Course Title: Auditory system

Course Description:
This course is designed to introduce auditory system and related research to PhD students with topics on medicine. The course covers four topics of; 1) Fundamental physics of sound, 2) Mechanism of hearing perception, 3) Hearing loss and surgical reconstruction, and 4) Research on hearing science.

All the students registered course are expected to 1) read the course materials before the starting date of the course (A pretest will be made at the beginning of the course) and 2) submit post-class report.

Grading:
Type: Fail or Pass (Attendance Mandatory)
Class participation: 40%
Pretest (at the beginning of course): 30%
Post-class report: 30%
Total credit point: 1 ECTS

Course details:
- **Date/time:** 01.02.2018 ~02.02.2018 (2 days, 8 hours per day 08:00 -12:00, 13:00 -17:00)
- **Room:** Nord2 (Frauenklikstrasse 24) Room B 834, University Hospital Zurich
- **Minimum/Maximum participants:** 5/15
- **Type:** Lecture, presentation and participation to laboratory work
- **Pre-class preparation:** Reading course material (will be provided two week before the course start; work for 2-3 hours). Pretest on the first day of the course.
- **Post-class report:** Answer to question sheet, Process and plot of provided measurement data (due 1 weeks after the class; work for 2-3 hours)
- **Coordination:** Dr. Wolfgang Knecht (ZNZ), Dr. Jae Hoon Sim (USZ).
- **Lecturers**
  - Prof. Dr. med Alexander M. Huber
  - PD Dr. med Christof Röösli
  - Dr. med Adrian Dalbert
  - PD Dr. Jae Hoon Sim
  - Dr. Flurin Pfiffner
  - Dr. Ivo Dobrev
Course contents:

1st day

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>08h00</td>
<td>Introduction and pre-class test</td>
</tr>
<tr>
<td>09h00</td>
<td>Physics of sound part 1</td>
</tr>
<tr>
<td>10h00</td>
<td>Physics of sound part 2</td>
</tr>
<tr>
<td>11h00</td>
<td>Physiology and mechanics of hearing: Middle ear</td>
</tr>
<tr>
<td>12h00</td>
<td>Lunch break</td>
</tr>
<tr>
<td>13h00</td>
<td>Physiology and mechanics of hearing: Inner ear</td>
</tr>
<tr>
<td>14h00</td>
<td>Physiology and mechanics of hearing: Bone conduction hearing</td>
</tr>
<tr>
<td>15h00</td>
<td>Physiology and mechanics of hearing: Auditory cortex process</td>
</tr>
<tr>
<td>16h00</td>
<td>Physiology and mechanics of hearing: Protection mechanism of the human middle ear</td>
</tr>
<tr>
<td>17h00</td>
<td>End of 1st day class</td>
</tr>
</tbody>
</table>

2nd day

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>08h00</td>
<td>Conductive and sensorineural hearing loss, Diagnosis of hearing loss</td>
</tr>
<tr>
<td>09h00</td>
<td>Aural rehabilitation</td>
</tr>
<tr>
<td>10h00</td>
<td>Research in hearing science: Middle-ear mechanics</td>
</tr>
<tr>
<td>11h00</td>
<td>Research in hearing science: Inner-ear mechanics</td>
</tr>
<tr>
<td>12h00</td>
<td>Lunch break</td>
</tr>
<tr>
<td>13h00</td>
<td>Research in hearing science: Assessment of surgical reconstruction</td>
</tr>
<tr>
<td>14h00</td>
<td>Practical course: Part1- Participation to diagnosis of hearing loss Audiometric hearing threshold test &amp; Tympanometry</td>
</tr>
<tr>
<td>15h15</td>
<td>Practical course: Part2- Participation to experimental assessment of middle ear surgery Measurement &amp; calculation of middle-ear ossicular motion and middle-ear transfer function</td>
</tr>
<tr>
<td>16h30</td>
<td>Wrap up class</td>
</tr>
<tr>
<td>17h00</td>
<td>End of class</td>
</tr>
</tbody>
</table>
Course contents:

1) Physics of sound
   - Longitudinal & transverse wave
   - Wave length, period, wave speed
   - Resonance
   - Harmonics
   - Sound in frequency domain with Fourier transform
   - Loudness, pitch, and timbre of sound
   - Binaural hearing and sound localization

2) Physiology and mechanics of hearing
   - Anatomy of ear
   - Air conduction (AC) hearing
     - Role of outer and middle ears in hearing perception
     - Frequency analysis in the cochlea: Macro and micro mechanism of cochlea
   - Bone conduction (BC) hearing
     - Contribution of BC to hearing
     - BC pathways
   - Auditory cortex process
   - Protection function of human middle ear

3) Hearing loss and aural rehabilitation
   - Conductive vs. sensorineural hearing loss
   - Diagnosis of hearing loss
     - Hearing threshold and air-bone gap (ABG)
     - Tympanometry
     - Distortion product of oto-acoustic emission (DPOAE)
   - Surgical reconstruction
     - Ossicular replacement surgery
     - Otosclerosis and stapes surgery
     - Cochlear implant
     - Bone conduction hearing aids (BCHA)

4) Research on hearing science
   - Research on middle-ear mechanics
     - Measurements of middle-ear transfer function, 3D ossicular chain
     - Middle-ear model: Multi-body system (MBS) and finite element model (FEM)
   - Research on middle-ear mechanics
     - Measurement of intracochlear pressure, cochlear impedance
     - Passive & active models of cochlea
   - Assessment of surgical reconstruction
     - Assessment in cadaveric preparation
     - Intraoperative measurement
Place for class

Room B834 (B floor) in Nord2, University Hospital Zurich (UniversitätsSpital Zürich)

Address: Frauenklinikstrasse 24, CH-8091 Zürich