Project number: 5704
Funding source: FP6 (FOOD-CT-2006-036256)

Date: June, 2011
Project dates: Jan 2007 – Jan 2010

Pathogenic *Escherichia coli* Network

Key external stakeholders:

Farmers, food processors, scientists, regulatory personnel, medical doctors, veterinarians, epidemiologists, microbiologists, consumers, EFSA

Practical implications for stakeholders:

Up-to-date information and advice on the different *E. coli* pathogens, detection, epidemiology, pathogenicity, virulence, ecology and control in the farming and beef processing stages of the food chain.

Main results:

Six reports were published on current knowledge, identifying data gaps and making a range of key recommendations designed to improve food/medical testing, epidemiological investigations, control and our overall understanding of these serious pathogens.

Opportunity / Benefit:

This project furthered the existing knowledge base by bringing together international experts on pathogenic *E. coli*, especially verocytotoxigenic *E. coli* (VTEC), to discuss and resolve issues relating to culture and molecular detection, virulence, pathogenicity, epidemiology, ecology and control.

Collaborating Institutions:

See page two of the full Technology Update

Contact   Declan Bolton   Email: declan.bolton@teagasc.ie.

http://www.teagasc.ie/publications/

Teagasc project team: Dr. Declan Bolton (PI)
External collaborators: 35 international partners including:
                                                  Federal Institute for Risk Assessment (BfR) (Germany,)
                                                  Istituto Superiore di Sanità (ISS) (Italy)
                                                  Statens Serum Institut (SSI) (Denmark)
                                                  Institut National de la Researche Agronomique (INRA) (France)
                                                  Institute of Environmental Science and Research, New Zealand (ESR)
                                                  Robert Koch Institute (RKI) (Germany)

1.   Project background:

Escherichia coli form part of the natural gastro–intestinal flora of man and warm-blooded animals. Although most *E. coli* are harmless commensal organisms, there are many pathogenic strains which can cause a variety of illness in man and animals. There is little doubt that more pathogenic *E. coli* groups will evolve and be recognised in the future. The research / surveillance community must be proactive in recognising and sharing information on emergent strains so that they can be addressed in a timely manner.

Despite considerable research on *E. coli* O157, there are still areas where a fundamental understanding of these organisms is lacking. Furthermore, technical deficiencies, a lack of harmonisation across disciplines along the food chain and between continents have prevented optimum gain from past and ongoing research. This co-ordination project formed a durable multidisciplinary network of international research groups working on *E. coli* O157 and other potentially pathogenic strains and serotypes of *E. coli* with the ultimate aim of reducing the burden of related illness.

Key issues to be addressed included: [1] methods of detection and molecular characterisation of *E.coli* O157 and other potentially pathogenic strains and serotypes of *E. coli*; [2] epidemiology and transmission of *E. coli* O157 and other potentially pathogenic strains and serotypes of *E. coli*; [3] pathogenecity, virulence and emerging pathogenic *E. coli*; [4] ecology of *E. coli* O157 and other potentially pathogenic strains and serotypes of *E. coli* and [5] control and management of *E. coli* O157 and other potentially pathogenic strains and serotypes of *E. coli*.

2.   Questions addressed by the project:

- How do we better integrate ongoing research and surveillance activities on pathogenic *E. coli* from along the entire chain (environmental, farm, food and medical)?
- How do we promote collaboration and sharing of research information both within Europe and also with the USA, Australia, New Zealand and INCO countries (Africa and Latin America) on pathogenic *E. coli*?
- What are the most effective Pathogenic *E. coli* detection methods?
- What is the epidemiology of pathogenic *E. coli*?
- What do we know about the ecology of pathogenic *E. coli*?
- What are the pathogenicity factors in the different groups of pathogenic *E. coli*?
- How do we most effectively control pathogenic *E. coli* from farm to fork?

3.   The experimental studies:

There were no experimental studies in this co-ordination action type project but the PEN team organised 5 international conferences and the preparation of associated materials including the abstract book and associated deliverable. On the 26th and 27th of July 2007 CCFRA hosted the first international conference titled 'Methods of Detection and Molecular Characterisation of Pathogenic *E. coli*' in Chipping-Campden in England. ISS hosted the second international conference titled '*E. coli*: Pathogenicity, Virulence and Emerging Pathogenic Strains' on the 6th to 7th March 2008 in Rome. SMI hosted the third international conference titled 'Epidemiology and Transmission of Pathogenic *Escherichia coli*' in Stockholm, Sweden 25th and 26th September 2008. The fourth international conference 'Ecology of *Pathogenic E. coli*' was hosted by NVH in Oslo, Norway on the 5th and 6th March 2009. The final conference 'Control and Management of Pathogenic *Escherichia coli*' took place in Dublin on the 17th and 18th September 2009.

Each of these has associated deliverables listed below (section 6)

4.   Main results:

The main impacts of this co-ordination action project were in the areas of [1] public health protection; [2]

Contact   Declan Bolton   Email: declan.bolton@teagasc.ie.

http://www.teagasc.ie/publications/

optimisation and harmonisation of laboratory methodologies; [3] the promotion of collaboration and sharing of research information and technologies both between disciplines and within Europe the USA, Australia and INCO countries (Africa and South America) on pathogenic *E. coli* including the optimisation and progress in risk management and [4] a major contribution to research and the understanding of *E. coli* O157 and other potentially pathogenic strains and serotypes of *E. coli* by addressing the research and surveillance issues related to pathogenic *E. coli* including detection and characterisation, epidemiology and traceability of strains, pathogenicity, virulence (including current and emergent pathogenic *E. coli*), ecology and transmission of pathogenic *E. coli* and control and management of these organisms through a risk analysis framework and innovative control measures.

The PEN project discussed, developed and described the most effective, science based risk management strategy(s) on the farm and in the meat processing plant. It also provided important information and shared valuable 'tips' among public health professionals and the regulatory function on how current and newly emerging strains can be detected and assessed in terms of their virulence factors and modes of transmission. There is little doubt that this shared information will ensure expediency in diagnosis, treatment and future prevention and control.

Before the PEN project there were a multitude of cultural, immunological, molecular and typing methods available for the detection and characterisation of *E. coli* O157 with deviations and entirely new technologies being reported on an ongoing basis. This project provided the first single source of information on these assessing the relative merits of each methodology and providing guidance on which laboratory technique should be used in different circumstances. This work was particularly timely as during this project non-O157 VTEC became as prevalent as O157 in reported clinical cases throughout Europe.

In recent times there has been ongoing debate about the usefulness or otherwise of intervention technologies during red meat slaughter and processing. The European risk management model focuses on pre-requisite hygiene activities, to the exclusion of interventions. Effective food safety risk management is reliant on the implementation of effective control measures on the farm and in the abattoir. Deliverables 5.1 and 5.2 provide all the necessary information to achieve this.

In recent years there has been major advances in our understanding of VTEC epidemiology, virulence and pathogenicity. The PEN project took the opportunity to collect, collate and present up-to-date information to a wide audience thus enhancing understanding, providing a platform for discussion and shared ideas for future developments. This was achieved through the conferences and the website (www.pen-europe.eu).

5. Opportunity/Benefit:

This project presented an opportunity for leading experts in the field of pathogenic *E. coli* to address the range of issues relating to these organisms. The benefit should be improved detection methods, epidemiological investigations and control and reduced related food-borne illness in the future.

6. Dissemination:
Dissemination was primarily achieved through the 5 international conferences.

Main publications:
O'Sullivan, J., Bolton, D. J., Duffy, G. , Baylis, C., Tozzoli, R., Wasteson Y. and Lofdahl, S. (2008).
Methods for Detection and Molecular Characterisation of Pathogenic *Escherichia coli*, ISBN 1 84170 506 3, T
Dublin

Bolton, D. J., Duffy, G., Baylis, C., Tozzoli, R., Wasteson Y. and Lofdahl, S. (2008). Pathogenicity, Virulence and Emerging pathogenic *Escherichia coli*, ISBN 1 84170 517 9, Teagasc, Dublin

Bolton, D. J., O'Neill, C. J., Duffy, G., Baylis, C., Tozzoli, R., Wasteson Y. and Lofdahl, S. (2009). Epidemiology and Transmission of Pathogenic *Escherichia coli*, ISBN 1 84170 535 7, Teagasc, Dublin

Bolton, D. J., O'Neill, C. J., Duffy, G., Baylis, C., Tozzoli, R., Wasteson Y. and Lofdahl, S. (2009). Ecology of Pathogenic *Escherichia coli*, ISBN 1 84170 535 7, Teagasc, Dublin

Bolton, D. J., O'Neill, C. J., Duffy, G., Baylis, C., Tozzoli, R., Wasteson Y. and Lofdahl, S. (2010). Guidance

Contact   Declan Bolton   Email: declan.bolton@teagasc.ie.

document on the control of *E. coli O157* and other strains and serotypes of pathogenic *E. coli* in slaughter plants for processors, ISBN 1 84170 548 9, Teagasc, Dublin

Bolton, D. J., O'Neill, C. J., Duffy, G., Baylis, C., Tozzoli, R., Wasteson Y. and Lofdahl, S. (2010). Guidance document on the control of *E. coli O157* and other strains and serotypes of pathogenic *E. coli* on farms for primary producers, ISBN 1 84170 547 0, Teagasc, Dublin

7. **Compiled by:** Dr. Declan Bolton