

Genetic Diversity, Animals, Plants and Pathogens: the Good, the not so Good and the very Bad

Introduction

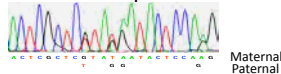
Biological diversity may be measured in a variety of ways depending of the scale of the system. The system may be as large as Planet Earth or as small as a single virus particle. Common to all biological life on Earth are the molecules of inheritance or **nucleic acids**, better known as **DNA** or in the case of some viruses **RNA**. The arrangement or **sequence** of these molecules forms the **genetic code** which is unique to every species on the planet from the **pathogens** that cause **disease**, the **plants** and **animals** that inhabit our landscapes, to those that provide us with the **food** we eat. By studying **genetic diversity** within and between species (some examples are shown below) we are able to answer many important questions, develop new tools and products which support of the aims of the **Scottish Government**.



Measuring genetic diversity; animals, plants and pathogens

A range of methods are used to study biological diversity at the genetic level. Sequencing technology has advanced enormously in the last few years to the extent where entire genomes of pathogens that affect livestock, wildlife, crops and people are readily obtainable. The complete DNA sequence or **genome** of organisms including mammals such as the cow, plants such as rice or pathogens such as the potato blight mould have recently been completed. The value of sequence information is apparent when comparisons are made between genomes and populations; disease resistant and susceptible plants and animals, pathogens that cause disease compared with relatives that don't. Genetic information may be also used for studying the dynamics of micro organisms, for example in soil, water or the gut of livestock. It can provide information on adaptation to change or levels of hybridization between native and exotic species of plants and animals.

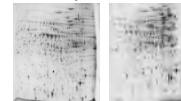
DNA sequence diversity inherited from each parent



Whole genome analysis High density SNP chip



Bacterial protein diversity

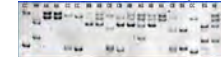


No disease Disease causing



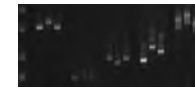
Genome sequence of the potato famine mold

Gut worm diversity



Drug resistant/Drug susceptible

Parasite population diversity



Plant DNA fingerprinting

Genome diversity



Bacterial species comparison

Maximum biodiversity, not always best
Smallpox/FMDV Viruses

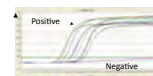


The very bad!! Conserve or remove?

Exploiting genetic diversity; tools, products and actions



Vaccine development



Molecular diagnostic tools



Sequence analysis tools



Species/strain identification



Genome sequences



Disease/climate resistant crops and livestock



Genetic epidemiology



Nature conservation

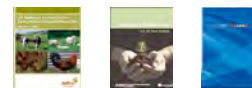


Disease surveillance



Gene and protein expression

Scottish Government policy drivers



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