

# Toxins and diagnostic microbiology

Brock 21.10 - 21.12  
and Ch. 24

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# Exotoxins

- Toxic proteins released as the microbe grows
  - Exception: some exotoxins are not released until lysis occurs
- Most exotoxins fall into one of three categories:
  - Cytolytic toxins
  - A-B toxins
  - Superantigens

# Cytolytic toxins

- Activity is often detected with red blood cells
- Called *hemolysins*
- Act on other cells as well
- Some dissolve membranes by cleaving lecithin (phosphatidylcholine)
- Called *lecithinases* or *phospholipases*

Images of *Streptococcus pyogenes* removed due to copyright restrictions.

# Diphtheria toxin

- *Corynebacterium diphtheriae*
- A-B toxin is secreted as a single polypeptide
- Encoded by a bacteriophage
- A subunit ADP-ribosylates elongation factor-2

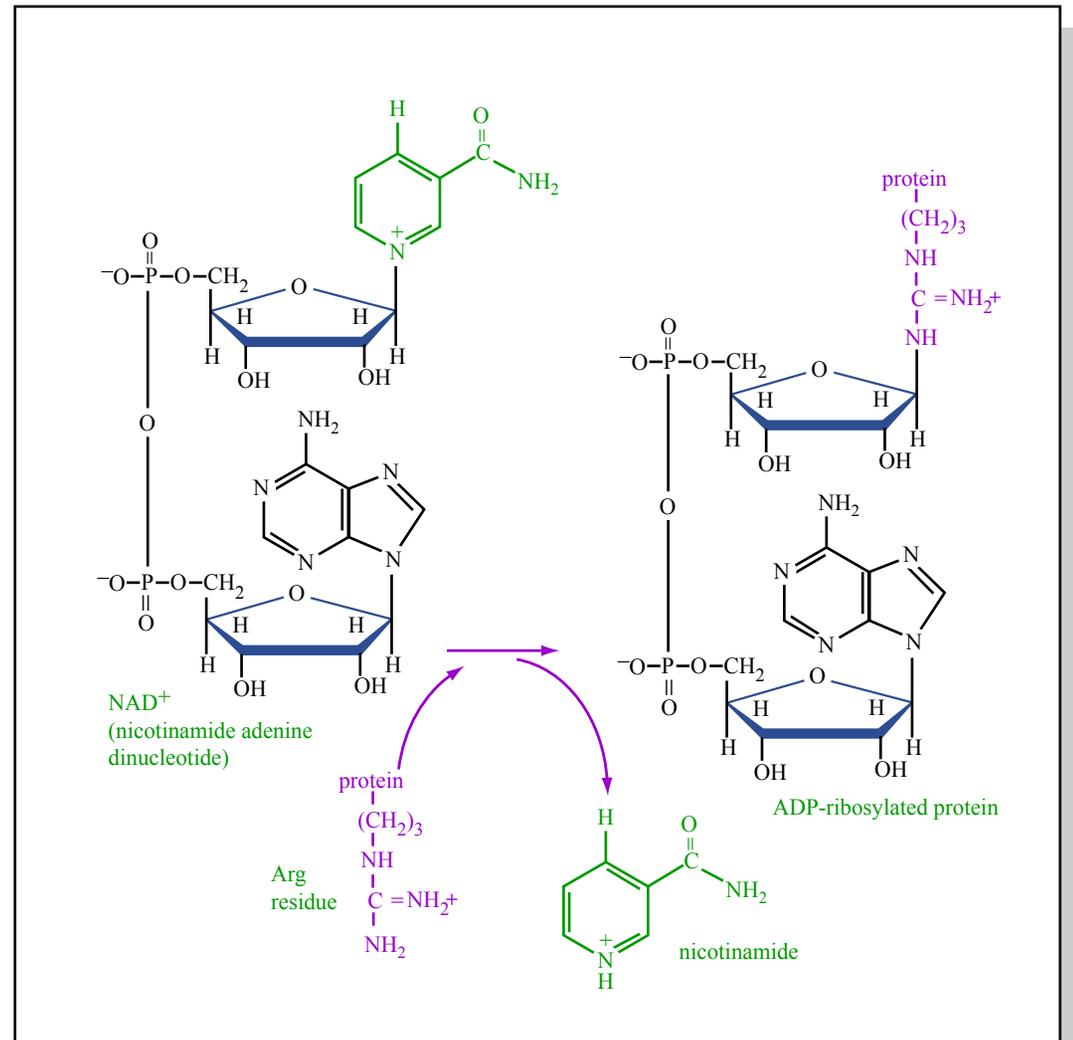


Figure by MIT OCW.

Diagram showing normal protein synthesis and protein synthesis stops removed due to copyright restrictions.  
See Figure 21-19 in Madigan, Michael, and John Martinko. *Brock Biology of Microorganisms*. 11th ed.  
Upper Saddle River, NJ: Pearson Prentice Hall, 2006. ISBN: 0131443291.

## Action of diphtheria toxin

Photograph of Emil Adolf von Behring  
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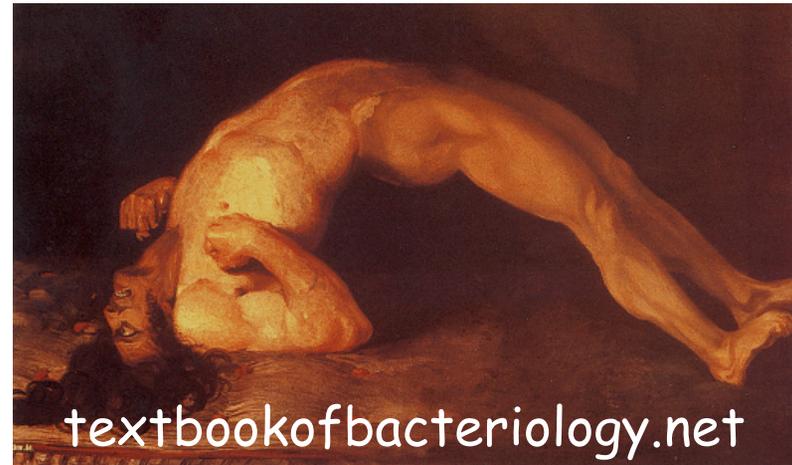
Image of the sled dog Balto removed due to  
copyright restriction. Balto was the Siberian husky  
who led a dogsled team through a blizzard to deliver  
an antitoxin, halting a diphtheria epidemic in Alaska.

Emil Adolf von Behring  
The Nobel Prize in Physiology or Medicine 1901

[www.centralparknyc.org](http://www.centralparknyc.org)

# Tetanus and botulinum toxins

- Not typically invasive
  - Infant botulism and wound botulism
- Tetanus causes spastic paralysis
- Botulism causes flaccid paralysis



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See Figures 21-20 and 21-21 in Madigan, Michael, and John Martinko. *Brock Biology of Microorganisms*. 11th ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2006. ISBN: 0131443291.

# Enterotoxins

- Act on gastrointestinal tract
- Causes vomiting and/or diarrhea
- Cholera toxin is produced by *Vibrio cholerae*

Photograph of a bed used to treat cholera patients in the developing world removed due to copyright restrictions. Please see the fourth photo down at <http://www.oucom.ohiou.edu/tdi/ecuador2000/Macara.html>.

# Ctx mechanism of action

- B subunit binds  $GM_1$
- A subunit ADP-ribosylates  $G_s$  protein and activates adenyl cyclase
- No  $Na^+$  resorption, plus  $Cl^-$  secretion

Diagram removed due to copyright restrictions.  
See Figure 21-22 part 5 in Madigan, Michael, and John Martinko.  
*Brock Biology of Microorganisms*. 11th ed. Upper Saddle River,  
NJ: Pearson Prentice Hall, 2006. ISBN: 0131443291.

# Superantigens

- *Staphylococcus aureus* enterotoxin
- Cause food poisoning within 1-6 hours of exposure
- Acute salivation, nausea, and vomiting, followed by abdominal cramps and diarrhea

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# Culture and isolation

- Enrichment culture is the use of selected media and incubation conditions to isolate microorganisms
- Enriched media
- Selective media
- Differential media

# Common specimens for culture

- Blood culture
- Urine culture
- Fecal culture
- Wounds and abscesses
- Genital specimens

Images of laboratory equipment removed due to copyright restrictions.

# Selective and differential media

## LACTOSE FERMENTERS



*Escherichia coli*: *Enterobacter cloacae*: *Klebsiella pneumoniae*

(*E. coli* Green metallic sheen)

## NON-LACTOSE FERMENTERS



*Salmonella typhi*: *Shigella sonnei*: *Proteus vulgaris*

Photograph of test tubes removed due to copyright restrictions.  
See Figure 24-7b in Madigan, Michael and John Martinko. *Brock Biology of Microorganisms*. 11th ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2006. ISBN: 0131443291.

[www.spiceisle.com/zross/Enteric%20Demo.htm](http://www.spiceisle.com/zross/Enteric%20Demo.htm)

Courtesy of Dr. Z. Ross. Used with permission.

# Monoclonal antibody production

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See Figure 24-12 in Madigan, Michael, and John Martinko. *Brock Biology of Microorganisms*. 11th ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2006. ISBN: 0131443291.

# Serological tests

- Neutralization
- Precipitation
- Agglutination
- Direct
- Passive
- Fluorescent methods
- ELISA

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See Figure 24-15b in Madigan, Michael, and John Martinko. *Brock Biology of Microorganisms*. 11th ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2006. ISBN: 0131443291.