<table>
<thead>
<tr>
<th>주</th>
<th>일</th>
<th>수업내용</th>
<th>Chapter</th>
<th>비고</th>
</tr>
</thead>
<tbody>
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<td>3</td>
<td>9/17</td>
<td>Bacterial diversity: Gram-positives</td>
<td>23-24</td>
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</tr>
<tr>
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<td>9/24</td>
<td>Eukaryal &amp; viral diversity</td>
<td>25-27</td>
<td></td>
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<td>10/1</td>
<td>Microbial interactions</td>
<td>32</td>
<td>1차시험</td>
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<tr>
<td>6</td>
<td>10/8</td>
<td>Microbial pathogenesis</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>10/15</td>
<td>Microbial diseases I</td>
<td>36-37</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>10/22</td>
<td>Mid-term</td>
<td></td>
<td>Study break</td>
</tr>
<tr>
<td>9</td>
<td>10/29</td>
<td>Microbial diseases II</td>
<td>38-40</td>
<td></td>
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<tr>
<td>10</td>
<td>11/5</td>
<td>Microbial immunology I</td>
<td>33-34</td>
<td>2차시험</td>
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<td>11/12</td>
<td>Microbial immunology II</td>
<td>33-34</td>
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<td>12</td>
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<td>33-34,36</td>
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<td>11/26</td>
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<td>9</td>
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<td>9</td>
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</tr>
<tr>
<td>16</td>
<td>12/17</td>
<td>Final exam</td>
<td></td>
<td>3차시험</td>
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</tbody>
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시험 및 평가 방법, 주의사항
모든 성적은 채점 후 공개.
시험점수 반영 비율: 1차시험 (20%), 2차시험 (30%, 영어), 3차시험 (50%).

질문점수: 빠른 정답 (1점). 늦은 정답 (0.5점). 오답 및 무답 (0점) (총 10점).
한줄요약(제안 및 질문 포함 가능): 성의 있는 제출 (1점). 성의 없는 제출 (0.2점). 미제출 (0점). (총 10점).
출결점수: 0~10분(지각), >10분(결석). 지각 n=1, 결석 n=3 / 10점, 3<n≤9 (10-n)점, n>9 0점. (총 10점)

질의응답 및 의견교환
모든 질의 및 응답, 의견교환은 홈페이지(또는 이메일)을 통해 이루어지는 것을 원칙으로함.
비공개로 질의를 하고자 하는 경우, 이메일, 문자, 카카오톡을 이용함.

교재 및 참고자료 (미생물학 I 과 동일)
2. 약품미생물학. 2011. 미생물면역학분과회. ㈜라이프사이언스
3. 최신면역학. 2011. 미생물면역학분과회. ㈜라이프사이언스
MICROBIOLOGY II

Course  Microbiology II  Attribute  Required
Credits  3 cr.  Participants  3-year students
Instructor  You-Hee Cho  E-mail  youhee@cha.ac.kr

OBJECTIVES AND DESCRIPTION
The general objective of this course is to provide the second part of the two-semester overview of classical and modern microbiology, focusing on the diversity of microorganisms, which would be the basis of the environmental and, more importantly, pathogenic microbiology: For this, I will accentuate the diversity and classification of various microorganisms featuring pathogenic bacteria and viruses and cover the microbial immunology and clinical microbiology as well.

Thus the primary goal of this course is for students to obtain a broad appreciation for the unique problems and opportunities presented by these various life forms; how human health and physiology have been being affected by microorganisms, by understanding the diversity and characteristics of microorganisms and their interactions with natural as well as human environments.

TEACHING METHOD
Lecture, 100%

GRADING POLICIES
Attendance will be taken even on the first few days, since we would like to correct and finalize the seating scheme and the lecture summary roster (see below). I am trying to recognize your names and faces though. You are strongly encouraged to attend every lecture, since almost all of the materials for exams will be derived from lectures and not taken directly from the texts or from the handouts. Your attendance is incorporated directly to the final score (see below). I have my own FA (failure absence) policy which will be strictly obeyed. More importantly, good attendance usually translates into better understanding of the material and subsequently a better grade. Prescott’s Microbiology is the excellent text, but is meant as a supplement to lectures. All materials presented in this class will be available on the course website (or via e-mail).
We will have three examinations with the following weights on the final score: 1st exam, 20%; 2nd exam, 30%; 3rd (final) exam, 50% (100 points). Additional points (50 pts) will be incorporated to the final score based on the quiz at the beginning of the lecture (10 pts), the brief (so called “one-line”) summary at the end of the lecture (10 pts), the attendance (10 pts), and the attitude (20 pts) that encompasses the grade for the lecture summary.

**MAJOR TEXT**

**SUPPLEMENTARY READING MATERIALS**
최신면역학. 2011. 미생물면역학분과회. ㈜라이프사이언스

<table>
<thead>
<tr>
<th>Wk</th>
<th>Contents</th>
<th>Relevant Chapter</th>
<th>Features</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Microbial systematics and Archaea</td>
<td>Chapters 19-20</td>
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<td>2</td>
<td>Bacterial diversity I: Gram-negatives</td>
<td>Chapter 21-22</td>
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COURSE WEB SITE AND COURSE MATERIALS
The official course website has been opened (http://www.chamc.co.kr/professor/virulence/). At the website, you will find a complete copy of this syllabus, course materials (in PDF format), plus other valuable and presumably interesting materials including microbiology-related web sites and useful articles. Please take some time to check all of those materials. If you have trouble downloading or accessing the materials at both websites, please do not hesitate to ask me at youhee@cha.ac.kr.

LECTURE SUMMARY
You should submit the lecture summary according to the roster that will have been finalized and posted very soon, once the class begins. The summary should be posted within 36 h after the lecture (the 36-h policy), or you will lose the point. You should do that only once during the semester. As well, I strongly suggest group-study or group-discussion to grasp the huge amount of what we have to learn during this course and collaborate to understand what they are.
Antibacterials: cell wall synthesis inhibitors

B1. Beta-lactams (PBP)
B1.1. Penicillins: Amoxicillin, Methicillin, Ampicillin, Carbenicillin
B1.2. Cephalosprins: Cephapicycin, Cephalotin / Cefotaxime / Ceftriaxone, Latamoxef / Cefepime
B1.3. Carbapenems: Imipenem, Meropenem
B1.4. Monobactams: Aztreonam
B1.5. Bla inhibitors: Clavulamic acid (cf. AUGMENTIN: Clavulamic acid + amoxicillin)

B2. Other cell wall synthesis inhibitors
B2.1. Peptide antibiotics (Bactoprenol-PP): Bacitracin
B2.2. Glycopeptide antibiotics (D-Ala-D-Ala): Vancomycin, Teicoplanin
B2.3. Fosfomycin (PEP Tase)
B2.4. D-cycloserine (D-Ala)

Antibacterials: protein synthesis inhibitors

B3. 30S ribosomes
B3.1. Aminoglycosides (initiation): Streptomycin, Kanamycin, Amikacin, Tobramycin, Gentamicin
B3.2. Tetracyclines (tRNA binding): Tetracycline, Minocycline cf. Glycylcyclines (Tigecycline)

B4. 50S ribosomes
B4.1. Oxyzolidinones (initiation): Linezolid, Torezolid
B4.2. Amphenicols (peptidyl transferase): Chloramphenicol
B4.3. Macrolides (transpeptidation/translocation): Erythromycin, Azithromycin, Clarithromycin, Spiramycin
B4.4. Lincosamides (transpeptidation/translocation): Clindamycin
B4.5. tRNA analogues (tRNA binding): Puromycin

B5. Other protein synthesis inhibitors
B5.1. Steroids (EF-G): Fusidic acid
B5.2. Polyketides (IleRS): Mupirocin (pseudomonic acids)

cf. Polyketides: synthesized via decarboxylative condensation of malonyl-CoA (similar to FA biosynthesis)
- Macrolides (Antibiotics, FK506-Tacrolimus) / Polenes / Tetracyclines / Acetogenins etc

Antibacterials: Gyrase inhibitors and anti-folates

B6.1. Quinolones (GyrA): Nalidixic acid / Ciprofloxacin, Ofloxacin / Levofloxacin / Moxifloxacin
B6.2. Aminocoumarins (GyrB): Novobiocin, Coumermycin

B7.1 Sulfonamides (PABA analogues. DHPS inhibitor): Sulfanilamide, Sulfamethoxazole, Sulfadoxine, Mafenide
B7.2. Trimethoprim (pteridine analogue. DHPS inhibitor). cf. Pyrimethamine
- cf. Cotrimoxazole: trimethoprim + sulfamethoxazole
B7.3. Dapsone (antileprotic: DHPS inhibitor)

Other antibacterials

B8. Ansamycins (RNAP): Geldanamycin, Rifamycins, Rifampicin
B11. Antituberculotics: Isoniazid (niacin analogue. desaturase inhibitor), Ethambutol (EMB. arabinogalactan synthesis inhibitor)
B12. Other antibacterials also used as antiprotozoals: Salvarsan, Metronidazole
**Antifungals**
F1. Polyene antibiotics (ergosterol binding): **Amphotericin B, Nystatin**
F2. Azaoles (ergosterol synthesis inhibition): **Ketoconazole, Fluconazole, Itraconazole, Voriconazole**
F3. Allylamines (lanosterol synthesis inhibition): **Terbinafine, Butenafine**
F4. Echinocandins (1,3-β-D-glucan synthesis inhibition): **Caspofungin**
F5. Others: **Griseofulvin** (tubulin binding), **Flucytosine** (DNA/RNA inhibition), **Ciclopirox** (DNA repair?)

**Antiprotazoas/Antimalarials**
M1. 4-quinoline methanols (DNA intercalation): **Quinine**
M2. 4-aminoquinolines (DNA intercalation/hemozoin inhibitor): **Chlorquine, Hydroxychloroquine**
M3. 8-aminoquinolines (DNA intercalation): **Primaquine, Mefloquine**
M4. Other antimalariais: **Pyrimethamine, Proguanil (DHFR inhibition) / Artemisinin (ROS generation?)**
   cf. **FANSIDAR** (Sulfadoxine/pyrimethamine), **FANSIMEF** (Fansidar/mefloquine), **MALARONE** (Atovaquone/Proguanil)

**Antivirals**
V1. Flu therapeutics
V1.1. Symmetric tricyclic amines (uncoating inhibition): **Amantadine**
V1.2. Substrate analogues (neuraminidase inhibition): **Zanamivir, Oseltamivir**

V2. Herpes therapeutics
V2.1. Uridine derivatives (thymidylate kinase inhibition): **Iodoxuridine** (IUdR)
V2.2. Arabinose derivatives (DNA polymerase inhibition): **Vidarabine** (Ara-A), cf. **Cytarabine** (Ara-C)
V2.3. Acyclic guanosine derivatives (DNAP inhibition): **Aciclovir** (Valaciclovir)
V2.4. Acyclic cytidine derivatives (DNAP inhibition): **Cidofovir**
V2.5. Others: **Foscarnet** (a PPI analogue) / **Docosanol** (Behenyl alcohol)

V3. Hepatitis B therapeutics
V3.1. Cytidine analogues (RT inhibition): **Lamivudine**
V3.2. Purine analogues (RT inhibition): **Entecavir, Tenofovir**

V4. General antviral therapeutics (nucleoside analogues): **Ribavirin** (Taribavirin)

V5. AIDS therapeutics
V5.1. NRTI: **Zidovudine** (AZT), **Dideoxyinosine** (ddI), **Zalcitabine** (ddC), **Lamivudine, Emtricitabine, Tenofovir, Abacavir, Amdoxovir**
V5.2. NNRTI: **Epavirenz, Rilpivirine**, Nevirapine, Delavirdine
V5.3. Protease inhibitors (PI): **Saquinavir, Ritonavir**, Indinavir
V5.4. Integrase inhibitors: **Raltegravir, Elvitegravir**
V5.6. Fusion inhibitors (entry): **Enfuvirtide**

**Antitumor agents**
T1. Anthracyclines (DNA intercalation): **Daunorubicin** (Daunomycin), **Idarubicin, Doxorubicin** (Adriamycin), **Epirubicin**
T2. Actinomycins (DNA intercalation): **Actinomycin D** (Dactinomycin)
T3. Other antitumors: **Mitomycin C** (DNA synthesis) / **Bleomycin** (glycopeptides)
Domain Bacteria
B1. Proteobacteria (= purple bacteria): many!
B2. Nitrospirae: *Nitrospira*
B3. Cyanobacteria
- unicellular: *Synechococcus, Synechocystis, Gleobacter, Prochloron*
- filamentous: *Oscillatoria, Anabaena, Nostoc*
B4. Firmicutes: low GC gram-positives
- *Mollicutes*: *Mycoplasma, Spiroplasma, Ureaplasma*
- LAB: *Streptococcus, Enterococcus, Lactococcus, Lactobacillus, Pediococcus, Leuconostoc, Weissella*
- Bacilli: *Staphylococcus, Listeria, Bacillus, Paenibacillus, Sporosarcina*
- Clostridia: *Clostridium, Helio bacterium, Veillonella*
B5. Actinobacteria: high GC gram-positives
- Bifidobacterium
- *Corynebacterium, Arthrobacter, Propionibacterium, Norcadia, Rhodococcus*
- *Actinomycyes, M ycobacterium, Frankia, Micrococcus, Streptomyces*
B6. Chlamydia/Verrucomicrobia group: *Chlamydia*
B7. Planctomyces/Pirellula group: *Planctomyces, Pirellula*
B8. Bacteroidetes: CFP group
- Cytophagia: *Cytophaga, Spirocytophaga, Flexibacter*
- Flavobacteria: *Flavobacterium*
- Bacteroides: *Porphyromonas, Prevotella*
- Sphingobacteria: *Sphingobacterium*
B9. Deferribacteres: *Deferribacter*
B10. Chlorobi (= Green sulfur bacteria): *Chlorobium*
B11. Spirochetes (Spirilla): *Spirocheta, Treponema, Leptospira, Borrelia*
B12. Deinococcus-Thermus: *Deinococcus, Thermus*
B13. Chloroflexi (= Green nonsulfur bacteria): *Chlroflexus, Thermomicrobium*
B14. Deeply branching group: *Thermotoga, Thermodesulfobacterium, Aquifex*

Domain Eukarya: Eukaryotic microorganisms
E0. Urkaryotes: Diplomonads (*Giardia*), Microsporidia (*Encephalitozoon*), Trichomonads (*Trichomonas, Dientamoeba*)
E1. Subkingdom protozoa: lots of pathogenic parasites
E1.1. Mastigophora: *Leshimania, Trypanosoma*
E1.2. Sarcodina: *Amoeba, Entamoeba*
E1.3. Ciliophora (=Ciliaphora): *Paramecium, Balantidium, Ichthyophthirius*
E1.4. Apicomplexa (=Sporozo) : *Plasmodium, Eimeria, Theilaria, Toxoplasma, Cryptosporidium*
E2. Kingdom fungi
E2.0. Oomycota: *Allomyces*
E2.1. Chytridiomycota
E2.2. Zygomycota: *Rhizopus*
E2.3. Gleomerymocota
E2.4. Ascomycota: *Saccharomyces, Schizosaccharomyces, Neurospora, Claviceps, Hansenula, Monascus*
E2.5. Basidiomycota: *Amanita, Agaricus, Pleurotus,*
E2.x. Deuteromycota: *Aspergillus, Penicillium, Candida, Blastomyces, Histoplasma, Trichophyton, Epidermophyton, Stachybotrys /Cryptococcus*
E3. Subkingdom slime molds
E3.1. Myxomycota (Myxogastria = a cellular slime molds): *Physarum*
E3.2. Acraziomycota (Dictyostelium = cellular slime molds): *Dictyostellium*
E4. Subkingdom algae
E4.1. Euglenophyta (= Euglenozoa): *Euglena*
E4.2. Dinoflagellata: *Cochlodinium, Gonyaulax*
E4.3. Chrysophyta
E4.4. Phaeophyta
E4.5. Rhodophyta
E4.6. Chlorophyta: *Chlamydomonas*
Domain Archaea
A1. Korarchaeota
A2. Thaumarchaeota
A3. Nanoarchaeota: Nanoarcheum
A4. Euryarchaeota
A4.1. Halobacteria: Halobacterium
A4.2. Thermoplasmata: Thermoplasma, Ferroplasma
A4.3. Methanogens: Methanobacterium, Methanocaldococcus/Methanococcus
A4.4. Hyperthermophiles: Thermococcus, Pyrococcus, Methanopyrus, Archaeoglobus
A5. Crenarchaeota
A5.1. Hyperthermophiles (from terrestrial volcano): Sulfolobus
A5.2. Hyperthermophiles (from submarine volcano): Pyrolobus

Viruses: Acellular microorganisms
Group I / dsDNA: Siphoviridae, Podoviridae, Myoviridae, Adenoviridae, Poxviridae, Papillomaviridae, Herpesviridae
Group II / ssDNA: Microviridae, Inoviridae, Paroviridae
Group III / dsRNA: Reoviridae
Group IV / (+)ssRNA: Leviviridae, Picornaviridae, Togaviridae, Flaviviridae, Caliciviridae, Astroviridae, Coronaviridae,
Group V / (-)ssRNA: Paramyxoviridae, Orthomyxoviridae, Rhabdoviridae, Bunyaviridae, Filoviridae
Group VI / RNA-RT: Retroviridae
Group VII / DNA-RT: Hepadnaviridae

Phage λ Siphoviridae
Phage T7 Podoviridae
Phage T4 Myoviridae
Phage X174 Microviridae
Phage M52, Qβ Leviviridae
Phage M13, fd Inoviridae
Adenovirus Adenoviridae
Astrovirus Astroviridae
Ebola virus Filoviridae
Epstein-Barr virus (EBV) Herpesviridae
Enteroviruses (EnteroV, RhinoV, CoxsackieV, PolioV) Picornaviridae
Hepatitis A virus (HAV) Picornaviridae
Hepatitis B virus (HBV) Hepadnaviridae
Hepatitis C virus (HCV) Flaviviridae
Hepatitis D virus (HDV) Virusoids
Hepatitis G virus (HGV) Flaviviridae
Herpes simplex viruses (HSV-1, HSV-2) Herpesviridae
Human immunodeficiency virus (HIV) Retroviridae
Human norovirus Caliciviridae
Human parvovirus B19 Paroviridae
Human papillomaviruses (HPVs) Papillomaviridae
Influenza viruses Orthomyxoviridae
Marburg virus Filoviridae
Measles virus (Morbillivirus) Paramyxoviridae
Mumps virus (Rubulavirus) Paramyxoviridae
Rabies virus (Lyssavirus) Rhabdoviridae
Rotaviruses Reoviridae
Rubella virus Togaviridae
Severe acute respiratory syndrome coronavirus (SARS-CoV) Coronaviridae
Varicella-zoster virus (VZV) Herpesviridae
Variola virus Poxviridae
West Nile virus Flaviviridae
### B1. Proteobacteria (= purple bacteria)

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<td><em>Rhodospirillum</em></td>
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<td></td>
<td><em>Nitrosovoccus</em></td>
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<tr>
<td><strong>Sulfur/iron oxidizer</strong></td>
<td><em>Thiobacillus</em></td>
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<tr>
<td><strong>Hydrogen oxidizer</strong></td>
<td><em>Ralstonia</em></td>
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<tr>
<td><strong>Methanotrophic</strong></td>
<td><em>Methylobacillus</em></td>
<td><em>Methylomonas</em></td>
<td><em>Pseudomonas</em></td>
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<tr>
<td><strong>Methylotrophic</strong></td>
<td><em>Methylobacter</em></td>
<td><em>Methylococcus</em></td>
<td><em>Xanthomonas</em></td>
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<td><strong>Pseudomonads</strong></td>
<td><em>Zymomonas</em></td>
<td><em>Burkholderia</em></td>
<td><em>Moraxella</em></td>
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<tr>
<td><strong>Acetic acid bacteria</strong></td>
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<tr>
<td><strong>Free-living aerobic nitrogen-fixing</strong></td>
<td><em>Azotobacter</em></td>
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<td><strong>Spirilla</strong></td>
<td><em>Spirillum</em></td>
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<td><em>Bdellovibrio</em></td>
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<tr>
<td><strong>Sheathed</strong></td>
<td><em>Sphaerotilus</em></td>
<td><em>Leptothrix</em></td>
<td><em>Campylobacter</em></td>
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<td><strong>Budding</strong></td>
<td><em>Hyphomicrobium</em></td>
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<td><strong>Prosthecated</strong></td>
<td><em>Caulobacter</em></td>
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<td><strong>Gliding myxobacteria</strong></td>
<td><em>Stigmatella</em></td>
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<tr>
<td><strong>Sulfate/sulfur reducer</strong></td>
<td><em>Desulfuromonas</em></td>
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</table>

- *δ* denotes endospore-forming bacteria
- *α* denotes endospore-forming bacteria