As a result of technological innovation, the use of genomic research in the battle against pathogenic bacteria has been gaining power over the past few years. The genome is the entire hereditary information of an organism coded by its DNA molecules.

Genomic research in general, and pathogenomic research in particular, provides us with novel understanding of bacteria and their relations with the human body and the environment we live in and of their resistance to various medications. Such information is important and provides weapons against the rapid evolution of pathogenic bacteria. Furthermore, it could provide a rapid epidemiological tool with the potential to locate the bacteria's natural reservoir and the source of outbreaks. For example, researchers have developed genetic markers that have enabled rapid identification of pathogenic bacteria in food and water as well as revealing the possible source of infection. Such developments, based on genetic research, are our hope for better and healthier future.

Illustration: the double helix of DNA

Genomics – facing the future

- **Specific and sensitive treatment against pathogenic bacteria.**
- **Development of novel vaccines based on genetic knowledge.**
- **Novel development of rapid techniques to identify bacteria.**

ERA-NET PathoGenoMics

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For more information on ERA-NET PathoGenoMics:
www.pathogenomics-era.net

2006

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Bacteria – Friend or Foe?

600 ill from salmonella in chicken

Associated Press in

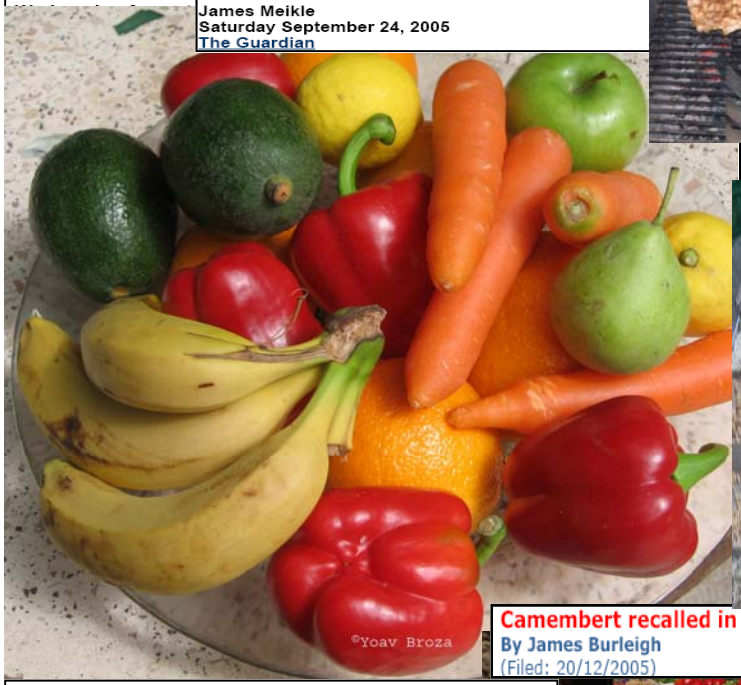
Officials renew listeria poison

James Meikle
Saturday September 24, 2005
The Guardian

Pupils avoid sc
E coli outbreak

Liz Ford and agencies
Friday October 14, 2005

Listeria scare



Camembert recalled in E.coli poison alert
By James Burleigh
(Filed: 20/12/2005)

Special report
What's wrong with our food?

160 ill after eating at kebab shop

Press Association
Thursday March 10, 2005
The Guardian

More than 160 people were stricken with suspected food poisoning after eating food from the same kebab shop, it

Inquiry call after boy, 5, dies in E coli outbreak

Steven Morris
Wednesday October 5, 2005
The Guardian

Pathogenic bacteria, skilled warriors

Bacteria are single-celled, mostly independent organisms that reproduce by fission.

Pathogenic bacteria Are disease-causing bacteria.

Most virulent (hostile) factors of the bacterium are proteins that are encoded by genes in the bacterial DNA (the genetic material) or by chemicals secreted by the bacterium.

Bacterial virulence is influenced by a number of factors such as the ability to adhere to and penetrate into the body's cells, the ability to proliferate in different areas in the body, the ability to produce toxins which destroy or damage body cells function and the ability to avoid the body's defense, the immune system.

However it is important to note, that there could be two genetically similar bacteria that have very different pathogenic levels. Novel genetic technologies are requierd to distinguish between them.

Bacteria and food & water poisonings

Food and water related diseases are caused by the consumption of contaminated food, infected by pathogenic bacteria, parasites, toxins and so on. Most infections are the result of poor treatment and storage of food or consumption of polluted water (e.g. sewage percolating ground water).

Food: important and tasty but could be harmful

Some statistics

*Based on the World Health Organization regional office for Europe, a total number of 3,000,000 cases related to microbiological foodborne diseases were reported from 1995-2003.

*Based on the World Health Organization, there are over 8000 cases of infections with *Salmonella spp*. (see table) per year. Furthermore, over one million deaths resulted from infectious and parasitic diseases in European countries between 1994-2004.

*An estimated 27,000 reported outbreaks in European countries between 1995 and 2003 were related to foodborne pathogenic bacteria.

Some food & water bacterial pathogens

Bacterium	Related food	Main symptoms	Population at high risk	Risks
Salmonella spp.	Beef, poultry, milk, eggs, vegetables	Diarrhoea, fever, abdominal cramps	Elderly, infants and those with impaired immune systems	Septicemia, death
Listeria monocytgenes	Vegetables, meat and dairy products	Fever, muscle aches, nausea, diarrhea	pregnant women, newborns infants and adults with impaired immune systems	Miscarriage or stillbirth, premature delivery, infection , death
Escherichia coli O157:H7	Ground beef, unpasteurize milk, sewage contaminated water	Bloody diarrhea	Children and the elderly	Kidney failure, death

How can one avoid food contamination?

Some recommendations:

*Do not eat raw or undercooked meat, such as poultry or beef.

*Fruits and vegetables should be thoroughly washed before eating.

*Uncooked meats should be kept separate from fruits, vegetables and 'ready to eat' foods.

*Unpasteurized milk or unpasteurized milk products should be avoided.

*Maintain good hygiene, wash hands thoroughly before handling food.

The dangers – what do researchers need to cope with?

A variety of treatments are nowadays in use, such as antibiotics and vaccines, but their wide spread overuse causes drug resistant bacteria.

Zoonotic diseases communicable from animals to humans (e.g. avian influenza) are caused by specific mutations.

Emergence of novel pathogenic bacteria or viruses, whose source or spreading vector is unknown, cause epidemics and pandemics .

Current techniques for the identification of bacteria are not sensitive enough, take a long time, are costly and their reliability is sometimes doubtful.

Bioterrorism -use of pathogenic bacteria in terror attacks

Scientists are required to study these issues and to develop creative solutions.

Pathogenic bacteria colonies