

**CHAPTER 20**  
**ANTIBIOTIC RESISTANCE**

---

Microbiology: A Clinical Approach (2<sup>nd</sup> Edition) © Garland Science

---

---

---

---

---

---

---

---

**DEVELOPMENT OF ANTIBIOTIC RESISTANCE**

- ◆ Like the production of antibiotics, antibiotic resistance is a natural phenomenon
- ◆ Mutations that confer resistance to antibiotics are selected for if there is an evolutionary pressure that makes possessing them an advantage by substantially increasing the chances of survival

Microbiology: A Clinical Approach (2<sup>nd</sup> Edition) © Garland Science

---

---

---

---

---

---

---

---

**DEVELOPMENT OF ANTIBIOTIC RESISTANCE**

- ◆ The more an antibiotic is used, the greater the chance of resistance developing
- ◆ The genes for antibacterial resistance can be passed from one generation of bacteria to the next (vertically) and between bacteria of the same generation and bacteria of different species (horizontally)

Microbiology: A Clinical Approach (2<sup>nd</sup> Edition) © Garland Science

---

---

---

---

---

---

---

---

### DEVELOPMENT OF ANTIBIOTIC RESISTANCE

- ◆ Inappropriate use of antibiotics, in clinical and non-clinical settings, is the major cause of the rapid increase in resistant populations of bacteria
- ◆ An increase in the number of immunocompromised individuals and modern lifestyle are also contributory factors
- ◆ Hospitals are ideal settings for the development and spread of antibiotic resistance

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---

---

### TIMELINE OF ANTIBIOTIC RESISTANCE

- ◆ Resistance can develop very quickly, in less than a year in some cases
- ◆ The time it takes organisms to develop resistance to an antibiotic varies, but there is no doubt that the more an antibiotic is used, the more quickly resistance occurs

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---

---

### TIMELINE OF ANTIBIOTIC RESISTANCE

- ◆ The therapeutic life span of an antibiotic is based on how quickly resistance develops
- ◆ Steps can be taken to lengthen the therapeutic lifetime of antibiotics

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---

---

### MECHANISMS OF RESISTANCE

- ◆ Bacteria have natural mechanisms to protect themselves from antibiotic action
- ◆ There are four mechanisms: inactivation of antibiotic, efflux pumping, target alteration, and altering metabolic pathways

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---

---

### MECHANISMS OF RESISTANCE

- ◆ Many of the enzymes involved in antibiotic resistance are coded for by inducible genes that are only switched on in the presence of antibiotic
- ◆ When the genes involved in antibiotic resistance mechanisms are on plasmids they can be easily transferred to another bacterium, which then acquires resistance

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---

---

### CLINICALLY DANGEROUS RESISTANCE

- ◆ Antibiotic resistance is a major clinical problem
- ◆ Antibiotic resistance plays a major role in emerging (MRSA, VRE, *E. coli* infections) and re-emerging infections (TB)
- ◆ Inappropriate use of antibiotics can lead to the development of superinfections

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---

---

### **DEVELOPMENT OF NEW ANTIBIOTICS**

- ◆ New targets for antibiotics are being investigated using several techniques
- ◆ There are also known antibacterial compounds that are being investigated further
- ◆ Compounds must undergo stringent safety checks to ensure they are suitably selectively toxic and will not harm the patient

Microbiology: A Clinical Approach (2nd Edition) © Garland Science

---

---

---

---

---

---

---