E. Coli Bacteria

Harmful

Or

Harmless???
Is part of a Major Group of Bacteria

- Phylum: *Proteobacteria*
- Class: *Gamma Proteobacteria*
- Order: *Enterobacteriales*
- Family: *Enterobacteriaceae*
- Genus: *Escherichia*
- Species: *E. coli*
Enterobacteriaceae
A Large Bacteria Family
which naturally live in the intestinal tracts of animals

- Salmonella
- Shigella
- Yersinia
- Escherichia
- Enterobacter
- Klebsiella
Escherichia coli bacterium

- There are over 200 identified strains of E. coli
- The bacterium is constantly mutating, so new strains are always being found
- Most strains are beneficial and harmless.
Most strains E. coli are beneficial to the health of mammals

- They break down and process food in the digestive tract. Often known as “probiotics” or “beneficial flora” in the digestive food industry.

- Where ever they live, they are breaking down other harmful substances.
But Sometimes these bacteria are associated with disease in human beings.
Negative strains of E.coli can cause

- Diarrhea
- Urinary Tract Infections
  - Meningitis
  - Peritonitis
- Mastitis
- Pneumonia
- Death
Where is Escherichia coli bacterim found?

• A multitude of strains of good & bad E.coli live.....
  • Lower intestines of mammals
  • Feces of mammals
  • Surface waters
  • in the soil
  • in and on all mammals (skin & fur)
The strains of E.coli become harmful.......  

- In mammals, when they are no longer a part of the digestive tract (enter the blood streams through ulcers or perforations).
- If concentrations in water are so high that the statistical chance of a negative mutation is likely. They can infect you through cuts in the skin.
- If a negative mutation of E.coli enters food production through the soil or through the slaughtering of animals for meat.
A deadly mutation: E.coli 0157:H7
Can cause in the young and the old *(b/c their immune & digestive systems are not operating at a premium)*

- Bloody diarrhea
- Kidney failure
- Average of 61 deaths per year in the U.S. *(a developed country)*

You can get it from

- Undercooked, contaminated meat
- Person to person contact
- Contaminated fruits & vegetables (uncooked)
- Un-pasteurized milk
- Swimming in or drinking contaminated water.
Current Detection Time for E.coli 0157:H7 is

48 - 72 Hours

(depending on the purity of the culture)
Why would we want to improve upon this detection time?

• Because food products leave processing before a positive/negative detection can be found (to sell the food while it’s still fresh).

• How many people could have been contaminated during the 48-72 hours while the culture was grown?
Your Assignment:

• Your group will be assigned just one bacteria or virus which we want to be able to detect with biosensors.

• Research your particular bacteria/virus & their antibody!
Questions you’ll want to answer in your presentation:

• *How long does it take for us to currently detect these bacteria/viruses?*

• *Do we have antibodies for all of these?*

• *Can we isolate the antibodies and use them to detect bacteria & viruses?*

• *Do the antibodies have to be made by a live animal, or can they be manufactured or bought from companies?*
Your Presentation:

• Use poster board or if possible the stand up, 2-fold poster board so it will stand on its own…………..OR………………
do a PowerPoint Presentation

• *Diagrams or photo’s of their bacteria/virus and antibody are important.*

• *Utilize as much of the vocabulary from the chapter as possible in your presentation.*

• *TIME ALLOTMENT: One block day of classtime – if you are not finished – you are on your own.*
PART II
ANTIBODIES
How can antibodies help with detection of Bacteria & Viruses?

- Antibodies are protein molecules, usually developed by the immune system in mammals.
- The immune system uses the antibodies to identify and neutralize bacteria and viruses.
- For every bacteria or virus there is an antibody to identify & neutralize that bacteria or virus.
What if..........

• We use the antibody to find the bacteria or virus..........

BUT...

• How will we know that the antibody found the bacteria/virus????
What if......

- We put some bacteria in a petri dish
- Some dishes will have the antibody in the dish, while other dishes will not.
- What should happen?
- What would our purpose or question be in doing this?
- Let’s write this up & do it!
PART III

BIOSENSORS

• Any ideas on an easier way to know that our antibody has found the bacteria/virus?

• What if – when the antibody finds the bacteria/virus………..it completes an electrical circuit?
Antibody + an electronic circuit =
A Biosensor!!
Analyte is the liquid to be tested and is put on the application membrane.
The analyte flows into the Conjugate Membrane
In the conjugate membrane are the antibodies specific to the antigen (bacteria/virus)
The antibodies have been attached to the polyaniline
Everything then flows into the Capture Membrane which is lined with electrodes.
The primary purpose of the Capture Membrane is to capture the antigen-antibody complex (if the antibody finds the antigen!) as it moves in from the capture membrane.
The Capture Membrane also has some secondary antibodies attached to polyaniline.
The Capture Membrane is where the electrical signal is produced if the antibody and antigen have found each other here!
The absorption membrane collects any excess Analyte.
Current dilemmas & challenges?

• How do we get industry interested in manufacturing biosensors?
• Should biosensors be legislated as mandatory at food processing plants? How could this save or cost industry in dollars?
• Or should biosensors be left to personal use for an individual to have on hand an home?
• Others?
References

• Alocilija, Evangelyn C., Biosystems Engineering, Michigan State University, Lansing, Mi.
• http://www.cfsan.fda.gov/~lrd/ecoli.txt
• http://textbookofbacteriology.net/e.coli.html
• http://en.wikipedia.org/wiki/Escherichia_coli
• http://textbookofbacteriology.net/Anthrax.html