179-
3744-
2682-
1939-
1389-
1004-
719-
515-
372-
267-
193-
138-
100-
base
apex
excitation
0.0
haircell activity
14.8ms
basilar membrane
Ready
Loud= 22
Amp=52.0dB
Freq= 198.4Hz

# Auditory and ordinary spectrograms