



**VIETNAM NATIONAL UNIVERSITY – HO CHI MINH CITY  
UNIVERSITY OF INFORMATION TECHNOLOGY**

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## **Chapter 1**

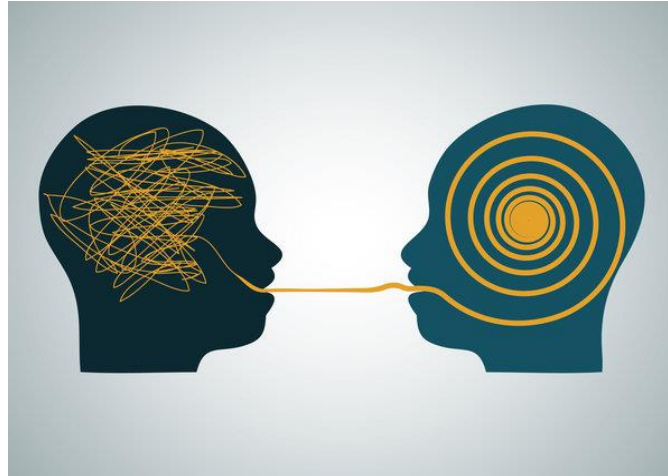
# **SPEECH PRODUCTION**

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**Faculty of Information Science and Engineering**

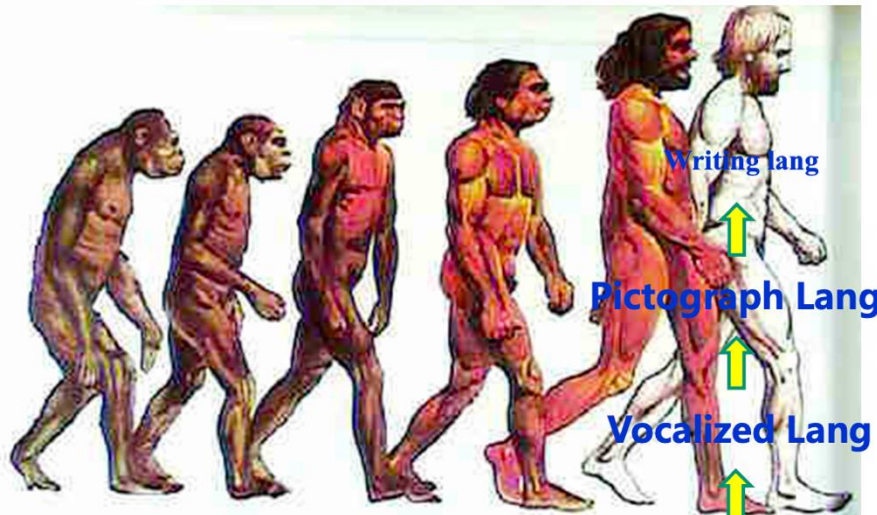
# Human Speech

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- ❖ Speech is an essential approach to human communication.
- ❖ Speech is a media shared in both speech production and perception.
- ❖ Speech is soundwave modulated by language.

# Speech emerged with human evolution



Writing language is completed about 4000 years ago

Pictograph appeared about 10000 years ago

Developed about 40,000-50000 years ago

Human became to stand up and release the hands

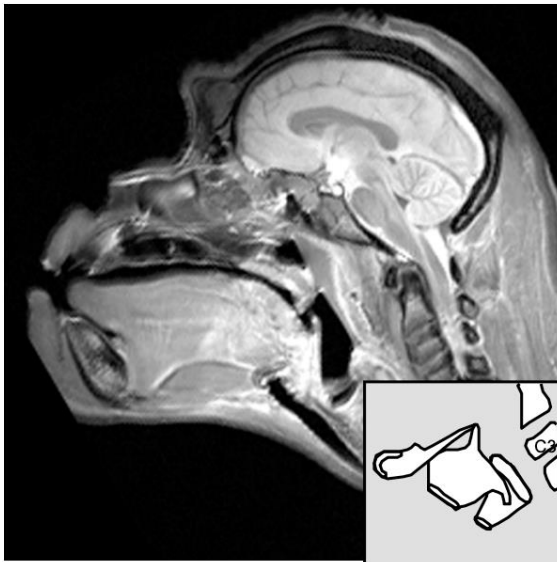
**Use of sounds and gestures for communication is common for human and animals**



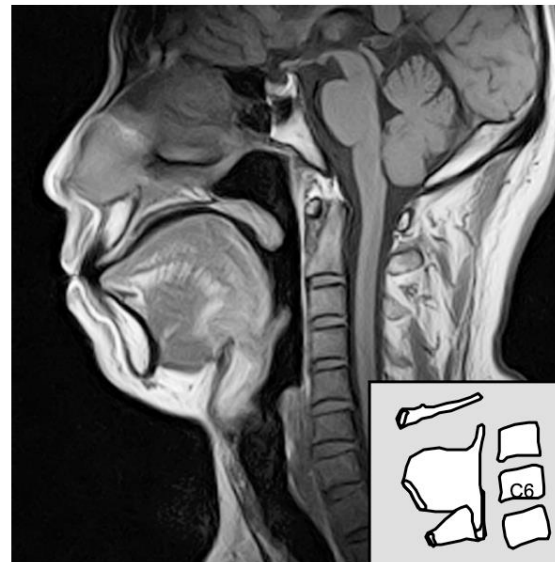
# Evolution of speech organs on morphology

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Protruded face, flat tongue,  
air-bag of larynx



Short oral tract, long pharynx,  
curved vocal tract,  
decomposition of the larynx



(Hayama, et al., 1996)

# Speech is soundwave modulated by language

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## What is the process of sound?

- ❖ Sound generation
- ❖ Sound propagation
- ❖ Sound perception

# Information technology in harmony with humans

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- ❖ Human-centered speech communication:
  - ❑ We can communicate with anyone, anytime and anywhere.
- ❖ Three factors that hinder smooth communication
  - ❑ **External Factor:** Obstacles from the outside world surrounding the speaker and the listener
  - ❑ **Internal factor:** Inhibition by the condition of the speaker and/or the listener
  - ❑ **Mutual factor:** Inhibition due to inconsistency in intention/behavior and cognition of spatial information between the speaker and the listener

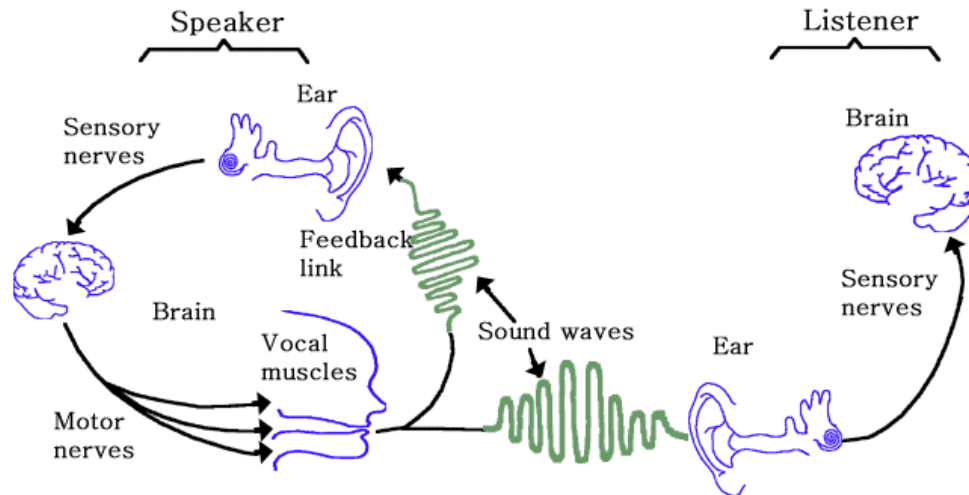
# What do animals hear?

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- ❖ Hearing is an important system for
  - ❑ Suspecting dangers to protect themselves
  - ❑ Specifying places in-game and taking it
- ❖ These are examples of direction and distance perception by sounds
- ❖ For humans, **hearing** is
  - ❑ Not only for direction and distance perception by sounds but also an important system for communications.

# Why do we study the speech chain?

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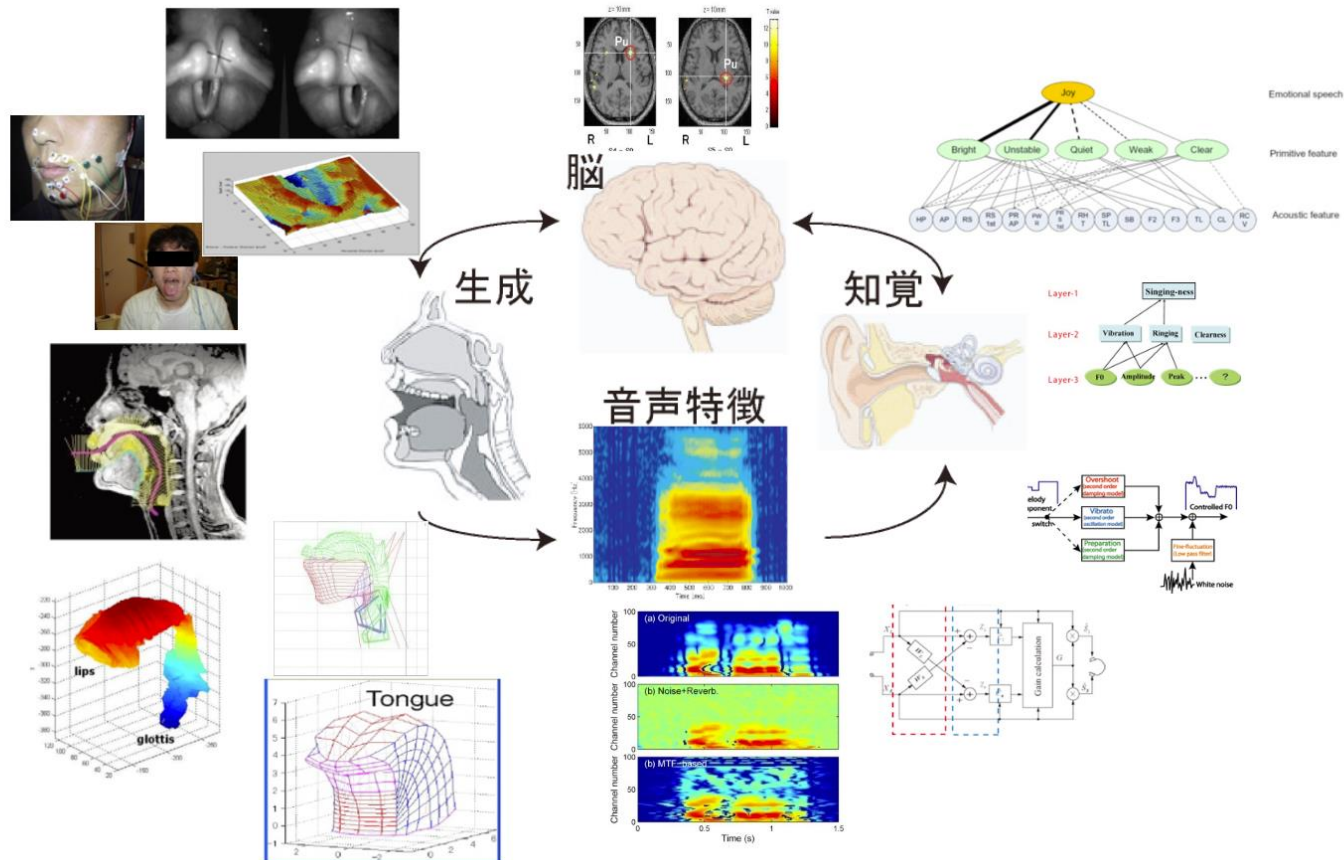


## ❖ Production and perception in speech chain.

- ❑ To investigate “hearing speech”, perception mechanisms has to be studied in the speech chain.
- ❑ Similarly, to investigate “producing speech”, production mechanisms has to be studied in the speech chain.



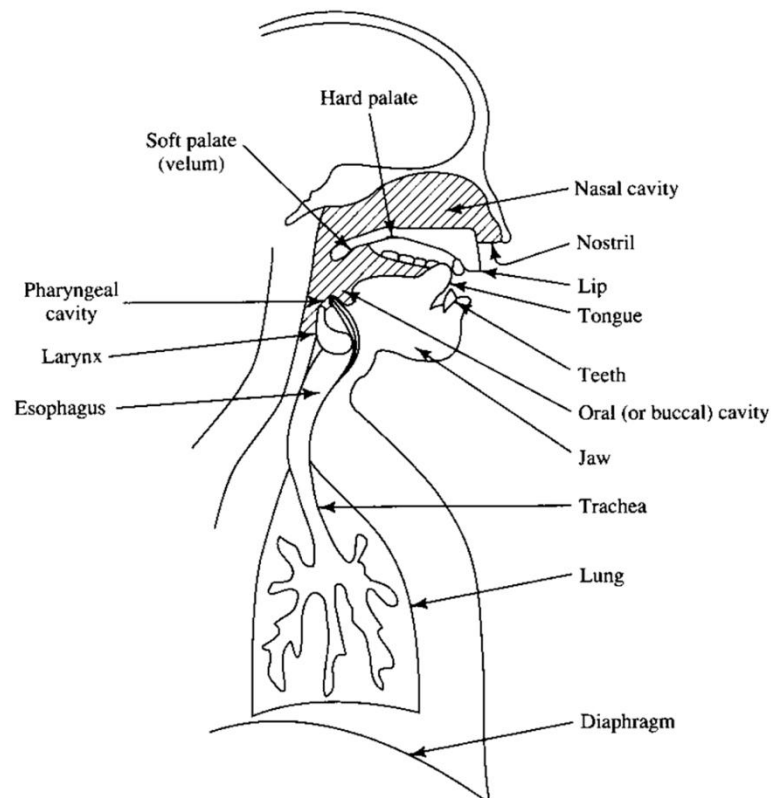
# Observation of human behaviors, modeling based on Speech Chain, and going toward useful engineering systems



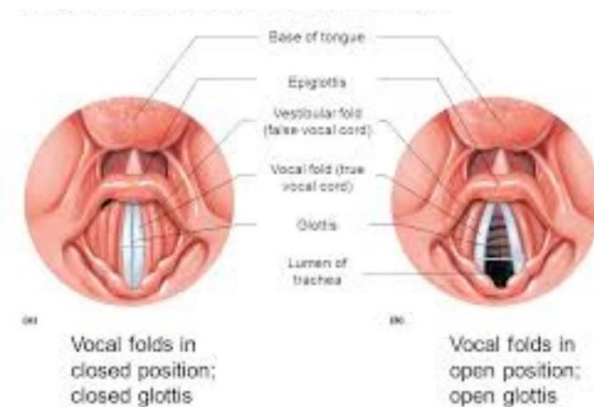
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# Speech Production

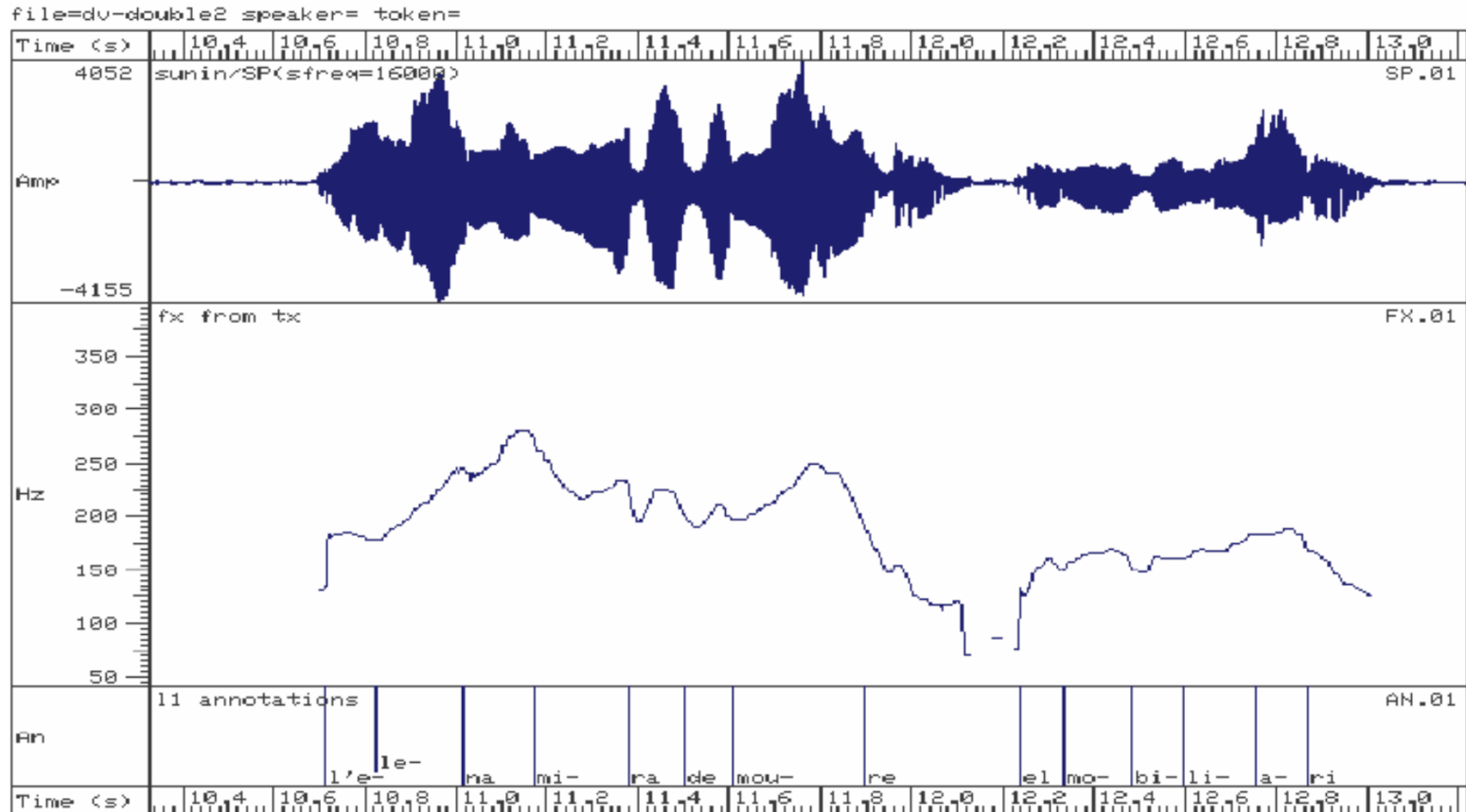
# Speech Production



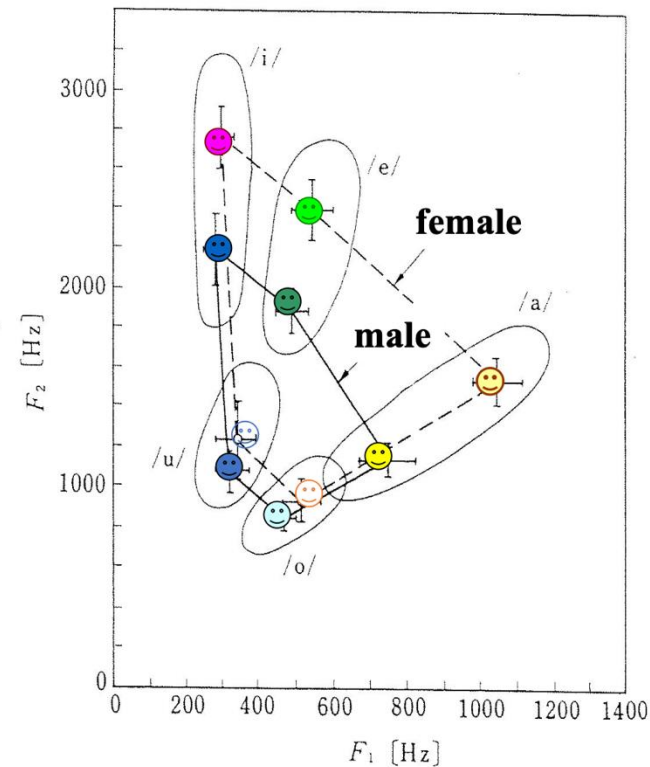
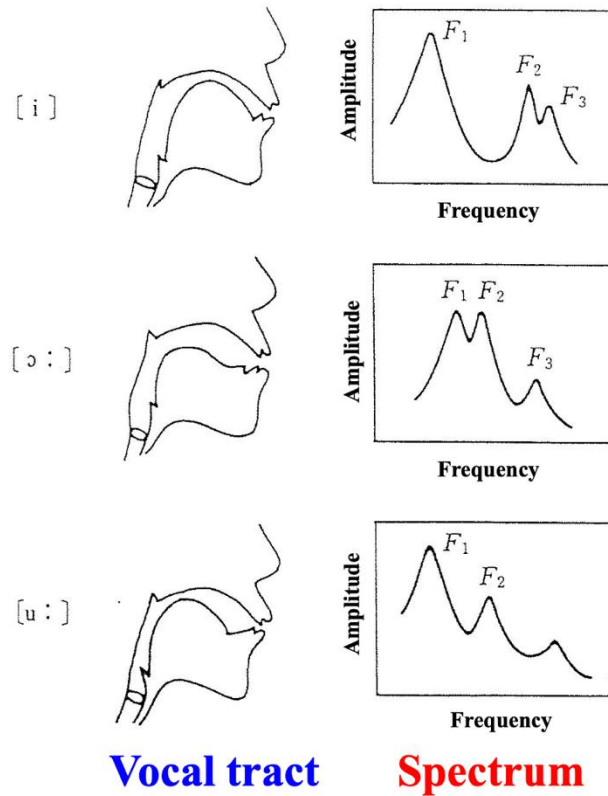
- Vocal tract length
  - Male 17.5 cm
  - Female 15.2 cm
  - Child 12.2 cm



# Speech Waveform



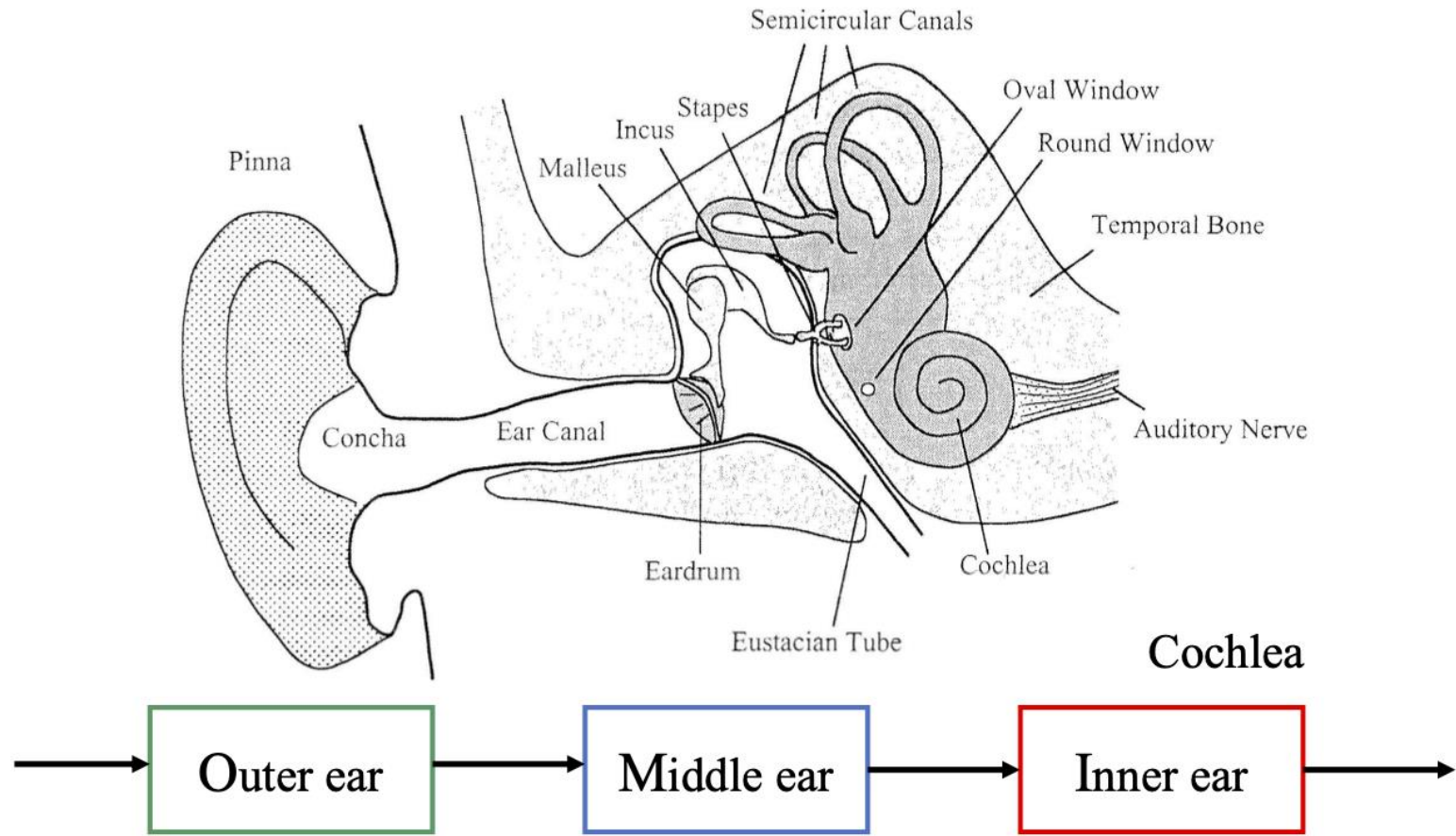
# Speech Waveform



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# Speech Perception

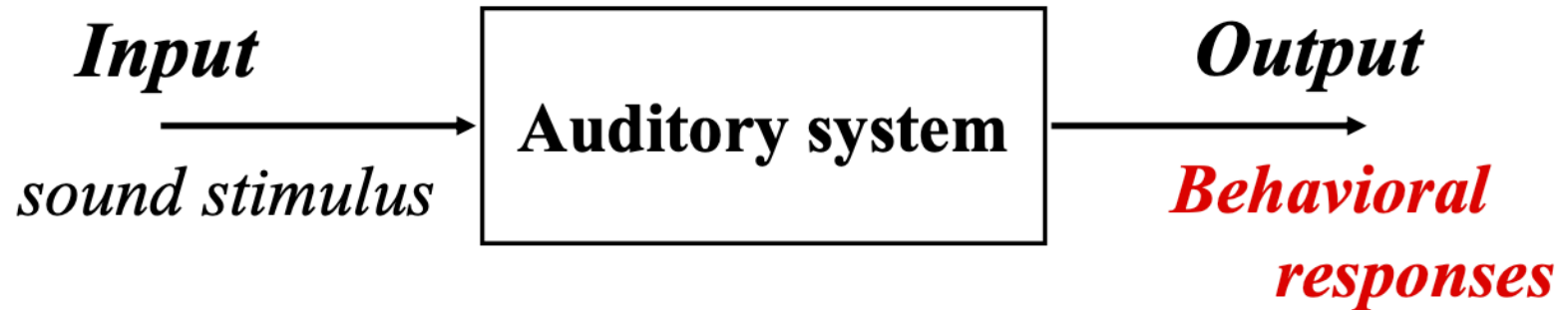
# Auditory Perception



# Auditory Sensation

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- ***Sensations*** evoked by sound



- ***Three main factors:***
  - ***“Loudness”*** related to ***“Intensity”***
  - ***“Pitch”*** related to ***“Periodicity”*** or ***“Harmonicity”***
  - ***“Timbre”*** related to ***Many physical factors...***



# Homework 1

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- 1) What is speech production?
- 2) What is speech perception?
- 3) What is the relationship between (1) and (2)?