

Colour vision deficiency (Colour blindness)

If you have colour vision deficiency, you don't see certain colours. The most common form of the condition is red-green colour vision deficiency. Colour vision deficiency is usually first diagnosed using special coloured pictures called Ishihara plates.

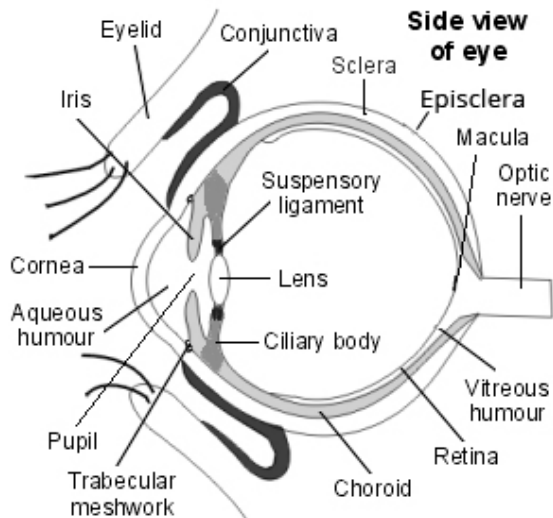
The effects of colour vision deficiency can be variable - from mild to severe. Some people with colour vision deficiency don't even know they've got it. Others may have a lot of difficulty and be unable to work in certain jobs.

What is colour vision deficiency?

Colour vision deficiency means you are unable to see certain colours. There are different types of colour vision deficiency. For example, you may be unable to tell red from green or blue from yellow. Red-green colour vision deficiency is by far the most common form.

How do you see different colours?

Different colours are seen by special cells in the retina at the back of your eye. There are two types of cells, called rods and cones. Cones are concerned with colour vision. There are three types of cones: red cones, blue cones and green cones.



Each type of cone senses a different range of light. Therefore the combination of light sensed by the different cones allows you to know the colour you are looking at. For example, stimulation of green and red cones makes you see green. If all three types of cone are stimulated then you see white.

If you don't have any of the three types of cone then you will only be able to see black, white and shades of grey. But this severe form of colour vision deficiency is very rare.

How common is colour vision deficiency?

Colour vision deficiency affects about 1 in 12 men and 1 in 200 women. It is much more common in men because the most common form (red-green colour vision deficiency) is passed on in a gene on the X chromosome (see below for further explanation).

What are the causes of colour vision deficiency?

For most people with colour vision deficiency the cause is inherited (genetic) and the special code inside each cell in your body (the gene) is passed on from your parents. The most common type - red-green colour vision deficiency - is caused by an abnormal gene on the X chromosome and is much more common in males.

Much more rarely colour vision deficiency can develop later in life as a result of conditions such as:

- Thyroid eye disease.
- Diabetes mellitus.
- Cataracts.
- Glaucoma.
- Macular degeneration.
- Alzheimer's disease.
- Parkinson's disease.
- Leukaemia.
- Sickle cell disease.

DNA, genes and chromosomes

In most cells of your body you have 46 chromosomes arranged in 23 pairs. 22 of the pairs are matching pairs. The 23rd pair of chromosomes are the sex chromosomes, which match exactly in women (who have two X chromosomes) but not in men (who have one X and one Y). One chromosome from each pair comes from your mother and one from your father. Chromosomes are made of DNA, which stands for 'deoxyribonucleic acid'. This is your genetic material. It is found in the nucleus of every cell in your body.

Each of your 46 chromosomes carries hundreds of genes. A gene is the basic unit of your genetic material. It is made up of a piece (a sequence) of DNA and sits at a particular place on a chromosome. So, a gene is a small section of a chromosome. A gene is effectively a coded set of instructions to the cells. Each gene has a particular function in your body. For example, a gene may be involved in dictating your eye colour or determining your height. Each gene has a matching 'paired' gene on the paired chromosome. So, as for chromosomes, one gene from each pair is inherited from your mother, the other from your father. Humans have between 20,000 and 25,000 genes.

How is colour vision deficiency diagnosed?

Colour vision deficiency is usually first diagnosed using special coloured pictures called Ishihara plates. Ishihara plates are used to assess red-green colour vision. (For more information see the link to 'Online colour vision tests' in Further reading below).

The Ishihara plate has 16 different diagrams made up of dots to show a number.

What problems can colour vision deficiency cause?

Nearly all people with colour vision deficiency can see things as clearly as other people but they cannot see certain colours clearly. If you have red-green colour vision deficiency you will not be able to clearly see any colour which has some red or green as part of the whole colour. For example, you will confuse blue and purple (because red and blue make purple).

The effects of colour vision deficiency can be variable, ranging from mild to severe. Some people with colour vision deficiency are unaware that they've got it.

Colour vision deficiency need not prevent someone from driving. Traffic lights can be distinguished by the position of the light.

Colour vision deficiency may cause difficulty at school. Colour vision deficiency can also affect the choice of certain jobs and careers. The list of careers that may not be possible for a person with colour vision deficiency includes:

- Certain grades within the armed forces.
- Civil aviation: pilots, engineers, technical and maintenance staff, air traffic controllers.
- Customs and excise officers.
- Railways: drivers, engineers and maintenance staff.
- Fire service officers.
- Hospital laboratory technicians and pharmacists.

- Workers in paint, paper and textile manufacture, photography and fine art reproduction.

However, the restrictions vary. For example, Australian airlines do now allow people with colour vision deficiency to be pilots.

Can colour vision deficiency be treated?

There is no treatment that can correct or prevent inherited (genetic) colour vision deficiencies.

Colour vision deficiency may be caused by an underlying condition such as thyroid disease or diabetes. The colour vision deficiency may improve with treatment for the underlying condition.

Further reading

- [Online colour vision tests](#)
- [Swanson WH, Cohen JM](#); Color vision. *Ophthalmol Clin North Am.* 2003 Jun;16(2):179-203.
- [Simunovic MP](#); Colour vision deficiency. *Eye (Lond).* 2010 May;24(5):747-55. doi: 10.1038/eye.2009.251. Epub 2009 Nov 20.

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Authored by:	Peer Reviewed by: Prof Cathy Jackson, MRCGP	
Originally Published: 19/11/2023	Next review date: 17/07/2018	Document ID: doc_29057

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