

What is eDNA?

DNA is the long molecule that contains your unique genetic code. A bit like a recipe book, it holds the instructions your cells need to make all the proteins in your body. To find out more about DNA, go to our Your Genome page: <https://www.yourgenome.org/theme/what-is-dna/>.

eDNA stands for environmental DNA, which is DNA gathered from organic material in the environment. This eDNA is genetic material left by an organism in an environment. It could be left behind in faeces, external cells shed by the organisms (e.g. skin cells) or in bodily fluids (e.g. blood or urine). For example, just 1 gram of human faeces contains around 10 million cells from the digestive system (colonocytes) [Bojanova and Bordenstein, 2016].

What can eDNA be used for?

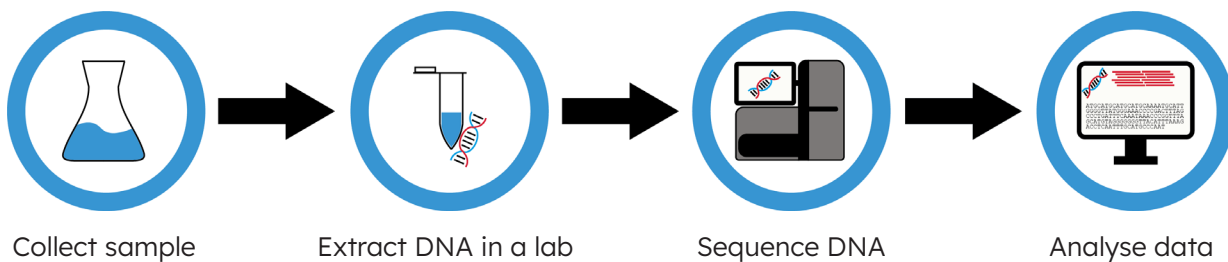
eDNA is still a relatively new concept (the term was first used in microbiology in the 1980s to describe a technique for collecting DNA from a soil sample without first isolating the target microorganisms [Ogram *et al.*, 1987]). There are a rapidly increasing range of technologies being developed to gather eDNA. eDNA samples can be gathered from a variety of sources, such as: a water sample, a soil sample or vegetation.

Current research is using eDNA to detect species in an area, to determine approximate population density in an area, to study the impact of climate change, to monitor for diseases and to assess overall health of an ecosystem.

It has many applications, for example estimating population density of commonly fished species in fishing locations from water samples can indicate whether the area is at risk of over-fishing.

How does eDNA sampling work?

In a wetland area, water samples are collected from different locations and sent to the lab. In the lab, eDNA is extracted and processed so it can be sent for DNA sequencing. The DNA sequences returned can be used to search against a DNA database, to identify which species are present in the area.



What does the data look like?

The DNA sequence used for analysis is a series of letters (A, C, G and T). Below is an example of a DNA sequence that can be used to search a database containing DNA sequences from millions of species to find a match.

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TCTATACCTTATCTTCGGGGCATGAGCCGGAATAATTGGCACAGCACTCAGCCTACTGATCCGGGCAGAA
CTAGGCCAGCCAGGGACCCTCCTGGGCGACGACCAAATTTATAACGTGATCGTCACCGCTCAGCCTTCG
TAATAATCTTCTTCATGGTAATGCCCATCATAATTGGAGGGTTTCGGCAACTGATTGGTCCCCCTGATAAT
CGGTGCCCCGACATAGCATTCCCACGAATAAACACATAAGCTTCTGACTCCTCCACCATCATTCCTC
CTTCTACTCGCCTCATCCACTGTAGAAGCTGGCGCTGGTACGGGTTGAACCGTATACCCACCTCTAGCAG
GCAACCTAGCCACGCCGAGCCTCAGTGGACCTGGCTATCTTCTCACTTCACCTGGCTGGTGTCTCCTC
CATCCTCGGAGCCATTAACCTTATTACCACAGCCATCAACATAAAACCCCCGCACTCTCACAATACCAA
ACCCCACTTTTTCGTCTGATCAGTCCTAATTACCGCCATCCTGCTCCTCCTATCACTCCCCGTCCTCGCCG
CCGGCATCACAATGCTACTAACCGACCGAAACCTAAACACCACATTCTTTGATCCTGCCGGAGGGGGAGA
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What are the benefits of identifying species?

All species in an ecosystem will have an impact through their habitat, competition for resources and position in the food web. Some organisms are given protected status by humans, as threats have put their populations at risk. By identifying species using eDNA, not only do we know about the organisms found in an ecosystem, but we can also consider their impact and the effect of changes on them.

Wild DNA

Discussion Guide

For example:

- predator populations, if unchecked, can drastically reduce populations of prey
- endangered species in an ecosystem may require additional measures for protection, such as a fishing ban to prevent over-fishing
- invasive species introduced into an area will not have evolved with predators and may bring new diseases - both of these factors can lead to them outcompeting similar organisms in the ecosystem
- some species act as indicators for the health of the ecosystem, e.g. good water quality, and people can actively maintain the environment to support their populations