

**Outbreak of Shiga toxin-producing  
*E. coli* O104  
(STEC O104:H4)  
In Germany and Europe 2011**

# Plan

- Generality of *E.coli*
  - Group
  - Pathogenic
- Epidemic in Germany and Europe
  - Epidemic
  - Causal agent
  - Pathogenic
  - Treatment
- *E.coli* in Vietnam

# Generality of *E.coli*

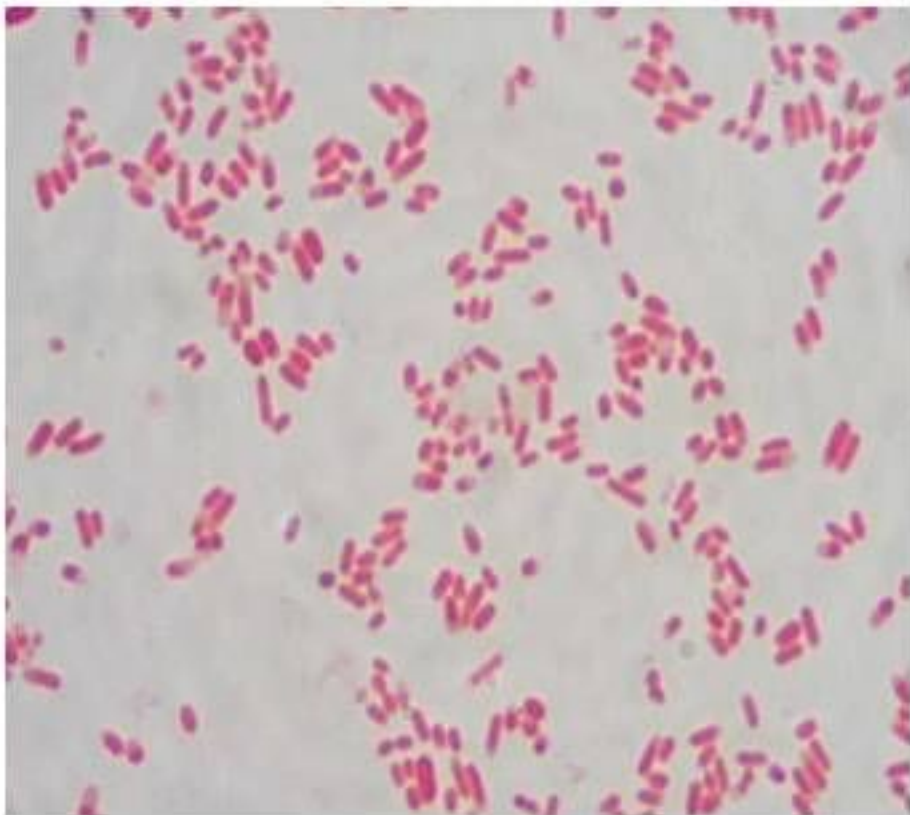
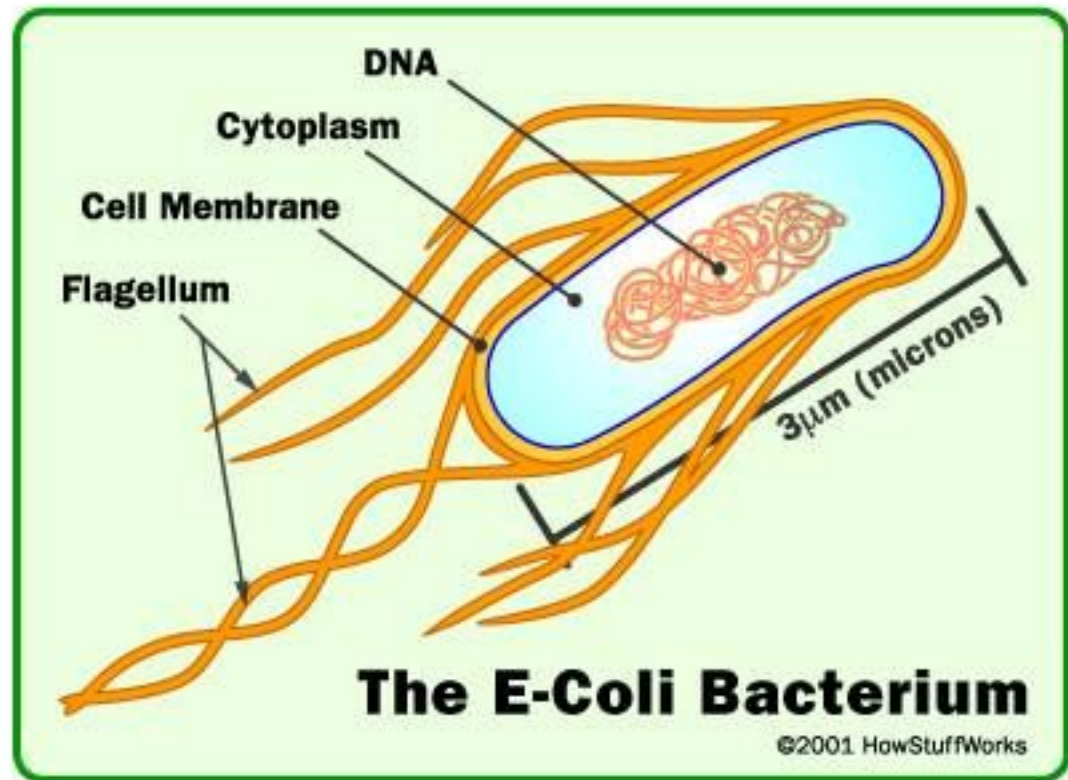
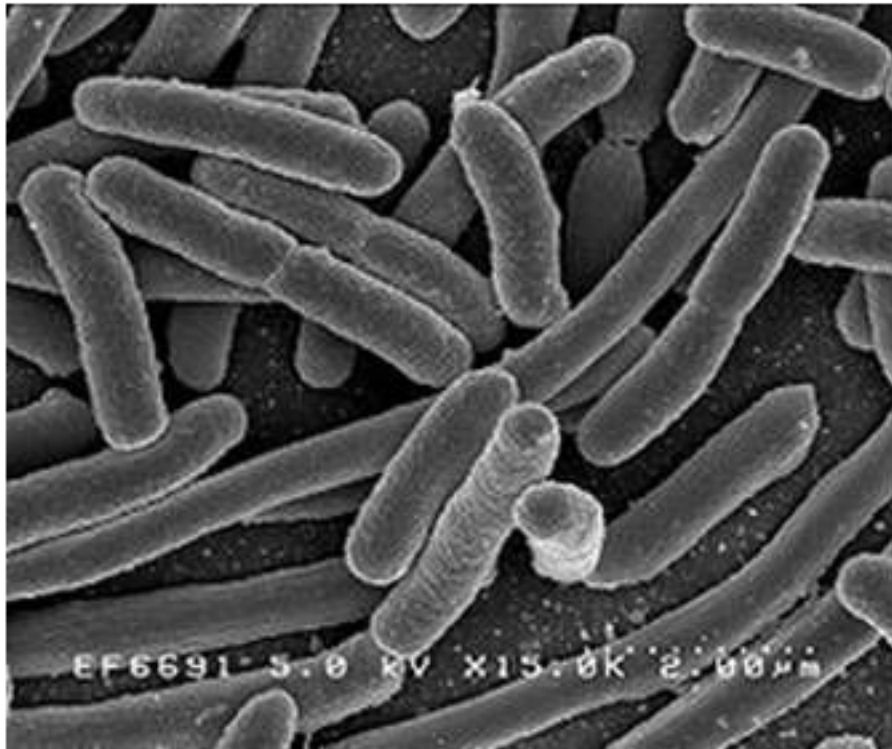
# Groups

- **Escherichia coli for humans can be faecally shed by humans and/or animals, and can be divided into different groups.**
  - **Enteropathogenic *E. coli* (EPEC) → infantile diarrhea.**
  - **Enteroinvasive *E. coli* (EIEC) → dysentery-like disease.**
  - **Enterotoxigenic *E. coli* (ETEC) → diarrhea.**
  - **Enteroblastogenic *E. coli* (EAEC) → aggregative adherence.**
  - **Enterohaemorrhagic *E. coli* (EHEC) → produce Verocytotoxin or Shiga-like toxin (vtx, stx) cause hemorrhagic colitis (HC) and sometimes HUS.**

# Serogroups

- *E. coli* O157
- Non-O157 STEC: *E. coli* serogroups O26, O111, and O103
- Non-O157 serogroup is less likely to cause severe illness than *E. coli* O157; however, some non-O157 STEC serogroups can cause the most severe manifestations of STEC illness.





# Symptoms and Complications

- **What are the symptoms of STEC infections?**
  - Vary for each person but often include severe stomach cramps, diarrhea (often bloody), and vomiting. If there is fever, it usually is not very high (less than 101°F/less than 38.5°C).
  - Most people get better within 5–7 days.
  - Some infections are very mild, but others are severe or even life-threatening.
- **What are the complications of STEC infections?**
  - Around 5–10% : hemolytic uremic syndrome (HUS).
    - Decreased frequency of urination
    - Feeling very tired
    - Losing pink color in cheeks and inside the lower eyelids.
  - Persons with HUS should be hospitalized because their kidneys may stop working and they may develop other serious problems



# Epidemic in Germany



# In Germany

From 1 May to 9 June :

- **759 cases of HUS, 21 fatal cases;**
  - **68% of cases are female and 88% adults aged 20 years or older, with the highest attack rates per**
  - **100 000 population in the 20–49 age groups.**
- **2229 cases of EHEC infections without HUS, 9 fatal cases**
  - **60% of cases are female**
  - **88% adults aged 20 years or older.**

# EHEC outbreaks: update 24/06/2011

- **Germany**

- HUS

- 834 cases
    - 30 deaths

- EHEC

- 2967 cases
    - 16 deaths

- **World**

- HUS

- 877 cases
    - 32 deaths

- EHEC

- 3043 cases
    - 16 deaths

# Severity of the outbreak

- The biggest ever seen in Europe
- The second biggest in world. (its size and virulence).
- The implicated strain seems to be very virulent: percentage of HUS and later neurological complications higher than that observed during previous EHEC outbreaks.

- **Why did so many people get sick?**
  - ***E. coli* O104:H4 produce Shiga toxin, as can most strains in the serotype O157:H7, and some other *E. coli* strains.**
    - **Attack the body in several areas: the gut (causing bloody diarrhea), the kidneys (causing kidney failure), nervous system.**
    - **Toxin can cause clots to form in small blood vessels. → damaged red blood cells → anemia.**
    - ***E. coli* O104:H4 strain has some genes that are found in another group of *E. coli* called enteroaggregative *E. coli*. → diarrhea**  
**enteroaggregative *E. coli* combined with Shiga toxin make people very sick.**



# Groups at highest risk

- Previous : EHEC outbreaks young children at highest risk of severe disease
- Current outbreak: unusual as affecting adults (88% are 20 years or older), mainly women (currently 60% of the EHEC cases and 69% of the HUS cases). Cases have also occurred in school-aged children-

# Causal agent

- **EHEC serotype O104:H4.**
  - not seem to have been documented in outbreaks before,
  - outbreak strain is shigatoxin (*stx2a*)-positive, intimin-negative (*eae*) and enterohaemolysin (*hyl*)-negative and enteroaggregative *E. coli* (EaggEC).
  - unusual combination of virulence genetic factors → explain its virulence, with, being both shigatoxin-producing and enteroaggregative. → both enteroaggregative and shigatoxin-producing characteristics.

# Laboratory criteria

- **Detection of toxin**

- Culture of the pathogen and isolation only from stool and detection of Shigatoxin (stx2) using enzyme-linked immunosorbent assay (ELISA) on the E. coli culture.

- **Indirect (serological) detection**

- anti- Lipopolysaccharides(LPS)-IgM-antibodies against E. coli serogroups (ELISA, Western-Blot).
- Marked change between two consecutive samples in titre/concentration of anti- Lipopolysaccharides (LPS) - IgG-antibodies against E. coli serogroups (ELISA).



# Foods implicated in outbreaks

- Undercooked bovine meat products (minced meat, hamburgers, kebabs), fermented salami made from bovine and ovine meats, fresh produce such as lettuce, bean sprouts and spinach, unpasteurized apple cider, and raw milk and raw milk cheeses.
- EHEC outbreaks have also been waterborne, owing to faecally contaminated drinking-water or contaminated water for swimming (such as lakes, pools and ponds).



# Syndrome surveillance

Cases with bloody diarrhea

*and*

with a history of consumption of raw vegetables and/or raw/undercooked meat

*and/or*

of travelling to northern Germany should be referred for confirmation through laboratory investigation.

# Treatment

- **Most people recover without any specific treatment in 5–10 days.**
- **WHO:**
  - **in general, treatment with antibiotics and antidiarrheal is not recommended for patients infected with EHEC.**
  - **Such treatments have been reported to actually increase the likelihood of complications**
  - **Treatment will probably include fluids.**
  - **For patients with severe HUS, blood transfusions and dialysis might be needed to support failing kidneys.**

# Prevention

- The best way : good hygiene practices
- The only reliable control measure to kill the pathogen is cooking of foods until all parts reach a temperature of 70°C or higher.
- WHO : five keys to safer food are:
  1. Keep clean
  2. Separate raw and cooked
  3. Cook thoroughly ( $\geq 70^{\circ}\text{C}$ )
  4. Keep food at safe temperatures
  5. Use safe water and raw materials

# *E.coli* in Vietnam

Type of *E.coli* in outbreaks in Germany  
doesn't exist in Vietnam.



# *E. coli* in Vietnam

- Resistance to many antibiotics.
  - More than 75% of the strains were resistant to ampicillin, chloramphenicol and trimethoprim-sulfamethoxazole.
  - Multiresistance was detected in 89.5% of *E. coli*  
(Antibiotic Resistance in Diarrheagenic *Escherichia coli* and *Shigella* from Children in Hanoi, Vietnam 2004)  
ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, Feb. 2005, p. 816–819

- Hospital Infections: *E coli* ESBL (+)

# Reference

- International Health Regulations. EHEC outbreak in Germany [web site]. Copenhagen, WHO Regional Office for Europe, 2011 (<http://www.euro.who.int/en/what-we-do/health-topics/emergencies/international-health-regulations/ehec-outbreak-in-germany>).
- Outbreak of life-threatening haemolytic uremic syndrome (HUS) caused by bacterial infection [web site]. Berlin, Robert Koch Institute, 2011 ([http://www.rki.de/EN/Home/homepageb\\_node.html](http://www.rki.de/EN/Home/homepageb_node.html)).
- *Questions & answers on EHEC infections caused by vegetable foods*. Berlin, Federal Institute for Risk Assessment (BfR), 2011 ([http://www.bfr.bund.de/cm/349/questions\\_answers\\_on\\_ehec\\_infections\\_caused\\_by\\_vegetable](http://www.bfr.bund.de/cm/349/questions_answers_on_ehec_infections_caused_by_vegetable)).
- Risk assessment on *Escherichia coli* (STEC) outbreak in Germany [web site]. Stockholm, European Centre for Disease Prevention and Control, 2011 ([http://www.ecdc.europa.eu/en/press/news/Lists/News/ECDC\\_Dispatch.aspx?List=32e43ee8%2Dc230%2D4424%2Da783%2D85742124029a&ID=435&RootFolder=%2Fen%2Fpress%2Fnews%2FLists%2FNews](http://www.ecdc.europa.eu/en/press/news/Lists/News/ECDC_Dispatch.aspx?List=32e43ee8%2Dc230%2D4424%2Da783%2D85742124029a&ID=435&RootFolder=%2Fen%2Fpress%2Fnews%2FLists%2FNews)).
- Health and Consumers Directorate-General. *Flash report. Audio conference on the Shiga Toxin-producing E. coli (STEC) outbreak in Germany and necessary follow-up*. Luxembourg, European Commission, 2011 ([http://ec.europa.eu/food/food/docs/stec\\_outbreak\\_flash\\_report\\_31052011\\_en.pdf](http://ec.europa.eu/food/food/docs/stec_outbreak_flash_report_31052011_en.pdf)).
- *Microbiological hazards in fresh fruits and vegetables*. Geneva, World Health Organization, 2008 ([http://www.who.int/foodsafety/publications/micro/MRA\\_FruitVeges.pdf](http://www.who.int/foodsafety/publications/micro/MRA_FruitVeges.pdf)).
- Risk assessment of Enterohaemorrhagic *Escherichia coli* (EHEC) in meat and meat products [web site]. Geneva, World Health Organization, 2006 (<http://www.who.int/foodsafety/micro/jemra/meetings/ehec/en/index.html>).
- Mølbak K, Schentz F. Verocytotoxin-producing *Escherichia coli* and other diarrhoeagenic *E. coli*. In: Cotruvo JA et al., eds. *Waterborne zoonoses*. Geneva, World Health Organization, 2004 ([http://www.who.int/water\\_sanitation\\_health/diseases/zoonoses.pdf](http://www.who.int/water_sanitation_health/diseases/zoonoses.pdf)).
- *Risk profile for enterohemorrhagic E. coli including the identification of the commodities of concern, including sprouts, ground beef and pork*. Rome, Codex Alimentarius Commission, 2003 (<ftp://ftp.fao.org/codex/ccfh35/fh0305de.pdf>).
- Shiga toxin/verotoxin-producing *Escherichia coli* in humans, food and animals in the EU/EEA, with special reference to the German outbreak strain STEC O104. ECDC – EFSA joint report (<http://www.efsa.europa.eu/en/supporting/pub/166e.htm> )
- Urgent advice on the public health risk of Shiga-toxin producing *Escherichia coli* in fresh vegetables EFSA (<http://www.efsa.europa.eu/en/press/news/110609.htm?wtd=01> )



*Thank you for listening*