Role of Oxygen Concentration in Media on Hydra Stem Cell Growth and Differentiation under Pressure

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Abstract of Paper

Hydra is a simple organism composed of a head with tentacles and sticky foot region, with a central body column composed of stem cells, which live in water. If a hydra is dissected in half, the stem cells will facilitate regeneration of the missing part. Hydra stem cells provide a simple model for stem cell differentiation studies.

In our previous work, we studied the role of static pressures on hydra regeneration. Dissected hydra pieces were submerged at different depths inside a water column, and the regeneration rates were monitored over a period of seven days. Another experiment involved the use of pressurized chamber to apply equivalent pressures on the hydra pieces, which were kept in shallow media in a Petri dish. Results indicated that pressurization yielded significantly greater regeneration in hydra than the use of water column.

Since oxygen in water obeys Henry's Law, an increase in barometric pressure indicates an increase in dissolved oxygen. It is hypothesized that pressurizing the media increased dissolved oxygen, which could have played a role in promoting regeneration. As a result, the oxygen concentration level in the media constituted a confounding factor in the studies of the influence of mechanical pressures on hydra regeneration. The present work aims at testing this hypothesis with a means to eliminate the confounding factor.

Preliminary studies have shown that when a flexible, semi-permeable barrier is introduced between the environment within the pressure vessel and media, we can prevent additional oxygen dissolution while allowing pressurization on the hydra pieces. These studies were performed in a 24-hour time period at a pressure of 10 psi. In this paper, we will report on the complete test setup, methodology, statistical results, and the findings on the role of oxygen concentration on hydra regeneration under pressure.