

# The molecular biography of John Dalton

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## Background

John Dalton's contribution to the theory and molecular makeup of colour blindness has continued well beyond his last published work in the nineteenth century. We review his original theories and recent developments.

## John Dalton

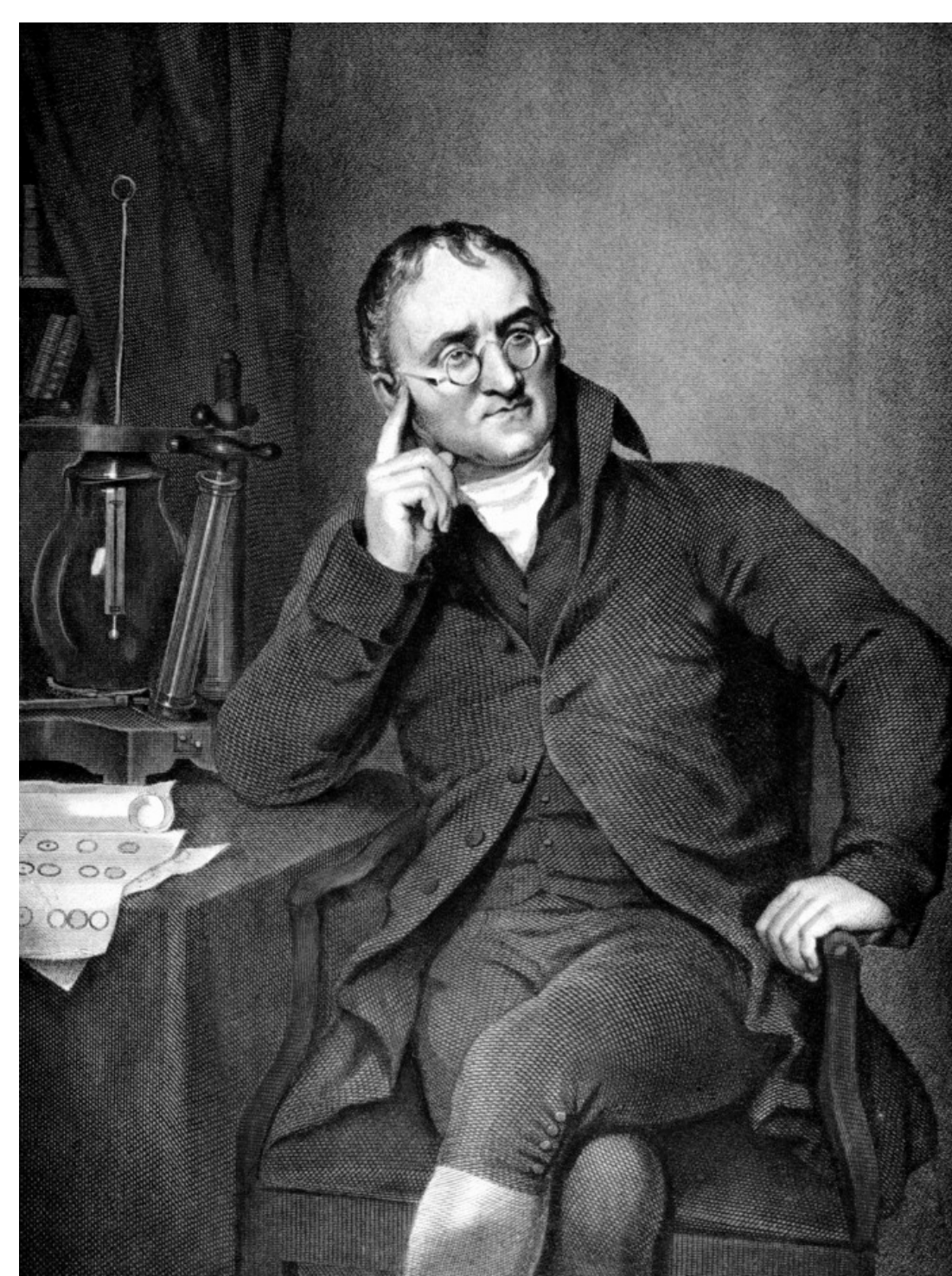
6 Sep 1766 – 27 Jul 1844

John Dalton was a celebrated chemist, scientist and meteorologist most well known for his physics theories:

- Dalton's Law of Partial Pressures

$$P_{total} = P_1 + P_2 + P_3 + \dots$$

- Atomic Theory 



## Observations on colour blindness

In 1794, John Dalton described his own colour blindness in a lecture to the Manchester Literary and Philosophical Society.<sup>1</sup>

Red sealing wax appeared nearly identical to the leaf of the English laurel (*Prunus laurocerasus*).



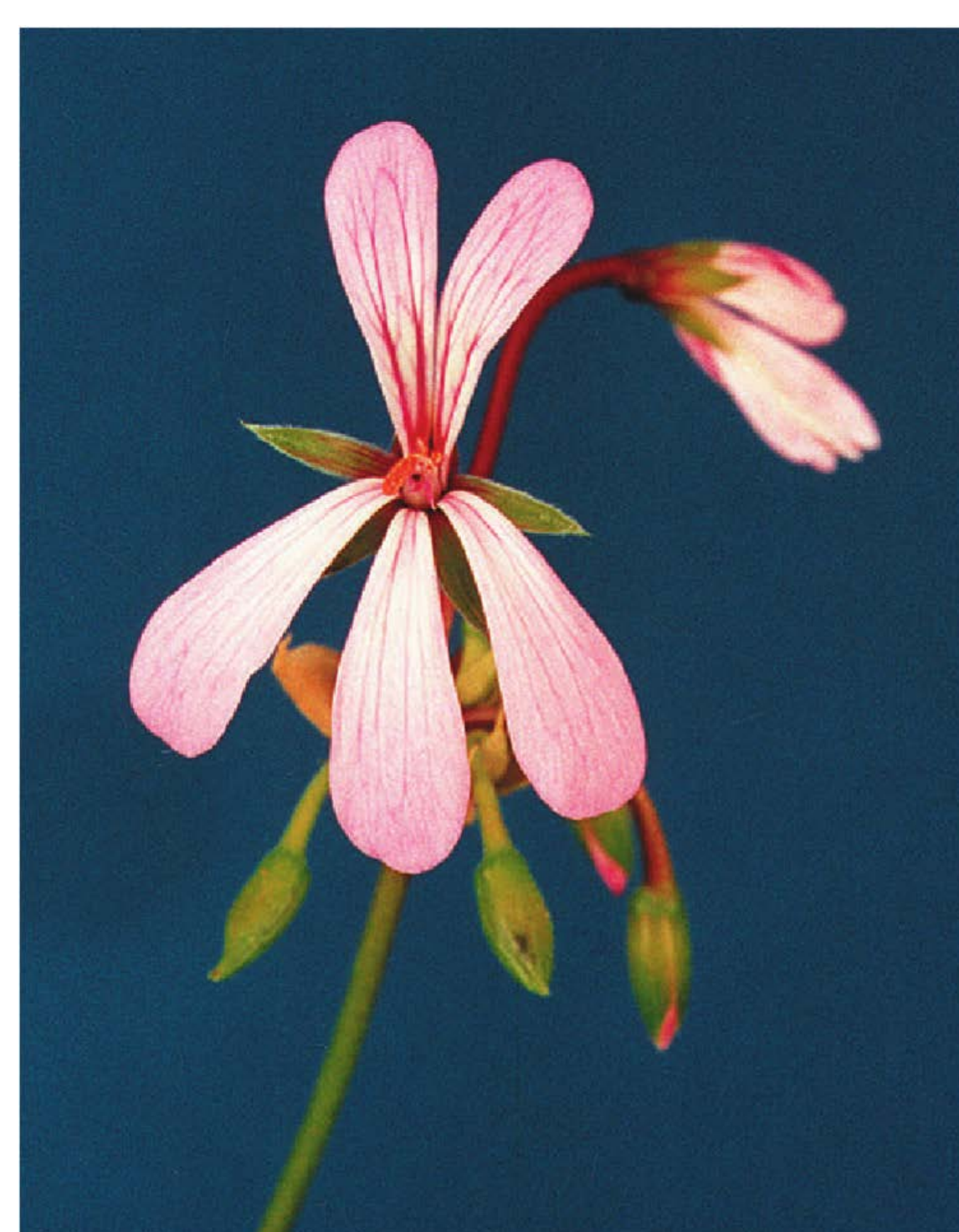
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The pink flower of the cranesbill (*Pelargonium zonale*) appeared sky blue in the daylight, but red by candle-light.

Dalton distinguished only two kinds of hue:

- Yellow, corresponding to the normal person's red, orange, yellow, and green
- Blue, corresponding to blue and purple



## An inherited anomaly

Dalton observed similar colour deficiency in up to 20 family members and friends, including his brother. Colour blindness only seemed to occur in **males**, the first clue of a sex-linked inheritance.

## Post-mortem

Dalton proposed the distortion of colour was due to a **blue-tinted vitreous**.<sup>1</sup>

His foresight to preserve his own eyes following his death resulted in his theory being disproven. Post-mortem examination by his assistant, Joseph Ransome, found his vitreous to be perfectly clear.<sup>2</sup> Ransome left the other eye intact, removed the posterior pole and observed that red or green objects were not distorted when viewed through the eye. Ransome proposed Dalton's colour blindness arose from a cortical defect.

George Palmer later proposed three types of molecule in the retina.<sup>3</sup> Thomas Young postulated Dalton's colour blindness arose from a lack of "fibres of the retina, which are calculated to perceive red", what is now known as protanopia.<sup>4</sup>

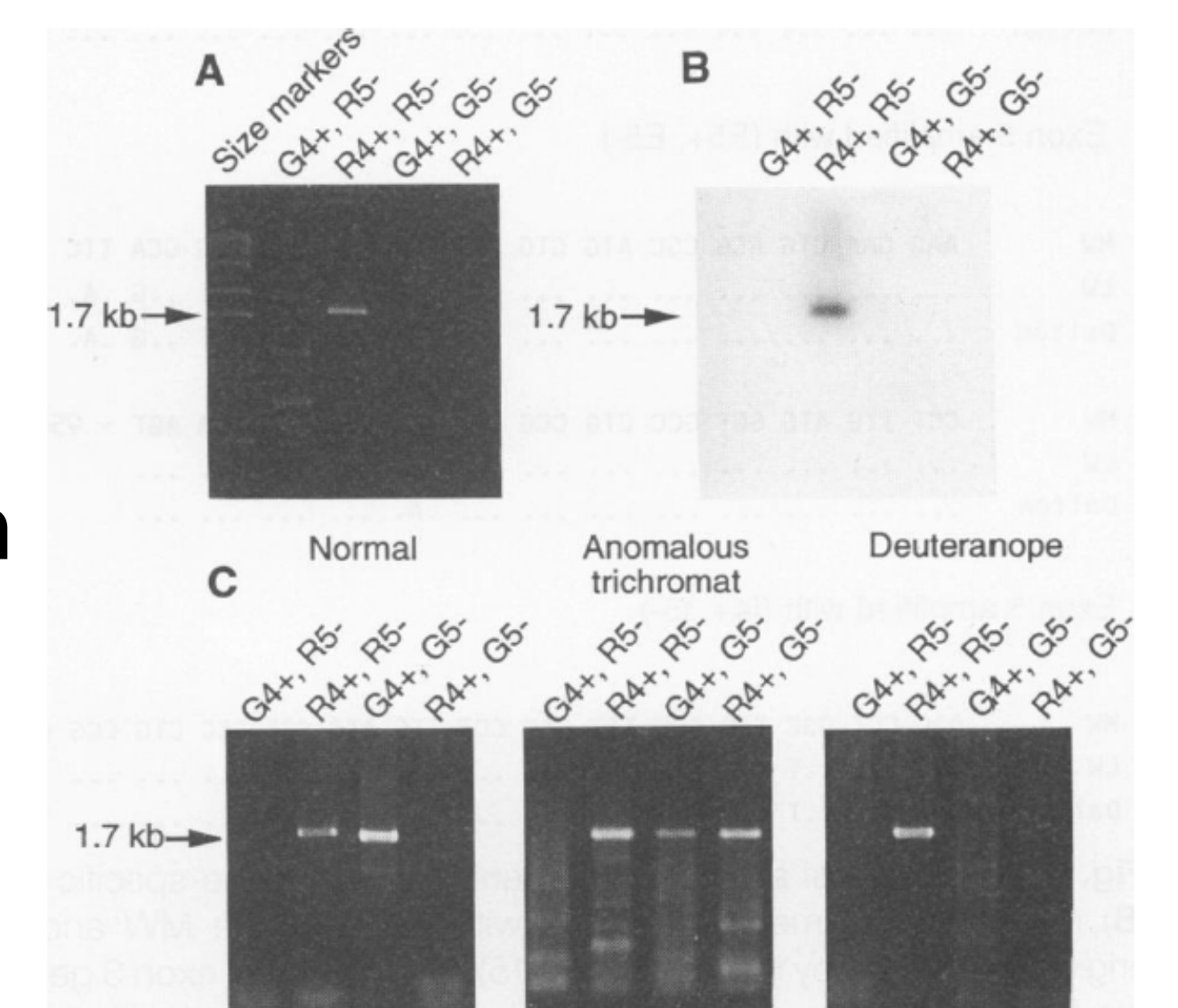


Dalton's preserved eyes<sup>5</sup>

## DNA from a shrivelled eye has the right gene

Dalton's eyes remained preserved until samples were taken in 1995 for DNA analysis.

PCR showed that Dalton lacked the middle wave length (530 nm) cone opsin gene, corresponding to **deuteranopia** and matching his historical descriptions of colour defect.<sup>5</sup>



## References

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