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BioMass

Student Coordinator: Brenna Peterson ‘17

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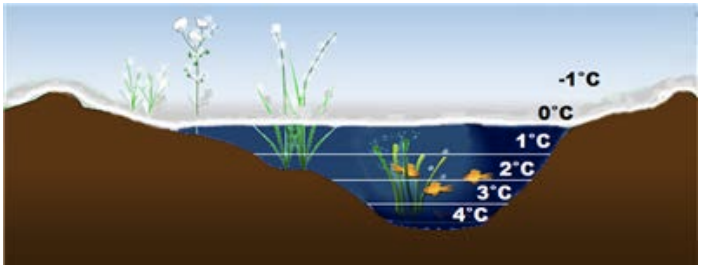
One of the Fall 2014 Photo Contest Winners

“The Salamander Slithers at Sunset” by Leah Stinson



How do fish survive the winter?

by Karly Boll ‘16

As we all bustle to and from classes during the tundra-like St. Olaf interim, we may give a passing glance or two to our squirrel friends and wonder how they are fairing this winter. It’s likely, though, that there is a whole group of animals we don’t give a second thought—fish. How have they survived the recent -15°F nights? Growing up in Minnesota, I spent many winters playing on the frozen lake by my house. Occasionally I would pause, squint between my feet, and ponder where the fish that I had caught all summer went, but the thought would quickly pass and I would be back to slipping and sliding along. I was much older than I would like to admit before I finally decided to find out the answer, which turned out to be more interesting than I expected.

Before we can understand how the fish survive the cold, we must first figure out why lakes freeze the way they do. We know that cold gases and liquids are denser than their warm counterparts, right? Well, as with all rules, there are exceptions, and water is one of them. Water undergoes something called “anomalous expansion,” or an expansion caused by cooling, that results in decreased density. This only happens between 4°C and 0°C, at which point the water freezes. Above 4°C, water follows the rule we are used to (as it warms, it gets less dense). This means that the densest water is 4°C, so in the winter, the bottoms of our lakes are actually the warmest. This explains why ice forms on the top of the body of water instead of at the bottom.

After figuring this out, I still wondered why the whole lake doesn’t freeze solid. It turns out that the answer to this question is quite simple: ice is a great insulator. The layer of ice on top of the lake means that freezing deeper than, say, six inches to a foot is a slow process, slower than our winters are. Thus, there is ample room under the ice for fish to hang out. And “hang out” is exactly what they do. Fish are cold-blooded, meaning their body temperature matches the temperature of the surrounding water. This means they don’t expend much of their valuable energy trying to stay warm, but it also means they don’t have much energy at all when they are cold. As a result, the sunfish, crappies, bass, and muskies we enjoy in the summer are simply laying low and slow in the 4°C water at the bottom of the lake, lazily waiting for the spring thaw. Perhaps fish and Oles have more in common than I thought!

Introducing Joy Broin

by Brenna Peterson '17

Joy Broin, our new Academic Administrative Assistant, joined the biology department right at the end of last semester. However, if you were off wandering in the Galápagos, snorkeling in the Bahamas, or hiding in Holland Hall this Interim, you may not have had a chance to meet her yet.

Joy is a native of Redwood Falls, MN, and studied Business Communications at Augustana College in Sioux Falls, SD. In college, she sang in choir, was a member of the Public Relations Student Society of America, and performed in several musicals and variety shows. Joy spent an interim abroad in Norway and Germany, and interned in Norway after graduation.

Joy comes to St. Olaf with notable experience in human and public relations, as well as a solid background in marketing. In her first year out of college, she served as the contact for over 90 retailers at a letterpress company in Sioux Falls, SD. She then moved to Sutter Creek, CA, and was the assistant for the head of a Sacramento start-up. Joy was in charge of planning, marketing, and social media for the company.

"I'm a big fan of organization, and I love helping people," she says.

Now that she's at St. Olaf, Joy is having fun meeting students and faculty in the biology department. As an Academic Administrative Assistant, she informs students about summer research opportunities and department events, updates the biology website, and serves as a liaison between students and professors.

"Being able to assist a lot of people fits me well," she says.

When she isn't helping students, Joy enjoys dancing, theater, singing, and playing board games (her current favorite is King of Tokyo). She loves all things Harry Potter, and is happy to be back in the Midwest after three years out west.

If you're in Regents and have a few minutes, consider stopping by Joy's office (RNS 360) to introduce yourself. She's on campus from 8 a.m. to 3:30 p.m. on weekdays, and would love to meet you!

The Hemogoblin

Story and Illustrations by Rachel Lee '15

Hendrix the Hemogoblin was empty. His bright red body had four gaping holes on the sides and that made him angry! He hadn't had oxygen for too long—it must have been several minutes by now. He had considered himself a busy hemogoblin, what with all the buffering and facilitating and transporting he was supposed to be doing. Did they expect him to function in his deoxygenated state for long? He wasn't doing anything; just sitting there, stuck in Red Blood Cell traffic in the inferior vena cava, and he had been counting down the valves, 32 of them, for what felt like hours. The other hemogoblins in his RBC were relaxed, their pointy teeth set together in firms lines. They seemed so used to this—this wasn't the life he had expected when the big boss HIF-1 called his RBC into action and transcribed, translated, and modified him. He wanted to go full speed all the time! He wanted to carry oxygen all the time! He wanted to be the star hemogoblin in his BODY. Instead, he was tied to the traffic patterns of this circulatory system and he felt like it was holding him back. Sometimes, okay maybe just once, he never bound any oxygen and it ate at him, amino acid by amino acid. He knew that he was new but he wanted to be doing things! The action and purpose they had promised when he was still in the bone marrow.

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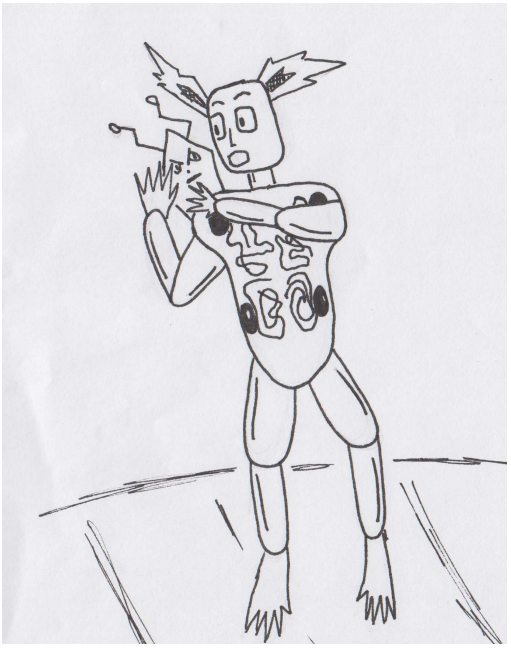
His RBC swung around the bend and the heart came into view, the big pulsating mass of muscle. He smiled. He watched the top atria contract and then the response of the ventricles. The beats resonated deep inside his binding sites; it was kind of like coming home.

They got closer and closer, the cavernous opening to enter the right atrium loomed in front of them. His RBC shot inside. Electricity flowed through the SA node and sparked another contraction. They were squeezed into the right ventricle, thump. And they were squeezed to the lungs, thump. "Magic," Hendrix whispered.

The fluorescent lights blared the numbers: Alveolar PO2: 13.3 kPa and Blood PO2: 5.3 kPa. Phew. Hendrix grinned. That difference was big; they could take up so much O2, he was bound to get some. Time to get saturated. Hendrix saw an O2 that had just diffused from the alveolar sacs and he reached out and yanked it out of solution and stuck it on one of his heme groups. Yes! Once he had one, Hendrix knew it was easier to get more—those O2 liked having friends to hang with on the hemegoblins. It worked. Another O2 approached him, waving at his friend. Hendrix scooped him up. Two more O2 floated up before he could finish attaching his second. As they left the lungs, Hedrix jumped up and down, elated. He was fully saturated! This felt so good.

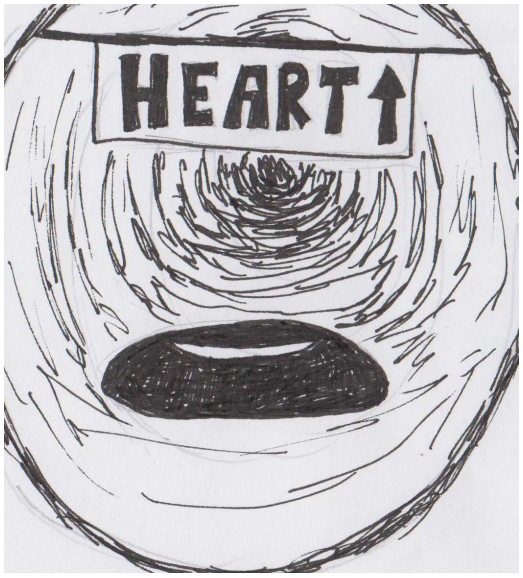


"Hey guys!" He called to the oxygens on his back. "Ready for a wild ride?" And he dipped and swerved, circling round his RBC. The oxygens giggled.

The black hole of the left atrium appeared in front of them. "Just wait for it! Get pumped! Hahaha!" Hendrix guffawed.

They passed into the left atria and left ventricle and the power of that muscle made Hendrix wild with delight. Out into the greater reaches of the unknown! "Here we go!"

The other hemegoblins looked at him from the corner of their eyes and tucked themselves neatly into the seat belts stretching across the RBC. Most of them had four oxygens too. It had been a successful exchange.



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As they sped down—Hendrix thought maybe they would make it down to the leg!—their RBC and all the others around them picked up the pace. Faster and faster, almost twice the speed they had been going at before. It must be exercise! Hendrix was pleased. Not only was the new speed exhilarating, it was the first time his BODY had exercised since he'd been pieced together. "Go, go, go!" Hendrix shouted. "Faster!"

But he felt his RBC drawing away from the aorta. "No! Not yet!" His RBC approached the exit for the Internal Illiac Artery. "Not the butt!" Hendrix wailed. "I don't want to go to the butt!" It didn't matter. His RBC was directed into the new slide and Hendrix moaned. Right to the butt.What a shame.

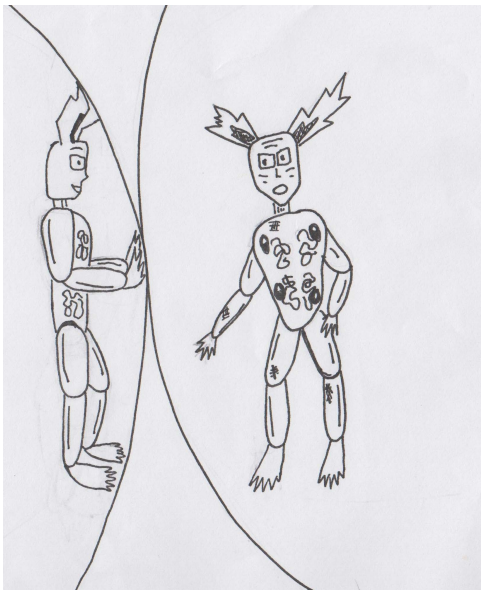
One of his fellow hemegoblins rolled his eyes. "The glutes are powerful muscles. Quit your yapping."
The RBC roared down the artery and the walls became smaller and smaller with every turn. Pretty soon, they could only travel two RBCs abreast and Hendrix knew what was coming—the capillary beds. In the arteriole, a sign blazed above them: vasodilation for the next 100 millimeters. "At least we get to go faster," Hendrix reasoned with himself.

All too soon, however, they were in the capillary bed and Hendrix felt at tugging at his back—one of his little O2 buddies was pulled off and diffused out. He lost two others in quick succession. He caught sight of a final sign: Mitochondria PO2: 1.3 kPa. Blood PO2: 2 kPa. "Holy Buckets! We are exercising up a storm!" That huge drop in partial pressure scared him; Hendrix had never been at such a low PO2 before. He hoped everything was okay. "You can do it, BODY!" His one little clinging O2 was shaking but he held on. "It's okay little guy. Don't worry!" Hendrix said it for himself too. As they left the capillary bed and moved into the venules and into the larger veins, they slowed down to a more comfortable speed. "They must not have exercised for long." Hendrix thought out loud. He stroked his long ears. The other hemegoblins looked forward, ignoring him. He didn't understand why they were so stoic. He wished they were as excited as he was. He hoped he never became as dull as them.
Before he could believe it, their RBC rounded the turn into the right atrium. To the lungs! This time the sign in the alveolar sacs read: Alveolar PO2: 13.3 kPa and Blood PO2: 3 kPa. In less than a second, one O2 hopped on his back and then two more. Like clockwork. Hendrix settled back to enjoy the ride.

When the left ventricle propelled them into the aorta, an alarm screamed. Hendrix flinched and grabbed at his oxygens to make sure they were okay.

"Green alert! Green alert!" A disembodied voice echoed throughout the artery. "Low levels of pH detected. Repeat low levels of pH detected." And it cut off.

Hendrix whirled his head around and stiffened—he didn't know what was coming. He tried to think back to his training. What did low pH mean? He watched the other hemegoblins in his RBC; some of them had green H+ bugs oto man them! Oh no—it was an H+ attack. He remembered now. They stuck on you and lowered your affinity for O2. Sneaky little things! He saw more H+ bugs lurking in the blood. Hendrix started circulating in the RBC, moving about to keep away from the bugs. It was making him anxious; he didn't even know where the RBC was heading anymore, only that the passage was getting smaller and the number of H+ bugs on his fellow RBCs seemed to be growing. He didn't get why no one else was upset! The bugs would decrease his ability to keep his oxygen buddies and he really enjoyed having them around!



In a moment of stillness, Hendrix didn't notice the H+ bug creeping around behind him. A sharp pain ran up his shoulder. "Ouch!" He whipped his head around and caught a glimmer of green clutching his shoulder blade. "Shoot!" He wiggled and danced but the bug was stuck. They were in the capillary beds and Hendrix felt the first O2 leave him. And then the next. And the next and next. He was empty once more. "You little bugger, you!" The H+ bug stuck his tongue out at Hendrix but held on.

Up to the heart again. Hendrix bit his lip. He tasted iron. This bug was making him feel sick. He hoped they could swing by the kidney on their next circuit. He didn't know how long he could last. But the other hemegoblins weren't complaining and so Hendrix kept his pain to himself. Those guys are tough. Hendrix felt his appreciation for them growing.

His RBC bumped up against another one drifting by and Hendrix noticed that the hemogoblins in that RBD looked as though they had been through a lot.

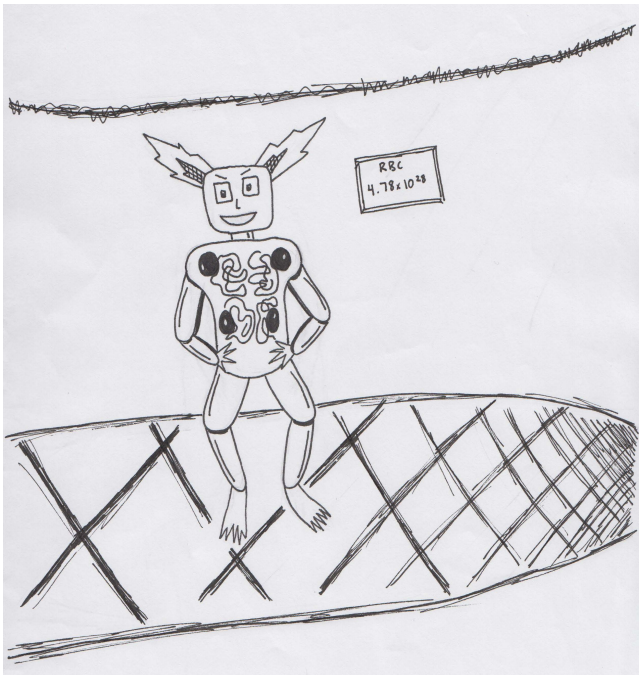
"Hey," he called out to the neighboring RBC, "what's the toughest job you've had in this BODY?"

A wizened hemegoblin rotated his head slowly, his alpha and beta subunits grinding against each other. Hendrix wondered how much longer this guy was going to last before he got shipped out to a proteasome.

"I've seen it all. High temperatures, lost O2 real fast. Low temperatures, held onto my oxygens for a long time. Got real close to one of them. Shame to see him go. Worst time was the stretch of anemia we faced a while ago—"

"—anemia?!" Hendrix could hardly contain himself. "You were part of a shortage?! I've only heard about those…"

"Yes. A rough time. We were all starved. Not enough iron to go around. And BODY got real sluggish. Luckily we got a surge of DPG to decrease our affinities. I had one DPG on me for quite some time and we would exchange stories of our travels. At first I didn't think we could get past our structural differences, but we made it there in the end. I still miss her.



She probably didn't make it for much longer once she left me. It's part of this life. The transient nature. You'll get used to it." He sighed and turned back to staring out into the blood whizzing by.

Hendrix didn't want to get used to the transient nature. He wanted to do this forever. He felt a tickling in his back.

"Hey. Hey, you!" A whisper filled his twisted ear. "I can be your friend too." The oily voice of the H+ bug.

Hendrix ignored him. They were back at the heart. He hoped they would get to offload their bugs at the kidneys. He hoped he would get to spend more time with his O2. He hoped he would become as well traveled as that ancient hemegoblin. He hoped. He felt the heart beat through him again and he smiled. Home again.

Tri-Beta Applications Coming Soon…

Tri-Beta is a Biology Honor Society open to active biology majors with a minimum biology GPA of 3.3 and completion of 3 biology classes. The St. Olaf chapter provides opportunities for Biology students to interact with each other, as well as Biology faculty. Activities include research poster presentations, field trips to science exhibits, volunteering around the natural lands, and casual dinners with professors. Tri-Beta also awards a yearly scholarship for members to help fund research. Applications to become a member of the honor society are accepted in the spring.

Membership Requirements:

Minimum GPA of 3.3 within the biology major

Minimum of 3 completed biology courses

2 completed biology club activities - A biology seminar/or dinner with the seminar speaker may count as one activity. The other activity must be a Biology Club sponsored event.

2 service related projects (Projects are not limited to biology, but preferred)

Membership Fee: $50.00

*Note: This membership fee is comprehensive, covering lifetime membership and all graduation honor materials.

Those who qualify will recieve the application sometime in February.