

Light influences mouth form polyphenism through the cGMP pathway in the nematode *Pristionchus pacificus*

Organisms can exhibit different phenotypes depending on their growing environment. Polyphenism is a biological phenomenon where organisms with the same genotype display multiple, discrete phenotypes in response to environmental conditions. The nematode *Pristionchus pacificus* shows polyphenism with the two mouth forms: the eury stomatous (Eu) form, characterized by a wider mouth opening and two tooth-like denticles, and the stenostomatous (St) form, characterized by a narrower mouth opening and a single denticle. While recent studies have partially identified the regulatory mechanism of the mouth form polyphenism, the interplay between environmental and genetic factors remains largely elusive. Our study identified light, especially short wavelengths, as a novel environmental factor influencing the mouth form polyphenism by increasing the proportion of the Eu form. Through forward genetic screening, we discovered the critical role of the cGMP pathway in phototransduction and mouth form determination. Additionally, RNA sequencing for comprehensive gene expression analysis showed that light exposure upregulated enzymes involved in drug metabolism and oxidative stress. While treatment of worms with a compound that generates reactive oxygen species (ROS) increased the Eu type, the addition of antioxidants suppressed the effects of light exposure. These results suggest that light-induced oxidative stress and the cGMP phototransduction pathway contribute to the mouth form polyphenism.