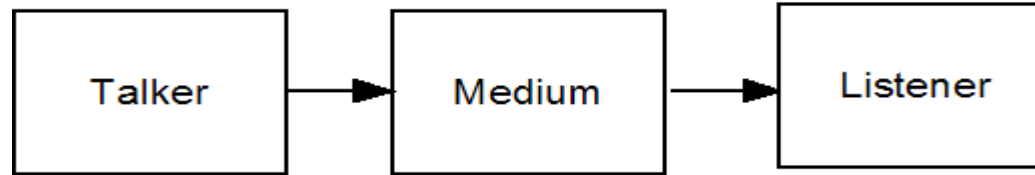


Speech Production and Perception

The slide features a white background with the title 'Speech Production and Perception' in a blue sans-serif font. On the right side, there is a large, abstract blue shape that resembles a stylized profile of a human head or a speech bubble. At the bottom of the slide, there are two horizontal blue decorative elements: a solid blue bar on the left and a blue bar with a white wavy pattern on the right.

Elements of Speech Communication

Human:



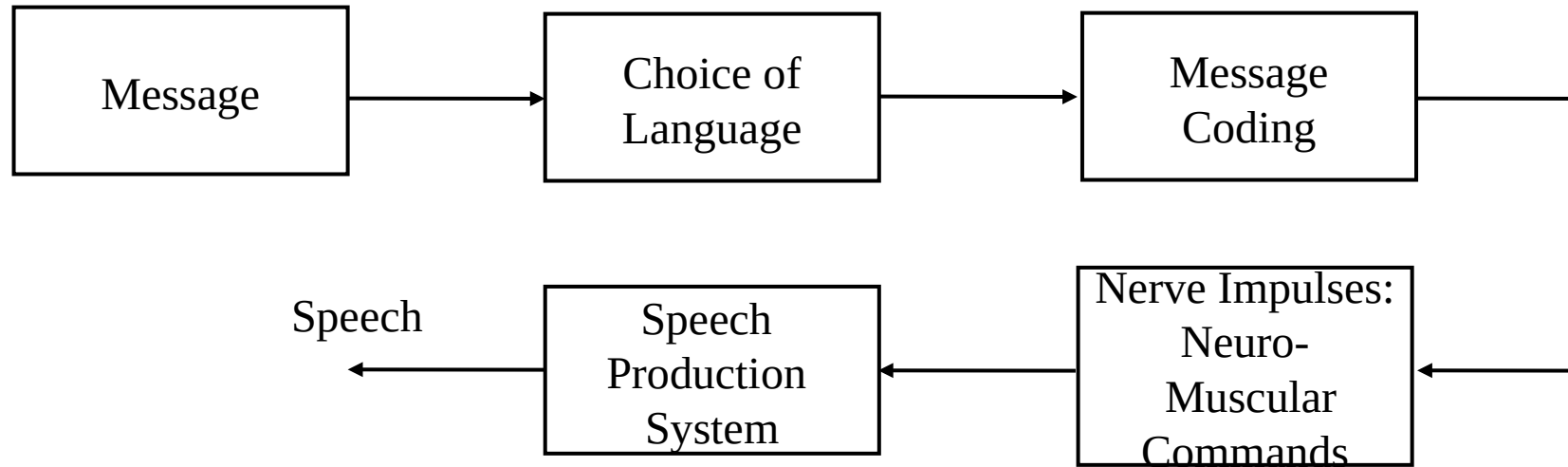
Electrical:



- **Talker:** Message formulation and conveying via speech mode.
- **Listener:** Reception of speech and message comprehension.
- **Medium:** Physical medium which carries speech from talker to listener.

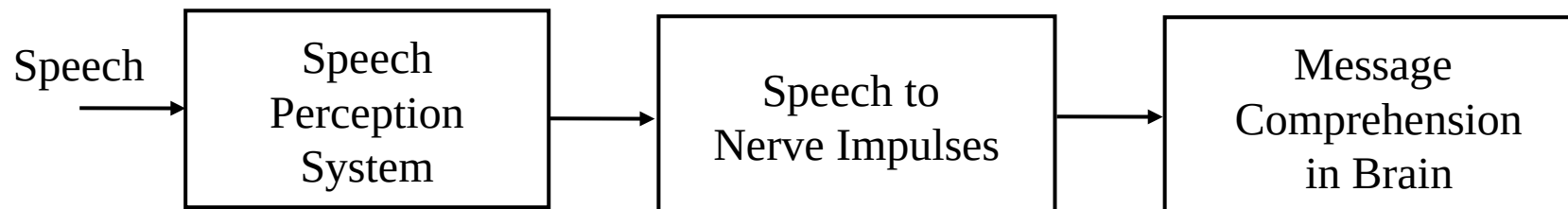
Speech Chain: Steps in Human Speech Communication

Talker:



Message->Language Coding->Nerve Impulses-> Mechanical Motion-> Acoustic Pressure Variations

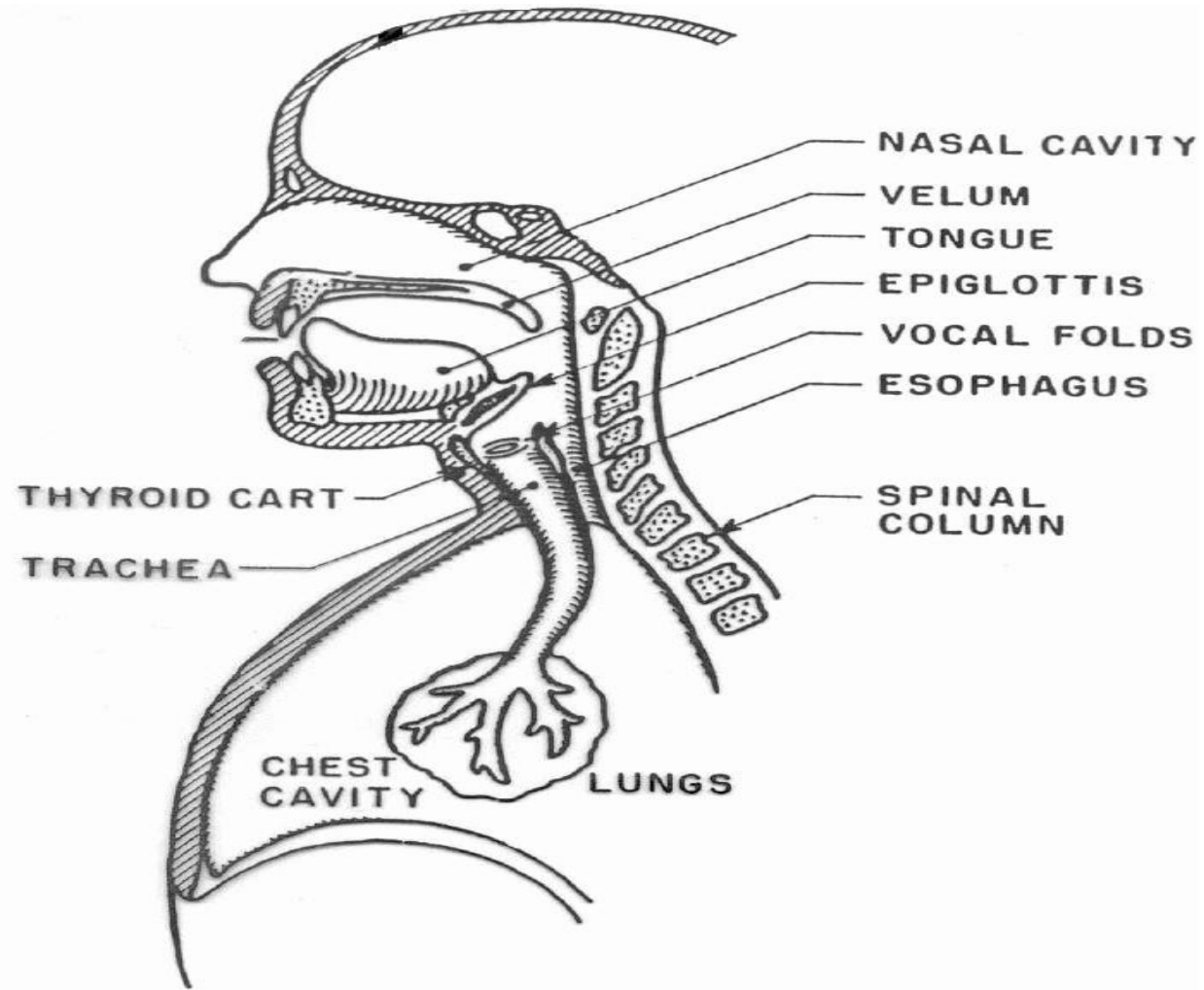
Listener:



Acoustic Pressure Variations->Mechanical Motion->Nerve Impulses->Language Decoding->Message

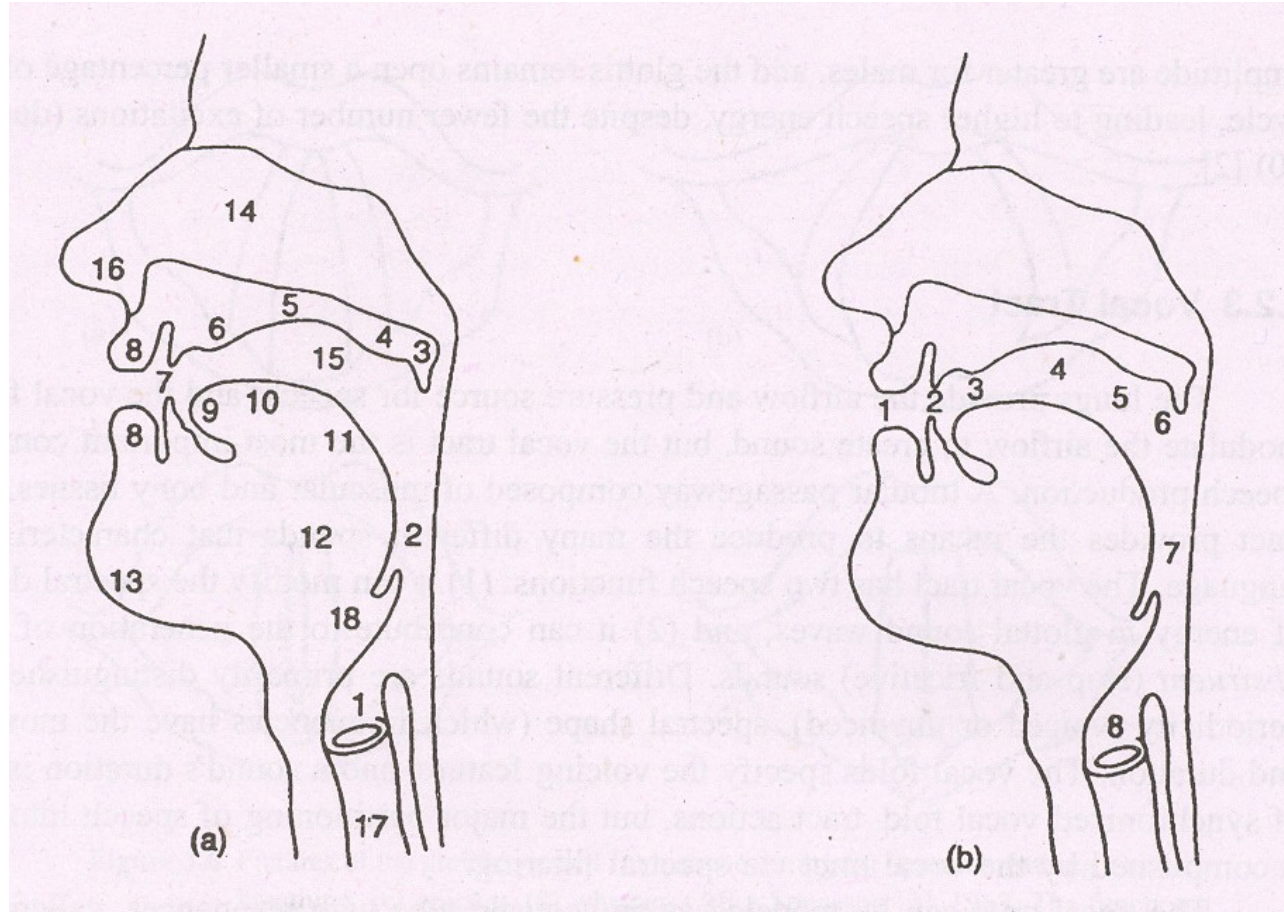
- **Dual role of a person as talker/listener**

Speech Production System



Vocal Tract

1. Vocal folds
2. Pharynx
3. Velum
4. Soft palate
5. Hard palate
6. Alveolar ridge
7. Teeth
8. Lips
9. Tongue tip
10. Blade
11. Dorsum
12. Root
13. Mandible (jaw)
14. Nasal cavity
15. Oral cavity
16. Nostrils
17. Trachea
18. epiglottis



Places of articulation

1. Labial
2. Dental
3. Alveolar
4. Palatal
5. Velar
6. Uvular
7. Pharyngeal
8. glottal

Speech Production Mechanism

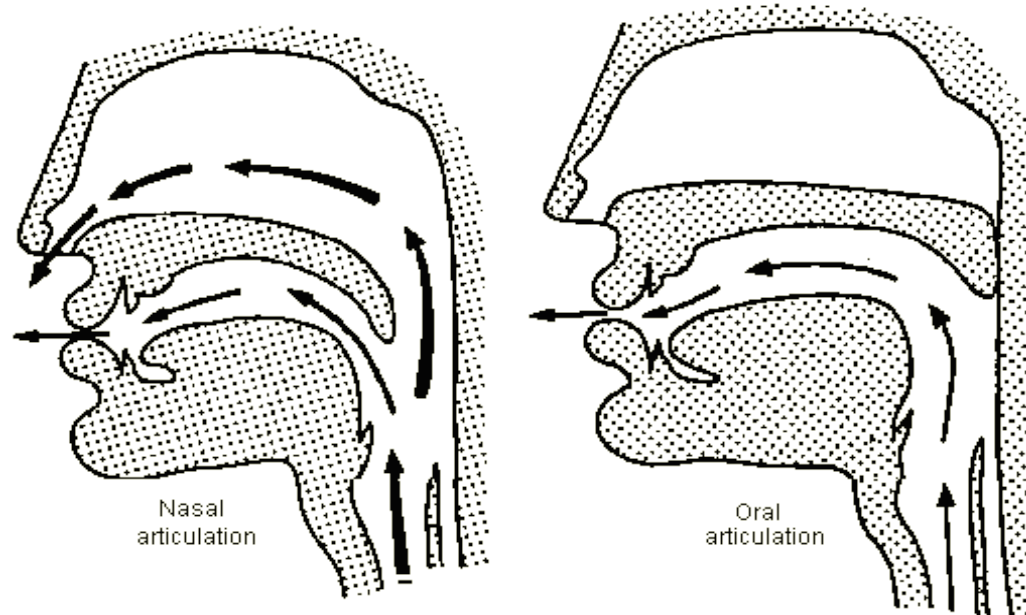
- Speech is produced during exhalation of air
- Lungs & associated structure provides required energy
- Vocal-folds inside larynx is the main excitation source and constriction (total or partial) along vocal tract is an additional source
- Supra-glottal system which includes pharynx, oral cavity and nasal cavity behave as time-varying resonator

Excitation Sources

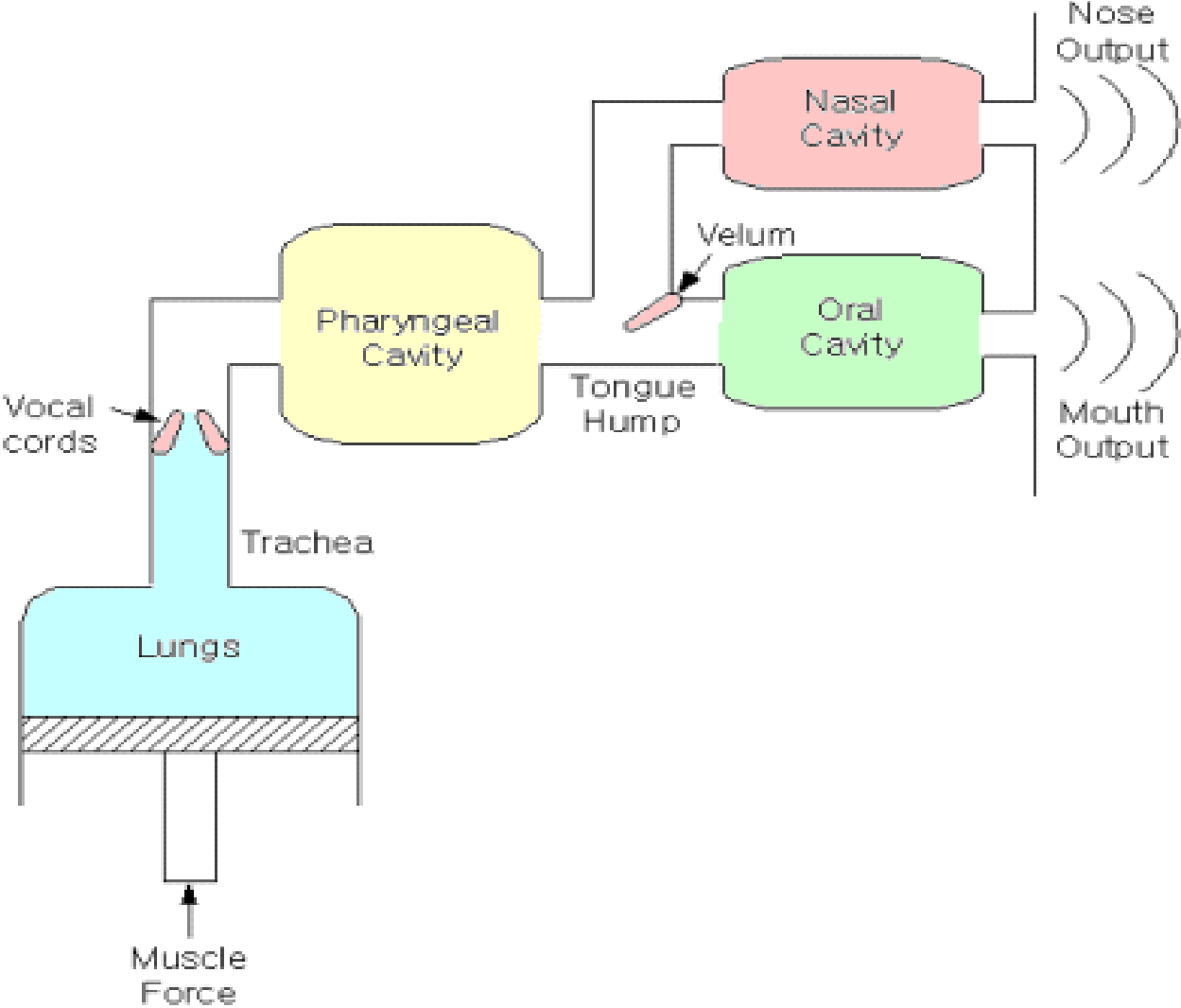
- **Voiced Excitation**
 - ✓ Vibration of vocal folds
 - ✓ Voiced speech
- **Unvoiced Excitation**
 - ✓ Total constriction along the vocal tract
 - ✓ Partial constriction along the vocal tract
 - ✓ Unvoiced speech
- **Mixed Excitation**
 - ✓ Combination of above
 - ✓ Mixed speech

Production of Speech Sounds

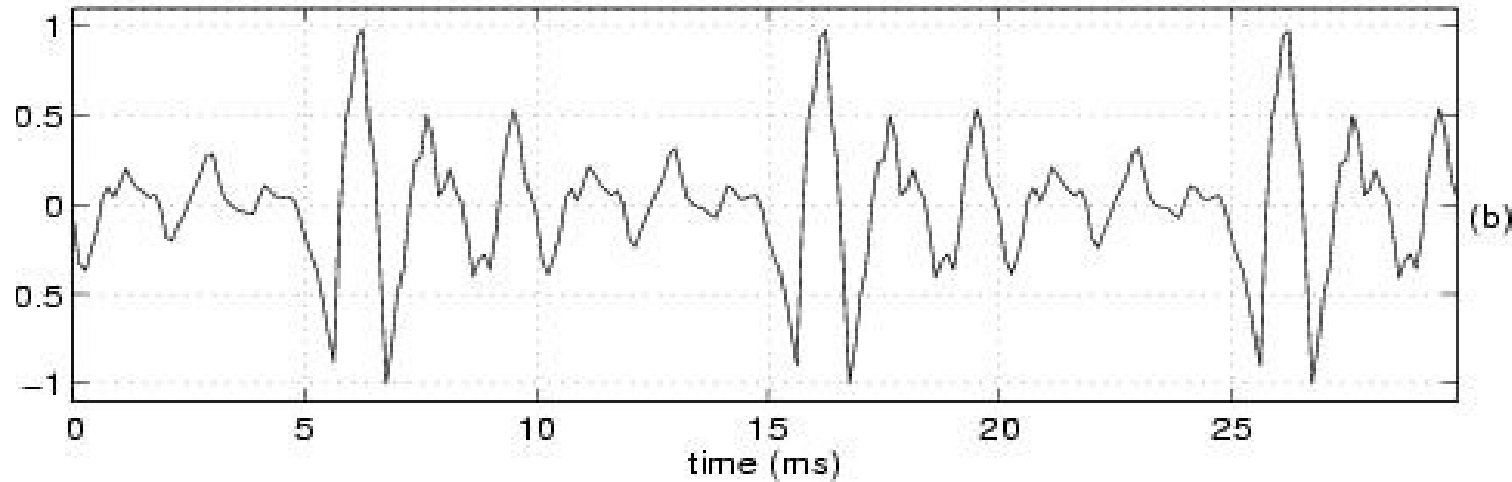
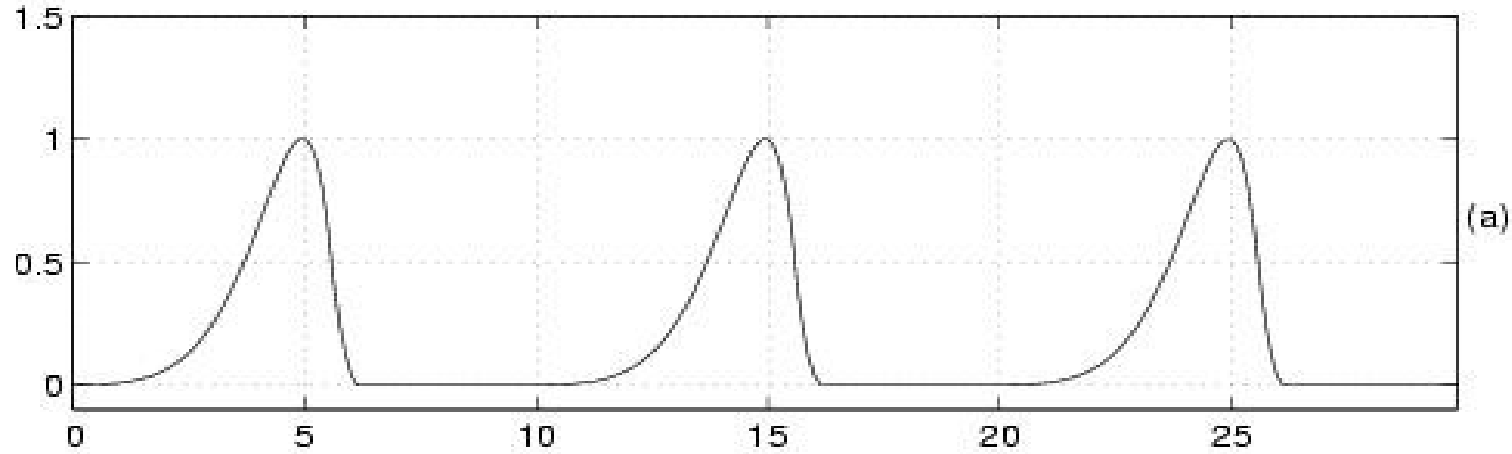
- Vowels - Oral cavity is wide opened, tongue hump, glottal vibration
- Unvoiced Consonants - constriction (Complete closure)
- Voiced Consonants - constriction & glottal vibration
- Nasal Sounds - nasal cavity is coupled
- Fricatives - Partial closure, Narrow opening



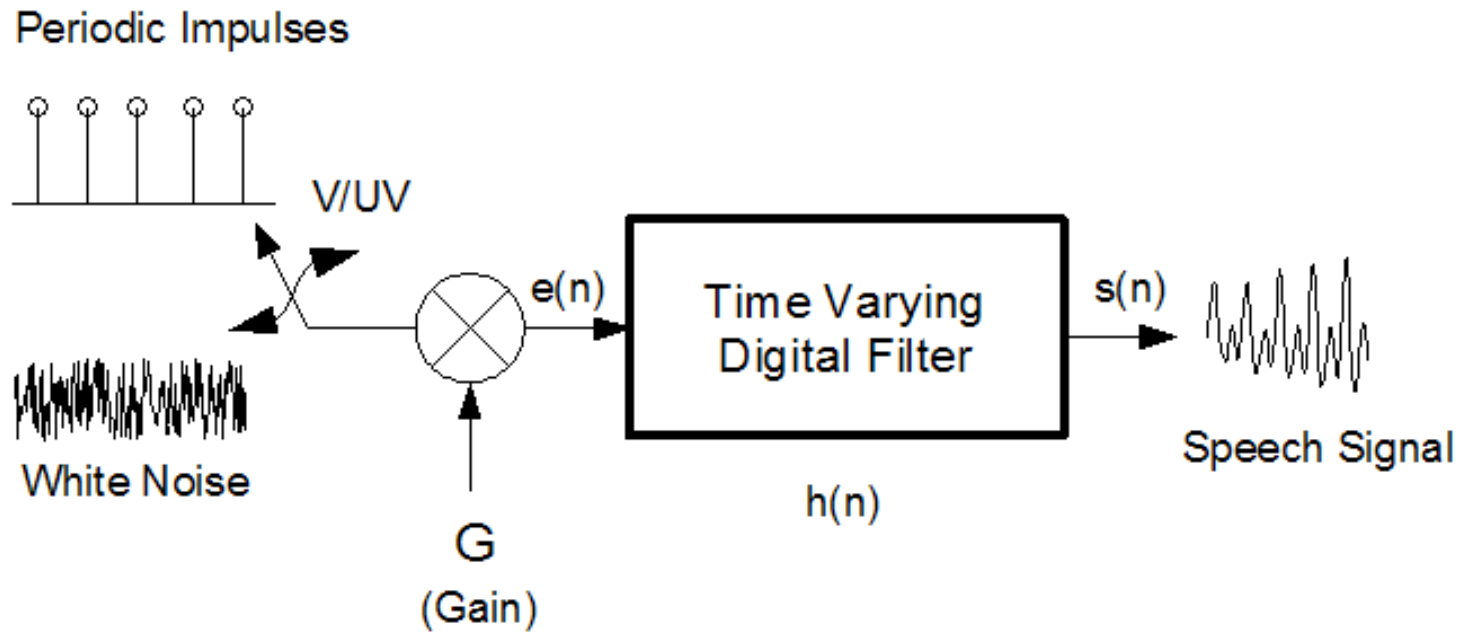
Schematic Representation of Speech Production Process



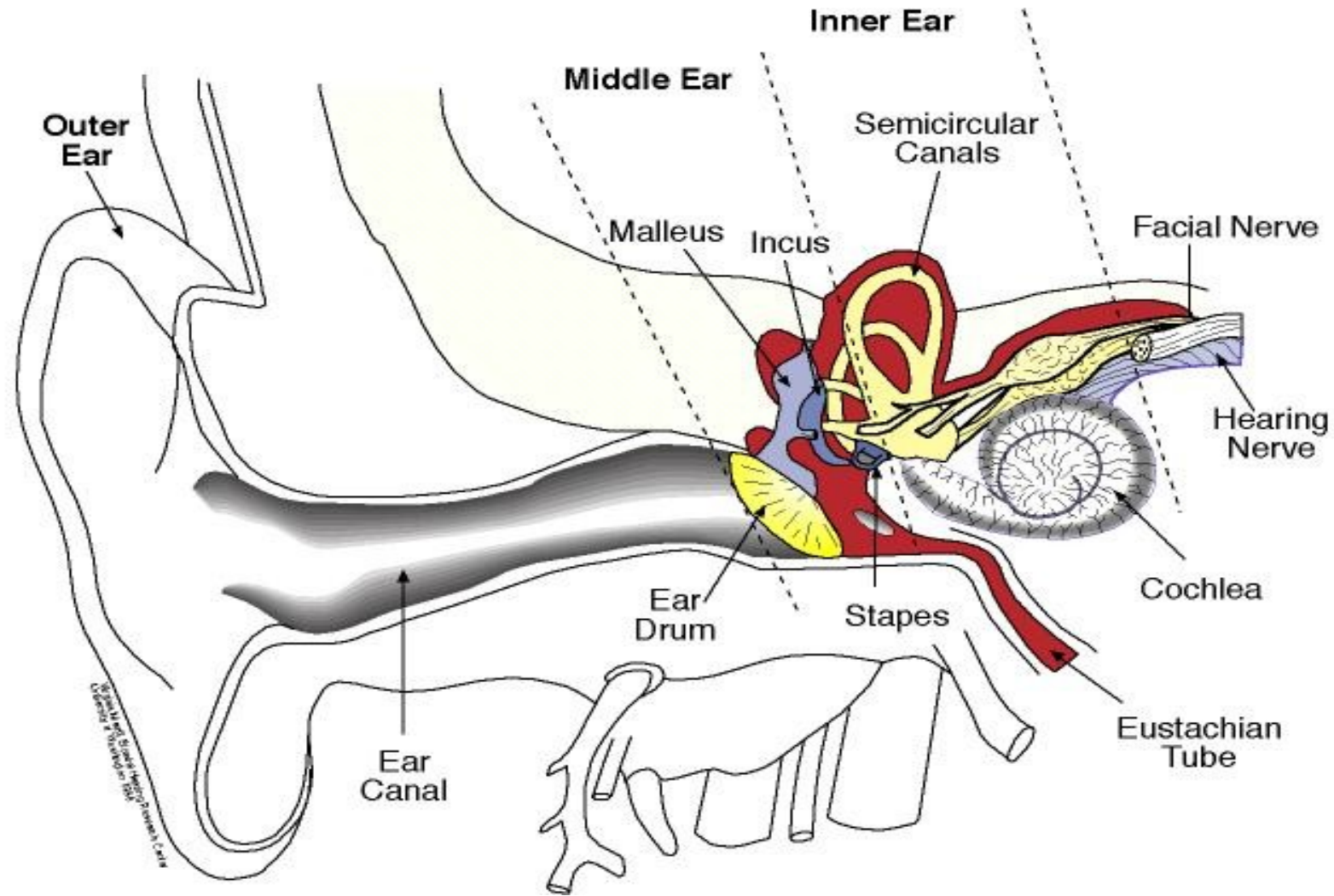
Glottal Volume Velocity and its Speech Signal



Digital Model for Speech Production



Speech Perception System



Speech Perception Mechanism

- Mainly three regions - outer ear, middle ear & inner ear
- Outer ear - directs speech pressure variations towards the middle ear
- Middle ear - transforms pressure variations into mechanical motion
- Inner ear - converts mechanical vibrations into electrical firings in the auditory neurons, which leads to brain
- Language decoding and message understanding at the higher centers of learning which is less understood

Steps in Speech Reception and Message Comprehension

- Acoustic pressure variations funnelled into middle ear by outer ear.
- Eardrum converts acoustic pressure variations to mechanical vibrations.
- Mechanical vibrations are transferred to inner ear by middle ear bones.
- Standing wave patterns are generated in inner ear liquid.
- Standing waves are converted into neural firings on auditory nerve.
- Neural firings are decoded and message comprehension is done in brain.

Digital Model for Speech Perception

