Mapping of Medical Microbiology Content in a Clinical Presentation Curriculum

Robin K. Pettit & Yen-Ping Kuo
A. T. Still University, School of Osteopathic Medicine in Arizona, Mesa, AZ, USA

Abstract
Clinically important microbes, and the pathogenesis, symptoms and diagnosis of their corresponding infectious diseases were integrated into clinical schemes within a clinical presentation curriculum. Decisions on microbe placement considered a variety of factors, including spaced reinforcement of major pathogens. We report here the map of our integrated medical microbiology curriculum.

The pervading trend in medical education is integration of formal knowledge with clinical experience. A strong rationale for this approach is that student retention of non-contextualized basic science information is poor. Indeed, students who learn symptoms of a disease in the context of biomedical information are better able to retain their diagnostic performance over time than those who learn disease symptoms in isolation.

A. T. Still University’s School of Osteopathic Medicine in Arizona (ATSU SOMA) considered this critical issue when designing the curriculum. The SOMA program includes an integrated clinical presentation curriculum (CPC), and early contextual learning experiences. Our students learn to diagnose using inductive reasoning through investigation of clinical schemes that represent the most common presenting signs or symptoms (e.g. abdominal pain). Schemes provide a framework that students can use for both learning and problem solving, and reveal the road map that an expert clinician uses in an inductive decision-making process. Thus, the schemes serve two purposes, to organize learning and to solve clinical problems.

In SOMA’s CPC, 131 schemes are organized into 11 organ system courses that are sequenced through the student’s first two years. Instruction in basic, clinical and social sciences occurs within each scheme. Figure 1 shows the sequence of the courses in years 1 and 2, in addition to Medical Skills and Osteopathic Principles and Practice courses run in parallel. Year 1 begins with Principles of Medicine, where students learn basic science fundamentals in the context of clinical scenarios. As an example, bacterial endospores are introduced in a clinical scenario where a patient receives a tetanus booster after falling off a horse and fracturing her radius and ulna. Students are introduced to their first scheme, Sore Throat/Rhinorrhea, toward the end of Principles of Medicine.

For medical microbiology, clinically important microbes, and the pathogenesis, symptoms and diagnosis of their corresponding infectious diseases are integrated into the schemes within each organ system. As summarized in Table 1 (see Appendix), the medical microbiology content, presented in the context of infectious diseases, is integrated into 47 schemes housed within 8 organ systems. Decisions on optimum placement of medical microbiology topics are multifactorial. At the outset, a comprehensive list of objectives/content topics is formulated. The layout takes into account significance to the scheme, and whether the topic has been identified by USMLE, COMLEX and published medical microbiology core knowledge objectives. Integration with other basic science and clinical knowledge disciplines is coordinated.

Because spaced repetition promotes retention of knowledge and improvement of clinical skills, a critical consideration in placing medical
microbiology topics within the schemes is opportunity for review of major human pathogens. Placement of a major pathogen in multiple schemes and courses allows us to reinforce and build on material presented initially. When a pathogen is first introduced within a relevant scheme, its general characteristics and epidemiologic and clinical significance are discussed. Features such as growth characteristics, virulence factors and immune responses associated with that particular clinical presentation are emphasized. When the organism is revisited under other schemes, characteristics relevant to that clinical presentation are covered. Figure 2 provides an example of the distribution of Staphylococcus characteristics across the courses. The guiding principle here resembles that of Wilkerson et al., who have developed an ascending spiral pre-clerkship curriculum in which content is purposively repeated at a higher level of complexity. The layout of our map also reflects intentional review of major pathogens prior to board exams. Features of Pseudomonas aeruginosa infection, for example, are covered in five courses over the 2-year period (Table 1, see Appendix), with a final review in Dermatology (Figure 1).

Basic concepts and recurring themes in medical microbiology are woven throughout years 1 and 2 of the curriculum. For example, the role of biofilms in the pathogenesis and treatment of joint infections, endocarditis, catheter infections, periodontitis, vaginitis and otitis media is addressed in the Neuromusculoskeletal, Cardiopulmonary, Renal and Endocrine, Gastrointestinal, Genitourinary, and Senses courses, respectively. Lipopolysaccharide (LPS) is another example of a recurring topic. After students grasp LPS structural features and their relationship to disinfectant and antibiotic resistance in Principles of Medicine, the role of LPS in immune evasion and the pathogenesis and symptoms of gram-negative infections is discussed in multiple courses. Another major recurring theme is the predominance of human infection due to normal microbiota, which maps readily to all of the courses. Our strategy is designed to aid in the transfer of basic science knowledge to clinical learning. In transfer, a concept learned in one context is used to solve a problem in a different context, and this phenomenon is enhanced when multiple examples are provided. In addition to facilitating transfer, the reinforcement of medical microbiology principles over time within a clinical context likely facilitates long-term retention of the substantial amount of microbiology knowledge medical students must acquire.

Delivery of didactic content in our year 1 curriculum reflects the diverse styles of the basic science and clinical faculty involved in each organ system. Multiple approaches, including flipped classrooms, problem based learning, case studies, gallery walks, interactive clicker sessions, games, and traditional lectures are employed. ATSU SOMA MS years 2-4 train in a contextual setting at and around one of eleven community campuses nationwide (each affiliated with the National Association of Community Health Centers), and thus receive didactic content via podcasts. As there are no CPC textbooks, content resources are similar to those at institutions with more traditional curricula. Incoming students receive a list of 22 required textbooks which are used throughout their first two

![Figure 1. Sequence of organ system courses in years 1 and 2. Box size is proportionate to the length of each course. Students receive training in Medical Skills and Osteopathic Principles and Practice throughout years 1 and 2. Biostatistics and epidemiology is integrated throughout year 2.](image)
For medical microbiology, we require a single non-clinical microbiology text, and recommend an organ-system based microbiology text for clinical correlates. The current lack of CPC-based texts requires faculty to carefully structure their presentations around particular schemes.

One drawback to a CPC, particularly in a relatively new program such as ours, is that scheme details and the sequence of the organ systems are not static. Placement of microbes evolves with new knowledge and with changes in sequencing of the organ systems. However, the availability of a template facilitates this process enormously. Teamwork within the discipline and across disciplines is essential; flexibility and communication are absolute requirements! Another drawback is the need to condense information within an integrated course that contains both basic science and clinical components; however, this is an issue with any integrated curriculum. Faculty need to be mindful that students may have difficulty keeping track of the big picture for a particular discipline. Finally, it’s challenging to find the optimum location to cover microbes like *Staphylococcus* and *Streptococcus* that cause important infections in multiple organ systems, and emerging infections like hantavirus that cause divergent symptoms.

In providing a clinical framework for two years of basic science instruction and small group case work, the scheme-based clinical presentation model is likely motivating for students, and may enhance understanding, long-term retention and clinical problem solving skills. The Infectious Diseases Society of America Preclinical Curriculum Committee now advocates a medical education approach that facilitates transfer of classroom knowledge to the bedside. SOMA’s integrated medical microbiology content is an excellent example of such an approach. Our medical microbiology map may be of value to other programs interested in developing a scheme-based CPC.

**Figure 2.** Distribution of *Staphylococcus* topics across the curriculum. Clinically important members of the genus are introduced/reviewed in eight of the 47 schemes, and in all but one (Hematology) of the organ systems that include medical microbiology content. Basic characteristics, including morphology and gram-stain reaction, are reviewed in each of these schemes. Schemes are underlined. NMSK = neuromusculoskeletal, CP = cardiopulmonary, REM = renal and endocrine, GI = gastrointestinal, GU = genitourinary.

---

Medical Science Educator © IAMSE 2013 Volume 23(2) 203
Notes on Contributors

ROBIN K. PETTIT, PhD, is a Professor of Microbiology at A.T. Still University, School of Osteopathic Medicine in Arizona, Mesa, AZ, USA.

YEN-PING KUO, PhD, is a Professor of Microbiology at A.T. Still University, School of Osteopathic Medicine in Arizona, Mesa, AZ, USA.

Keywords

Medical microbiology, scheme, clinical presentation curriculum, integration, basic science

References

1. Swanson DB, Case SM, Luecht RM, Dillon GF. Retention of basic science information by fourth-year medical students. Acad Med. 1996; 71: S80-S82.
2. Fincher, RE, Wallach PM, Richardson WS. Basic science right, not basic science lite: Medical education at a crossroad. J Gen Intern Med. 2009; 24: 1255-1258.
3. Schmidt HG, Rikers RMJP. How expertise develops in medicine: knowledge encapsulation and illness script formation. Med Educ. 2007; 41: 1133-1139.
4. Custers JFM. Long-term retention of basic science knowledge: a review study. Adv Health Sci Educ. 2010; 15: 109-128.
5. Watt ME. Retention of preclinical knowledge by clinical students. Med Educ. 1987; 21: 119-124.
6. D'Eon MF. Knowledge loss of medical students on first year basic science courses at the University of Saskatchewan. BMC Med Educ. 2006; 6: 5.
7. Woods NN, Brooks LR, Norman GR. The value of basic science in clinical diagnosis: Creating coherence among signs and symptoms. Med Educ. 2005; 39: 107-112.
8. Woods NN, Neville AJ, Levinson AJ, Howey EHA, Ocziekowski WJ, Norman GR. The value of basic science in clinical diagnosis. Acad Med. 2006; 81: S124-S127.
9. Woods NN, Brooks LR, Norman GR. It all makes sense: biomedical knowledge, causal connections and memory in the novice diagnostician. Adv Health Sci Educ. 2007; 12: 405-415.
10. Mandin H, Harasym P, Eagle C, Watanabe M. 1995. Developing a “Clinical Presentation” curriculum at the University of Calgary. Acad Med. 1995; 70: 186-193.
11. Schwartz FN, Hover ML, Kinney M, McCoy L. Student assessment of an innovative approach to medical education. Med Sci Educ. 2012; 22: 102-107.
12. Schwartz FN, Hover ML, Kinney M, McCoy L. Faculty assessment of an innovative approach to medical education. Med Sci Educ. 2012; 22: 108-116.
13. Woloschuk W, Harasym P, Mandin H, Jones A. Use of scheme-based problem solving: an evaluation of the implementation and utilization of schemes in a clinical presentation curriculum. Med Educ. 2000; 34: 437-442.
14. Mandin H, Jones A, Woloschuk W, Harasym P. Helping students learn to think like experts when solving clinical problems. Acad Med. 1997; 72: 173-179.
15. Booth SJ, Burges G, Justemen L, Knoop F. Special Communication: Design and implementation of core knowledge objectives for medical microbiology and immunology. JIAMSE. 2009; 19: 100-138.
16. Kornmeier J, Sosic-Vasic Z. Parallels between spacing effects during behavioral and cellular learning. Front Hum Neurosci. 2012; 6: 1-5.
17. Bahrick HP, Hall JK. The importance of retrieval failures to long-term retention: A metacognitive explanation of the spacing effect. J Mem Lang. 2005; 52: 566-577.
18. Shebilske WL, Goettl BP, Corrington K, Day EA. Interleaved spacing and task-related processing during complex skill acquisition. J Exp Psych: Applied. 1999; 5:413-437.
19. Kerfoot BP, Fu Y, Baker H, Connelly D, Ritchey ML, Genega EM. Online spaced education generates transfer and improves long-term retention of diagnostic skills: A randomized controlled trial. J Am Coll Surg. 2010; 211: 331-337.
20. Kerfoot BP, Shaffer K, McMahon GT, et al. Online “Spaced Education Progress-Testing” of students to confront two upcoming challenges to medical schools. Acad Med. 2011; 86: 300-306.
21. Wilkerson L, Stevens CM, Krasne S. No content without context: Integrating basic, clinical, and social sciences in a pre-clerkship curriculum. Med Teach. 2009; 31: 812-821.
22. Norman G. Teaching basic science to optimize transfer. Med Teach. 2009; 31: 807-811.
23. Southwick F, Katona P, Kaufman C, et al. Commentary: IDSA guidelines for improving the teaching of preclinical medical microbiology and infectious disease. Acad Med. 2010; 85: 19-22.
Appendix

Table 1. Medical microbiology content mapped to 47 schemes and eight courses. aIntroduction to Medical Microbiology includes classification, normal microbiota, fundamentals of bacteriology, mycology, parasitology and virology, and introduction to microbial pathogenesis and diagnosis. bEtiologies in bold: introduction/content relevant to clinical presentation; etiologies in non-bold: review/content relevant to clinical presentation; etiologies in parentheses: mentioned but not discussed.
### Principles of Medicine

| Organ System/Course | Clinical Scheme | Sore Throat/ Rhinorrhea | Neuro-Musculoskeletal I (Musculoskeletal System Emphasis) |
|---------------------|-----------------|-------------------------|--------------------------------------------------------|
|                     | None            | pharyngitis diphtheria  | cellulitis necrotizing fasciitis                       |
|                     |                 | common cold             | pyomyositis myonecrosis                                |
|                     |                 | hand-foot-mouth disease | osteomyelitis                                          |
|                     |                 | mononucleosis           |                                                       |

### Infectious Disease/ Topic

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Microbe<sup>a</sup>

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Neuro-musculoskeletal II (Neurological System Emphasis)

| Organ System/Course | Neuro-musculoskeletal II (Neurological System Emphasis) |
|---------------------|--------------------------------------------------------|
|                     | Headache Acute Neurological Deficits Seizures         |
|                     | mucocellularcorticercinosis                           |
|                     | prion disease AIDS syphilis                           |
|                     | progressive multifocal leuкоencephalopathy polio, botulism |

### Infectious Disease/ Topic

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Microbe<sup>a</sup>

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Microbe<sup>a</sup>

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Microbe<sup>a</sup>

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Microbe<sup>a</sup>

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |

### Microbe<sup>a</sup>

| Microbe<sup>a</sup> | Introduction to Medical Microbiology<sup>b</sup> | painful upper extremity | lump/mass muscle pain | joint infection |
|---------------------|--------------------------------------------------|------------------------|-----------------------|-----------------|
| Clostridium tetani  | (Herpes simplex 1 virus, human papillomavirus)   |                         |                       | Lyme disease    |
| Organ System/Course | Cardiopulmonary | Renal and Endocrine |
|--------------------|----------------|---------------------|
| Clinical Scheme    | Abnormal Heart Sounds | Dyspnea Cough | Urinary Frequency | Hyperglycemia |
| Infectious Disease/Topic |
| Endocarditis | upper respiratory tract infections: | lower respiratory tract infections: | urethritis cystitis prostatitis pyelonephritis | rhinocerebral mucormycosis necrotizing otitis externa emphysematous UTIs emphysematous cholecystitis diabetic foot infections necrotizing fasciitis type 1 |
| | rhinitis pharyngitis laryngitis epiglottitis croup | bronchitis bronchiolitis typical, atypical, community-acquired, nosocomial pneumonia | | |
| Infectious Disease/Topic |
| Upper respiratory tract infections: | viruses: | |
| Endocarditis | rhinitis pharyngitis laryngitis epiglottitis croup | Influenza virus Parainfluenza virus RSV Mumps virus Coronavirus Rhinovirus Adenovirus | | |
| Infectious Disease/Topic |
| Lower respiratory tract infections: | opportunistic mycoses: | |
| Endocarditis | bronchitis bronchiolitis typical, atypical, community-acquired, nosocomial pneumonia | C. neoformans Aspergillus fumigatus Rhizopus and Rhizomucor spp. Pneumocystis jirovecii | | |
| | bacteria: | Proteus mirabilis Enterobacter spp. Serratia spp. Candida albicans | | |
| | Bacillus anthracis Bordetella pertussis Acinetobacter spp. S. pneumoniae H. influenzae P. aeruginosa M. tuberculosis Chlamydia spp. Legionella pneumophila | systemic mycoses: | | |
| | (Nocardia spp. S. aureus) | Histoplasma capsulatum Blastomyces dermatitidis Coccidioides immitis Paracoccidioides brasiliensis | | |
| | (S. aureus, S. epidermidis) | opportunistic mycoses: | | |
| | | C. neoformans Aspergillus fumigatus Rhizopus and Rhizomucor spp. Pneumocystis jirovecii | | |
| | | (S. epidermidis, E. faecalis P. aeruginosa) | | |

**Medical Science Educator © IAMSE 2013 Volume 23(2) 207**
| Organ System/Course | Oral Complaints | Dysphagia | Abdominal Pain | GI Bleeding | Jaundice, Abnormal Liver Enzymes | Anal Discomfort | Diarrhea | Nausea and Vomiting |
|---------------------|----------------|-----------|----------------|-------------|-----------------------------|----------------|----------|-------------------|
| **Infectious Disease/Topic** | caries periodontal disease cervicofacial actinomycosis oropharyngeal esophageal candidiasis | pharyngitis peritonsillar abscess | intra-abdominal abscess gastroenteritis | gastric and duodenal ulcers | viral hepatitis cholangitis fascioliatis | perianal cellulitis perirectal, perianal abscess intestinal helminth infections | acute diarrhea chronic diarrhea traveler's diarrhea hemolytic uremic syndrome dysentery pseudomembranous colitis | bacterial toxin-related foodborne disease |
| **Microbe** | Lactobacillus Bacteroides viridans streptococci A. israelii C. albicans (Fusobacterium) | S. pyogenes H. influenzae C. diphtheriae EBV Coxsackie A virus (C. albicans, CMV, S. aureus, anaerobic mouth flora) | Bacteroides fragilis | Norovirus Rotavirus Astrovirus Adenovirus | Helicobacter pylori | hepatitis viruses A, B, C, D, E Opisthochir sinensis Fasciola hepatica (S. pyogenes, E. coli, Enterococcus, Bacteroides, Staphylococcus spp.) | bacteria: Salmonella spp. Shigella spp. Campylobacter jejuni invasive E. coli toxigenic E. coli Vibrio cholerae Vibrio parahaemolyticus Yersinia enterocolitica C. difficile protozoa: Entamoeba histolytica Giardia lamblia Cryptosporidium spp. (Norovirus, Rotavirus, Adenovirus, Astrovirus) | B. cereus C. botulinum S. aureus |
| Organ System/ Course | Genitourinary I | Genitourinary II |
|----------------------|-----------------|-----------------|
| Clinical Scheme | Pap Smear | Vaginal Discharge/Discomfort | Pelvic Pain | Scrotal Mass |
| Infectious Disease/ Topic | genital warts | vaginitis | pelvic inflammatory disease | epididymitis |
| | | urethritis | | epididymoorchitis |
| | | cervicitis | | |
| | | genital ulcers: | | |
| | | genital herpes | | |
| | | chancroid | | |
| | | syphilis | | |
| | | lymphogranuloma venereum | | |
| | | granuloma inguinale | | |
| Microbe<sup>a</sup> | Gardnerella vaginalis | N. gonorrhoeae | A. israelii | mumps virus |
| | Trichomonas vaginalis | T. pallidum | | |
| | H. ducreyi | Mycoplasma spp. | | |
| | C. trachomatis | C. albicans | | |
| | K. granulomatis | HSV | | |
| Organ System/ Course | Genitourinary I | Genitourinary II |
| Clinical Scheme | Pregnancy Antepartum | Pregnancy Loss | Non-Reassuring Fetal Status | Labor | Breast Disorders | Urinary Incontinence |
| Infectious Disease/ Topic | TORCH | perinatal infections | spontaneous abortion | chorioamnionitis | postpartum infections: | mastitis breast abscess | STI-related UTI |
| | | | | UTI and RTI during pregnancy | endometritis | non-STI-related UTI |
| | | | | | wound infections | |
| | | | | | perineal cellulitis | |
| | | | | | respiratory complications | |
| | | | | | UTIs, mastitis | |
| | | | | | septic pelvic phlebitis | |
| Microbe<sup>a</sup> | T. gondii | Enterobacteriaceae | Mycoplasmataceae | Staphylococcus | (N. gonorrhoeae, C. trachomatis, |
| | T. pallidum | Influenza virus | spp. | spp. | Trichomonas, all common UTI |
| | HSV, VZV, CMV | (Bacteroides spp., S. | | | etiologies) |
| | HBV | agalactiae, E. coli, | Mycoplasmataceae | | |
| | Parvovirus B19 | Candida, Ureaplasma | Staphylococcus | | |
| | Rubella virus | urealyticum) | spp. | | |
| | (Coxsackievirus) | | | | |
| | S. agalactiae | | | | |
| | L. monocytogenes | | | | |
| | HIV | | | | |
| | | | | | |

<sup>a</sup> Includes common microorganisms.
| Organ System/Course | Senses | Hematology |
|---------------------|--------|------------|
| Clinical Scheme     |        |            |
|                     | Ear Pain, Tinnitus Hearing Loss |        |
|                     | Eye Redness |        |
|                     | Smell and Taste Dysfunction |        |
|                     | Anemia |        |
|                     | White Blood cell Abnormalities |        |
|                     | Lymphadenopathy |        |
|                     | Recurrent/Persistent Infections |        |
| Infectious Disease/Topic |        |            |
|                     | Otitis media otitis externa necrotizing otitis externa |        |
| Microbe\(^{a}\)    | Onchocerca volvulus Loa loa |        |
|                     | Adenovirus HSV S. aureus |        |
|                     | (S. pyogenes, S. pneumoniae) |        |
|                     | nontypeable H. influenzae, P. aeruginosa |        |
|                     | Moraxella catarrhalis |        |
|                     | (S. aureus, Candida, Aspergillus spp.) |        |
|                     | Rhizopus oryzae Aspergillus spp. |        |
|                     | (Rhinoivirus, Influenza virus, Parainfluenza virus, S. pneumoniae, nontypeable H. influenzae, M. catarrhalis, Fusarium, Mucorales) |        |
|                     | Plasmodium spp. Babesia spp. |        |
|                     | C. perfringens |        |
|                     | HTLV (HIV) |        |
|                     | Leptospira spp. Borrelia spp. Francisella tularensis |        |
|                     | Brucella spp. Yersinia spp. Bacillus anthracis |        |
|                     | Trypanosoma spp. Leishmania spp. |        |
|                     | Sporothrix schenckii |        |
|                     | HIV P. aeruginosa |        |
| Organ System/ Course | Clinical Scheme | Dermatology |
|----------------------|-----------------|-------------|
| **Infectious Disease/ Topic** | **Burn infections** | **Dermatology** |
| Burns | Macular Skin Rash | Papules/ Plaques | Blisters | Scalp Disorders | Pruritis |
| Scarlet fever | Rocky Mountain | fish tank granuloma leprosy | zoster | folliculitis tinea capitis piedra | pediculosis scabies |
| STSS | Spotted Fever | erythrasma papules/plaques due to hematogenous dissemination | oropharyngeal herpes | | |
| TSS | endemic typhus | dermatophytoses cutaneous candidiasis | traumatic herpes | | |
| rheumatic fever secondary syphilis folliculitis furunculosis skin abscess impetigo erysipelas SSSS | childhood viral exanthems tinea versicolor tinea nigra | sporotrichosis cutaneous warts molluscum contagiosum pityriasis rosea | hand, foot and mouth disease smallpox | | |
| **Microbe** | | | | | |
| | **S. pyogenes** | **M. marinum** | | | |
| | **S. aureus** | **M. leprae** | | | |
| | **T. pallidum** | **Propionibacterium acnes** | | | |
| | **P. aeruginosa** | **C. minutissimum** | | | |
| | (P. aeruginosa) | **Microsporum** spp. | | | |
| | | **Trichophyton** spp. | | | |
| | | **Epidermophyton** spp. | | | |
| | | **N. gonorhoeae** | | | |
| | | **N. meningitidis** | | | |
| | | **C. albicans** | | | |
| | | **Sporothrix schenckii** | | | |
| | | **HPV** | | | |
| | | **HHV molluscum contagiosum virus** | | | |
| | | **VZV** | | | |
| | | **HSV** | | | |
| | | **Coxsackievirus** | | | |
| | | **Variola virus** | | | |
| | | **Vaccinia virus** | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |