



Testing effects of the SSRI drug Paroxetine on survival of a freshwater amphipod (*Hyaella* sp.)

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BACKGROUND

Serotonin selective reuptake inhibitors (SSRIs) are drugs that typically are used as antidepressants and as treatment for anxiety in humans. It has been realized that these drugs are showing up in bodies of water from our waste water (Ruhoy et al. 2008, Scudellari 2015). As these drugs pollute the waterways, it can negatively growth, survival, or reproduction in aquatic organisms (Bossus et al. 2013, Sundaram et al. 2015).

The main goals of my study were to develop protocols for maintaining healthy amphipod (*Hyaella* species) cultures in the lab, and test how well amphipods were able to survive when exposed to different concentrations of the SSRI drug paroxetine (Paxil). Amphipods in the Genus *Hyaella* are common in lakes and rivers throughout the Midwest (Thorp and Rogers 2014).

Question 1:

What is the best way to care for and keep *Hyaella* sp. alive in laboratory conditions?

- Set up 1: I placed amphipods individually in 3 mL of water in 12 well plates. All amphipods died within a couple days.
- Set up 2: I increased the amount of water and used 60 mm petri plates. Survival was also low in this set-up.
- Set up 3: I used open containers to increase oxygen circulation in 15 mL and 30 mL of water. The 30 mL of water had the highest rate of survival.

In conclusion, the 30 mL of water worked best with containing and keeping the *Hyaella* sp. alive during experimental runs. The larger volume also made it possible to keep *Elodea canadensis* in each container, which provided a constant food source.



Question2:

How well can *Hyaella* sp. survive at different concentrations of Paroxetine (Paxil)?

Experimental design:

- Independent variable: Paroxetine concentration
Experimental trt: (10^{-5} M, 10^{-6} M, 10^{-7} M)
Control trt: no drug
- Dependent variable: Monitor amphipod survival each day for 20 days
- Replication: 6 replicates per drug concentration

Experimental procedure:

- Amphipods were placed in 30mL of water with a piece of *Elodea canadensis*
- 300 μ L of the appropriate paroxetine concentration/30 mL spring water was added to the container

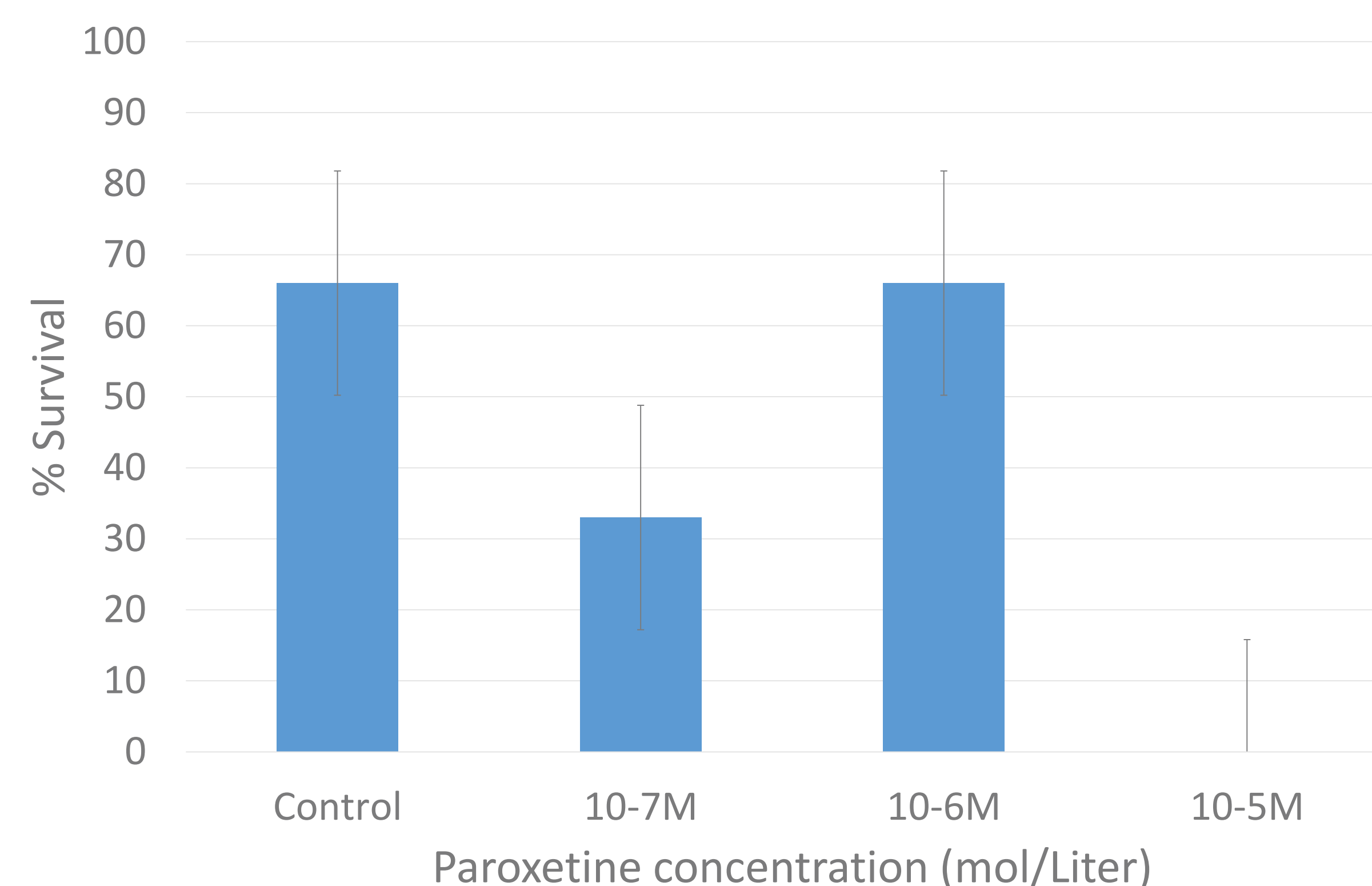


Fig. 1 % Survival of *Hyaella* amphipods after 20 days exposure to 3 concentrations of Paroxetine. No amphipods survived in 10^{-5} mol/liter Paroxetine after 10 days.

Literature cited:

Bossus MC, Guler YZ, Short SJ, Morrison ER, Ford AT (2013) Behavioural and transcriptional changes in the amphipod *Echinogammarus marinus* exposed to two antidepressants, fluoxetine and sertraline. *Aquatic Toxicology*, **151**, 46–56.

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Scudellari M (2015) Drugging the Environment. *Scientist*, **29**, 23-28.

Sundaram R, Smith BW, Clark TM (2015) pH-dependent toxicity of serotonin selective reuptake inhibitors in taxonomically diverse freshwater invertebrate species. *Marine and Freshwater Research*, **66**, 518-525.

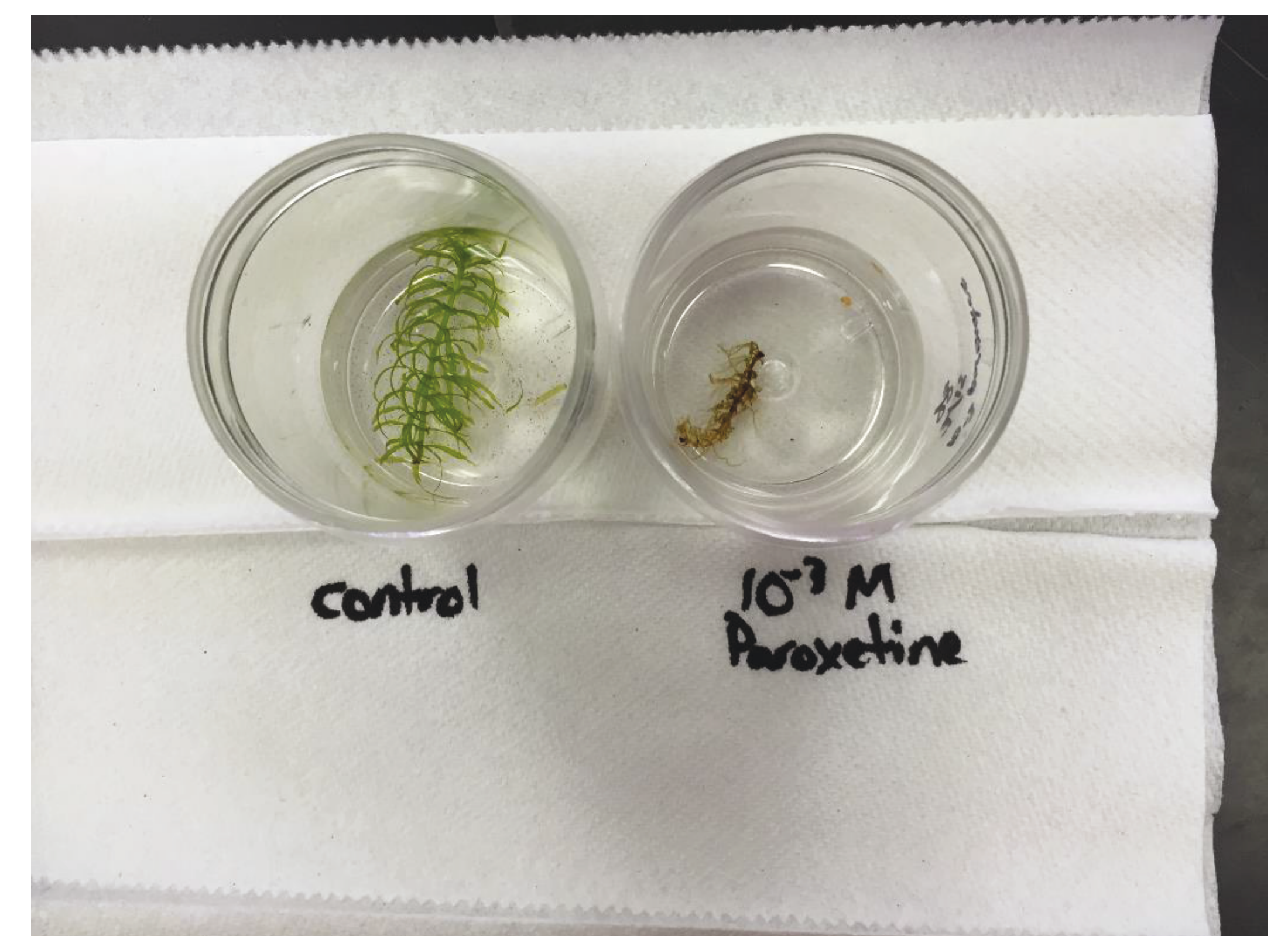
Thorp JH, Rogers DC (2014) *Thorp & Covich Freshwater Invertebrates*, Fourth edition. Academic Press, Cambridge, MA.

Elodea photo: bio.rutgers.edu/~gb101/lab1_cell_structure/section8_frames.html

Hyaella photo: www.andreaswerth.net/fotoarchiv/krebstiere-crustaceae/hoehere-krebse-malacostraca/flohkrebse-amphipoda/mexikanischer-flohkrebs-hyaella-azteca

Other Observations:

- *Elodea canadensis* (used as a food source for the amphipods) also showed negative effects due to the presence of Paroxetine
- In Control (no drug): *Elodea* stayed green
- In 10^{-5} mol/liter concentration: turned brown and began to deteriorate



CONCLUSIONS

QUESTION 1: Larger volumes of water (30 mL), maximizing air/water surface (to increase oxygen levels) and some vegetation are needed to maintain healthy *Hyaella* cultures.

QUESTION 2: Even small concentrations of the paroxetine SSRI drug can kill freshwater amphipods. In this experiment, 10^{-5} mol/liter concentration was lethal to amphipods after 10 days of exposure.

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