

8.5

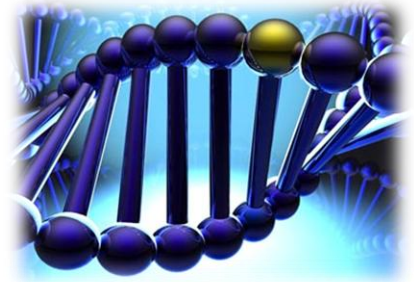
Dopamine and the DRD4 gene

Human behaviour, dopamine and DNA

Dopamine receptor D4

A chemical which acts as a **neurotransmitter** and hormone, **dopamine** is a precursor molecule in the production of adrenaline and noradrenaline (norepinephrine).

Abnormally low levels of dopamine are associated with Parkinson's disease. The chemical has a number of different effects on human behaviour, including *focus* and *addiction*. Different responses are elicited depending on the **dopamine receptor** (there are five main types – DRD1 to DRD5 – each having different structures). These dopamine receptors vary between people, so two people will have different versions of DRD3, for example, and different receptors can elicit different responses.



The receptor **DRD4** (dopamine receptor D4) has around 20 different alleles, and so the receptor varied from person-to-person. Particular variants of the DRD4 gene have been associated with behavioural disorders, such as *ADHD*. There are over fifty known variants of the DRD4 gene, differing in a specific sequence known as a **variable number tandem repeat**. A short section of nucleotides shows a different number of repeats in each variant.

The role of dopamine

Evidence for the role of dopamine in characterising certain disorders comes from studies looking at those with **ADHD** (attention deficit hyperactivity disorder). Drugs such as Ritalin given to those with ADHD to treat the neurobehavioural disorder affect the levels of dopamine in the brain, and in a number of studies, a particular variant of DRD4 has been identified as more frequent in individuals suffering from ADHD.

It has also been linked with addiction, and thus is associated with disorders such as anorexia nervosa and bulimia nervosa, as well as smoking and gambling. Research suggests particular variants of the DRD4 gene are genetically predisposed to addictive characteristics such as these.

Such research has led to the investigation of the role of other neurotransmitters in behavioural conditions, such as the chemical **serotonin** (another neurotransmitter belonging to the *monoamine* group, with dopamine and noradrenaline), which has been associated with **OCD** (obsessive-compulsive disorder), more specifically a lack thereof.