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Could Annual Killifish Help Us Treat Macular Degeneration with Carmen Rodriguez

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Carmen Rodriguez

Welcome to PDXPLORES, a Portland State Research podcast featuring scholarship innovations and discoveries, pushing the boundaries of knowledge practice and what is possible for the benefit of our communities and the world.

My name is Carmen Cecilia Rodriguez. I'm entering into my third year as a PhD student. I'm a part of the Biology department. My interest is studying eye development. I create a lot of protocols as well as adapt a lot of protocols, essentially to go ahead and stage embryos and look at their development. I study or I have studied two different model organisms.

I'm currently studying annual killifish. I am currently studying retinal cell regeneration in annual killifish fish. I've been tracking the eye development of annual killifish, and the biggest thing to go ahead and think about is that the current models that we have to study eye development have allowed us to understand gene expression patterns that support eye development, but they lack the context of extreme environmental conditions that actually challenge these fundamental programs.

In addition, typical vertebrate life spans can be years versus annual killifish can go through their entire adult lifespan in just a matter of months. Therefore, I am trying to establish annual killifish as a new eye model organism, and I actually believe that they are a strong model to study for age related macular degeneration, also known as AMD.

AMD is actually broken down into two categories, dry AMD and wet AMD. I will be studying dry AMD because it is 80% more common than wet AMD. Essentially for AMD, it is an irreversible loss of central vision of the retina, which is caused by photoreceptor cell death. Portions of the macula actually thin out, and essentially it ages, and there's tiny clumps of proteins known as *[unknown word]* that starts clouding the outer retina, and that's what causes the blindness.

In some cases, blood vessels actually start protruding out into the choroid and start leaking into the choroid, essentially, meaning blindness, AMD is also the cause of about 9% of all cases of blindness. It is actually estimated by 2040 that there will be 288 million cases of AMD patients. So in addition, annual killifish are an amazing model organism because they also experience embryonic DPOs, which most organisms actually don't go ahead and experience.

And what that is, is a period of developmental dormancy and metabolic arrests. So essentially, developing and depositing embryos of annual killifish are extremely resistant to environmental stresses such as hypoxia and anoxia, which just means super low amounts of oxygen or no oxygen, and that can cause irreparable damage to vital organs such as the eyes.

So I'm actually trying to hypothesize that embryos of an annual killifish actually possess molecular and physiological mechanisms that can prevent loss or regenerate eye cells when faced with oxygen stress. I've been able to characterize eye development in annual killifish and establish them as a viable model to tackle questions relating to eye development and disease.

I've done this via whole Mount Immunohistochemistry, which basically just means I make fish glow, and I've been able to explore their expression using a 3D localization of their proteins critical for eye development and cellular regeneration. Currently, I am also exploring the timing and location of the expression of key genes associated with eye development, AMD, and cellular regeneration during normal development, entrance into DPOs, and in response to anoxia and recovery from an.

My name is Carmen Cecilia Rodriguez, and I believe exploring the expression of a plethora of selected genes in response to anoxia and recovery from anoxia through RNA sequencing in the eye of annual killifish embryos will improve our understanding of vertebrate eye development and explore the potential for cellular regeneration in the eye.