

## **APPENDIX A: GLOSSARY**

### **Abiotic surfaces**

Non-biological surfaces, such as glass, polystyrene etc.

### **Adhesin**

A bacterial cell surface protein that mediates attachment to mammalian cell surfaces to initiate an infection.

### **AFLP**

Amplified Fragment Length Polymorphisms. Molecular markers typical of a strain of an organism obtained by combining RFLP and PCR techniques and applying these to restriction fragments obtained from a total genomic DNA digest of an organism.

### **Allotropic**

Changed or modified.

### **Attaching and effacing *Escherichia coli* (AEEC)**

Attaching and effacing *Escherichia coli* refer to *E. coli* strains capable of producing distinct attaching and effacing (AE) lesions. Pathotypes of *E. coli* commonly associated with A/E lesions are EPEC and EHEC.

### **Antibody**

Synonymous with immunoglobulin (Ig). Antibodies are the key molecules of the humoral immune defence system. Antibodies are produced in response to specific antigens and have highly specific binding properties. The antigen-binding sites are termed epitopes. Antibody molecules comprise heavy and light chains connected by disulfide bridges. The antigen-specific region of the molecule is termed the Fab portion. Five types of Ig molecule have been demonstrated in mammals: IgA, IgG, IgM, IgD and IgE. IgM is constructed of five basic four-peptide units joined at the Fc ends, and IgA can be comprised of a single unit or as a dimer; the remaining Igs are monomeric. The heavy chains of these Igs have been allocated Greek letters:  $\gamma$  (IgG),  $\alpha$  (IgA),  $\mu$  (IgM),  $\delta$  (IgD) and  $\epsilon$  (IgE), and these terms may be referred to by the suppliers of immunology reagents.

### **Attaching and Effacing lesions (A/E)**

A/E lesions are tight attachments of *E. coli* O157 and other EHEC to the gut cell wall which destroy the microvilli on the cell surface. They are essential in the pathogenicity of the EHEC infections and the genes involved in the A/E lesion formation are found in the LEE pathogenicity island.

**Autochthonous flora**

Microorganisms and/or substances indigenous to a given ecosystem; the true inhabitants of an ecosystem; referring to the common microbiota of the body of soil microorganisms that tend to remain constant despite fluctuations in the quantity of fermentable organic matter.

**Bacterial interspersed mosaic elements (BIMEs)**

Small, highly repetitive DNA sequences found throughout the *E. coli* genome.

**Bacteriophage**

Virus that infects a bacterium.

**Clathrin**

Major component protein that forms a lattice-shaped coating on the cytoplasmic side of a cell's plasma membrane and coats the endocytotic vesicles which bud off from the membrane. These coated pits occur during the initial stages of receptor-mediated endocytosis. Invagination of the pit results in a clathrin-coated vesicle.

**Critical control point (CCP)**

A step at which control can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

**Coliform**

A group of bacteria originating from animal (including human) intestines and used as an indicator of the sanitary quality of water and as an indicator of sanitary quality and post process contamination in the food industry.

**Colostrum**

The name given to the first milk present in the mammary glands following birth of an offspring, it is rich in components, such as immunoglobulins, important for the suckling infant.

**Cotyledons**

A leaf of the embryo of a seed plant, which upon germination either remains in the seed or emerges, enlarges, and becomes green. Also called seed leaf.

**Coumarin**

Substance found in plants, in particular clover, with the scent of new-mown hay. Used in perfumery and to make an anti-coagulant, dicoumarin.

**Curli**

Amyloid fibres produced by certain strains of *E. coli*, which form a meshwork around the bacteria joining them together in clusters (biofilms) which are more resistant to antibiotics and the body immune defences. The amyloid fibres are similar to those which accumulate in the brain to form senile plaques (as in Alzheimer's disease).

**Contraindicate**

To indicate the inadvisability of (a medical treatment, for example).

**D-value**

The time required (usually expressed in minutes) at a given temperature to reduce the number of viable cells or spores of a given microorganism to 10% of the initial population.

**Domestic animals**

Domestic animals refer to animals directly managed by humans. To be considered domesticated, a population of animals must have their behaviour, life cycle, or physiology systemically altered as a result of being under human control for many generations. Examples include cattle, equines, goats, sheep, swine, cats and dogs.

**Dynamamin**

A protein isolated from microtubule preparations.

**eaeA**

A gene associated with the production of the protein intimin which mediates binding of the bacterium to the host cell surface.

**Enterobacteriaceae**

A large family of Gram-negative rod-shaped bacteria of the order Eubacteriales.

**Enterohaemorrhagic *Escherichia coli* (EHEC)**

The term EHEC was originally used to describe strains of *E. coli* causing distinct clinical manifestations such as haemorrhagic colitis (HC) and haemolytic uraemic syndrome (HUS) in humans. EHEC are characterised by the production of a distinct group of prophage-encoded toxins, their ability to cause A/E lesions on epithelial cells using mechanisms similar to those found in EPEC, and the possession of a 60 MDa plasmid carrying other virulence determinants that may contribute to pathogenesis. *E. coli* O157:H7 is regarded as a model EHEC.

### **Enteropathogenic *Escherichia coli* (EPEC)**

A pathotype of *E. coli* responsible for causing diarrhoeal disease in humans. EPEC strains are characterised by possession of the EPEC adherence factor (EAF) plasmid and inducible bundle forming pilus (BFP) which are involved in the first stage in EPEC pathogenesis; the localized non-intimate attachment of the organism to intestinal epithelium. One of the most important characteristics of EPEC is attaching and effacing (A/E) histopathology, characterized by the local effacement of the microvilli and intimate adherence.

### **espA**

A protein secreted by various strains of pathogenic *E. coli*, required by the bacterium as part of the process of attachment to host cells surfaces.

### **Enterotoxigenic *Escherichia coli* (ETEC)**

A pathotype of *E. coli* responsible for diarrhoeal disease in humans and often associated with travellers' diarrhoea. Strains are characterised by the production of at least one of two types of enterotoxin; LT (oligomeric heat-labile enterotoxin) and ST (monomeric heat-stable enterotoxin). A characteristic feature of ETEC is their ability to adhere to the intestinal epithelium mediated by adhesive fimbriae, also referred to as *colonisation factors* (CFs),

### **Finishing Diets**

Finishing diets are used in stock feeding. They are used during the last few months prior to slaughter to improve one or more quality factors, mainly colour or tissue fat levels. This is achieved by altering the dietary components of the feed. These diets should not be used to obtain further growth from the stock but should be used once the selected slaughter weight has been attained to round off the product so that it is in the best possible shape.

### **Fimbriae**

Filaments, smaller than flagella but with a similar structure, fringing certain bacteria including *E. coli*.

### **Flagella**

Organelles of motility (approximately 20nm in diameter). Certain bacteria express only one flagellum while others express numerous flagellae over the entire cell surface. By SDS-PAGE, most extracted flagella have a subunit molecular mass of between 50 and 80 kDa.

## **Fluorescent Labelled Amplified Fragment Length Polymorphism (fAFLP, FALP)**

See AFLP above.

## **Gene**

The basic unit of heredity.

## **Genotyping**

Methods used to differentiate bacteria based on the composition of their nucleic acids.

## **Groundwater**

Water occurring below the ground surface.

## **Glucuronidase-negative *E. coli***

*E. coli* O157 are generally glucuronidase-negative and so the absence of this enzyme is regarded as diagnostic for the presence of *E. coli* O157.

## **HACCP**

Hazard Analysis and Critical Control Point (analysis).

## **Hazard**

A biological, chemical, or physical agent in, or condition of, food with the potential to cause an adverse health effect.

## **Haemorrhagic colitis**

Can arise from VTEC infection and has symptoms of inflammation and bleeding from the large intestine.

## **HEp-2 CELLS**

A human epithelial cell line of intestinal origin useful in the study of bacterial attachment and invasion.

## **Humoral immune response**

An immune response (chiefly against bacterial invasion) that is mediated by B cells and produces antibodies specific against that antigen.

## **HUS**

Haemolytic Uraemic Syndrome. A clinical condition which sometimes arises from VTEC infection and is characterised by anaemia and kidney failure.

**Infection**

In relation to bacterial food poisoning, a condition in which a pathogen multiplies in the host's body and becomes established in or on the cells or tissues of the host.

**Intimin**

A protein required by the bacterium to mediate intimate attachment to the host cell surface. Intimin cannot produce attaching and effacing lesions by itself.

**Impervious**

Unable to allow water or any other liquid to pass through.

**Kilobase (kb)**

The abbreviation for kilobase pairs or a measure of DNA chain length. 1 kb is 1000 bases. 1500 kb pairs is approximately equivalent to a length of DNA of 1 million Daltons (Mda).

**Kilo Daltons (kDa)**

The abbreviation for 1000 Daltons. A molecule of 1 kDa has a molecular mass of 1000.

**Kinases**

Enzyme that catalyses the conversion of a proenzyme to an active enzyme. Kinases phosphorylate (add phosphorous) to a wide variety of substances. Two broad classes exist: serine/threonine-specific and tyrosine-specific.

**Lactic acid bacteria**

A group of Gram-positive, non-sporing bacteria which carry out a lactic acid fermentation of sugars. It includes species of *Lactobacillus*, *Leuconostoc*, *Pediococcus* and *Streptococcus*.

**LEE**

Locus for Enterocyte Effacement. A cluster of genes located on the *E. coli* O157 chromosome, the locus encodes five secreted proteins, including intimin, which are associated with the characteristic attaching and effacing lesions of O157 VTEC infection.

**LPS**

Lipopolysaccharide. An antigenic component of the outer membrane of Gram-negative bacteria and forms part of the 'O' side chain.

**MDa**

Megadaltons or 1,000,000 Daltons.

**Monte Carlo methods**

Are algorithms for solving various kinds of computational problems by using random numbers (or more often pseudo-random numbers), as opposed to deterministic algorithms. Monte Carlo methods are extremely important in computational physics and related applied fields, and have diverse applications including their use in quantitative risk assessment.

**Neutrophil**

A type of white blood cell with a lifespan of about 3 days. A neutrophil is specifically a form of granular leukocyte (granulocyte), filled with neutrally-staining granules, tiny sacs of enzymes (cytokines) that help the cell to kill and digest microorganisms it has engulfed by phagocytosis. Neutrophil granulocytes are commonly referred to as polymorphonuclear neutrophil (PMN) leukocytes.

**Nexins**

A type of protein.

**O-Antigen**

This is also termed lipopolysaccharide or somatic antigen and has an unusual origin. Reaction of an anti-flagella antibody with a strain of *Escherichia coli* caused an agglutination resembling condensation on glass, termed "hauch" in German, hence the term H-antigen for bacterial flagella antigens. Where no hauch was detected the term "Ohnehauch" (without hauch) was used and became O-antigen.

**O157 VTEC**

Verocytotoxin-producing *Escherichia coli* of serogroup O157.

**Ozone**

A gas with molecules comprising three atoms of oxygen.

**Pasteurisation**

A form of heat treatment that kills vegetative pathogens and spoilage microorganisms in milk and other foods, e.g. for milk, the legal requirement for the pasteurisation process in the European Union is at least 71.7°C for 15 s.

**Pathogen**

Any microorganism that causes disease in humans or animals by direct interaction with (infection of) the host.

**Pathogenic**

Pertaining to behaviour as a pathogen.

**Pathogenicity**

The ability of a bacterium to cause disease. A measure of pathogenicity is termed "virulence". For example, strains of *Shigella dysenteriae-1* and *Salmonella Typhi* are highly virulent with an infective dose of < 100 bacteria. In contrast, strains of *Vibrio cholerae* are less virulent with an infective dose >10<sup>6</sup> bacteria.

**Pervious**

Admitting passage of water.

**Phage**

See bacteriophage.

**Phage typing**

A method used to distinguish among bacteria within the same species on the basis of their susceptibility to a range of bacterial viruses (bacteriophage).

**Phenotype**

The observable characteristics of an organism, including biotype, serotype, phage type and bacteriocin type.

**Plasmid**

Extrachromosomal DNA that replicates independently of the host cell DNA. Plasmids (and the genetic characteristics they carry) are transferable between cells.

**Polymerase chain reaction (PCR)**

The Polymerase Chain Reaction. A widely used technique to generate multiple copies of a target DNA sequence by amplification.

**Polymorphism**

The ability to occur in two or more morphologically distinct types (morphotypes), depending on prevailing conditions.

**Population**

A group of individuals of the same species, forming a breeding unit and sharing a habitat.

### **Prophage**

A phage genome covalently integrated as a linear part of the bacterial chromosome.

### **Pulsed field gel electrophoresis (PFGE)**

A technique that allows chromosomal restriction fragment patterns to be produced from restriction enzyme analysis. The technique separates DNA molecules by subjecting them to alternately pulsed, perpendicularly placed electrical fields.

### **Restriction endonuclease**

Enzymes which cleave DNA strands at sites with specific recognition sites.

### **Restriction enzyme analysis**

A method for discriminating among isolates of the same species on the basis of patterns obtained from the separation of DNA fragments in agarose gel after they have been digested with one or more restriction enzymes e.g. *EcoRI*, *HaeIII*, *HindIII*, *XbaI*. Differences in the banding profiles of two isolates are referred to as a restriction fragment length polymorphism.

### **Restriction Fragment Length Polymorphisms (RFLP)**

Restriction Fragment Length Polymorphisms. A technique used to distinguish between subtypes of bacteria on the basis of differences in DNA sequences and thus the size and number of restriction fragments generated.

### **Risk**

The probability of an adverse health effect and the severity of that effect consequential to hazard(s) e.g. in food.

### **Risk Assessment**

The process of identifying potential risks, quantifying their likelihood of occurrence and assessing their likely impact on the project.

### **Risk Management**

An organised assessment and control of project risks.

### **Risk Mitigation Action**

To reduce, transfer, or eliminate risk.

### **Risk Probability**

The degree to which the risk event is likely to occur.

### **Risk Quantification**

Process of applying values to the various aspects of a risk.

### **RT-PCR**

Reverse Transcriptase Polymerase Chain Reaction. Involves the amplification of an mRNA target sequence into a complementary DNA strand.

### **Runoff**

Portion of precipitation not immediately absorbed into or detained upon the soil and which thus becomes a surface flow.

### **Sandwich ELISA**

Enzyme-Linked Immunosorbant Assay. A technique which uses enzyme reactions as indicators. The sandwich assay is a double-layer procedure and visualises specific antibody. The antigen is sandwiched between the antibody and the secondary labelled antibody.

### **Sanitiser**

An agent which yields a significant reduction in the level of harmful bacteria or other microorganisms

### **SDS-PAGE**

Sodium dodecyl sulphate polyacrylamide gel electrophoresis. A method used to separate proteins by adding the ionic detergent SDS such that proteins fold in a random configuration.

### **Serotyping**

A method of distinguishing among bacteria on the basis of their antigenic properties (reaction to known antisera). The O antigen defines the serogroup of a strain and the H antigen defines the serotype of the strain; a number of serotypes thus constitute a serogroup.

### **Sewage sludge**

Sewage sludge is the residue collected after treatment of the contents of urban drainage systems. The bulk of its contents is human wastes, although discharges to sewer of industrial effluents and animal and vegetable processing wastes, together with run-off from roads may also contribute to its composition.

### **STEC**

Shiga-like toxin-producing *E. coli*.

**Strain**

An isolate or group of isolates that can be distinguished from other isolates of the same genus and species by either phenotypic and/or genotypic characteristics.

**STM**

Signature Tagged Mutagenesis provides a means of identifying virulence genes in bacteria which are essential for the process of infection in a chosen animal model.

<http://www.microscience.com/stm.pdf>

**Stomata**

The pore openings underneath plant leaves, surrounded by guard cells, that can open and close according to the metabolic needs of the plant. They are the ports for exchange of oxygen and carbon dioxide gas for photosynthesis, but also release excess water into the air. This process of water loss maintains a steady flow of water and minerals from the roots to the leaves. To minimise the water loss, many plants regulate the duration and time of day when stomatas are open.

**Species**

A group of plants, animals or micro-organisms that have a high degree of similarity and generally can interbreed only amongst themselves to produce fertile offspring, so that they maintain their 'separateness' from other such groups.

**Thrombocytopaenia**

Low numbers of platelets circulating in the blood stream.

**Transmission electron microscopy (TEM)**

An imaging technique whereby a beam of electrons is focused onto a specimen causing an enlarged version to appear on a fluorescent screen or layer of photographic film (see electron microscope), or can be detected by a CCD camera.

**Transgenic**

Animal or plant containing genetic material artificially transferred from another species.

**Type III secretion system**

A specialised secretion system found in many Gram-negative bacterial pathogens, which is utilized to deliver virulence effector proteins directly into host cells.

**Ultra Violet (UV)**

Light travels in wavelengths measured in nanometers (nm). The short wavelengths below 400 nm are called Ultra Violet.

**Verocytotoxigenic**

Pertaining to organisms that produce a toxin capable of killing vero cells, an established cell line derived from African Green Monkey kidney.

**Virulence**

The capacity of a pathogen to cause disease, generally expressed in relation to the severity of the illness caused in the host e.g. a highly virulent strain may cause very severe illness.

**VTEC**

Verocytotoxin-producing *Escherichia coli* that characteristically produce powerful toxins that kill a variety of cell types, including Vero cells on which their effects were first demonstrated.

**Volatile fatty acids**

(VFA) are fatty acids with a carbon chain of six carbons or fewer. They can be created through fermentation in the intestine. Examples include acetate, propionate and butyrate

**Xylem**

The supporting and water-conducting tissue of vascular plants. This is the part of the vascular system consisting primarily of tracheids and vessels; woody tissue that moves water and minerals through the plant.