Last Tuesday, Feb 23, 2010, Captain Studly A. McManmuffin was murdered aboard the starship USS Fancypants. With 11 suspects to consider, the alien police force investigating the crime (Captain Pepto of the Zynap Quadrant and Lieutenant Ex-Lax of the Neblar Quadrant) required the help of Carnegie Mellon University’s own Chemistry department to solve the mystery. Undergrads and grad students, faculty and staff alike gathered at the annual murder mystery dinner to mull over the story as it unfolded.

The play was written by junior Jason Fishel (who also played Captain Pepto) and directed by senior Erin Gantz, making this a truly departmental murder mystery dinner. To aid in the solving of the murder, Grizzly the Cook prepared dinner for the guests. In spite of Grizzly the Cook’s lack of hygiene, inclination to cough into the food, and status as a murder suspect, the food was devoured with relish. As of this writing, none of the guests have reported food poisoning, or death.

Surprisingly, Grizzly the Cook’s romantic pursuit of Ko-Ko-Mo, the princess of Saturn, was met with success. Ko-Ko-Mo informed us that she is grateful for shopping and tiaras, and even got Dr. Das to admit that he is also grateful for tiaras. Whether he is grateful for shopping as well remains to be seen.

Other murder suspects included Craig the Intern, who was on board only for the easy A, but showed a fishy desire to man the ship after Captain McManmuffin’s sad demise. He falls madly in love for alien stowaway Gleep-Glarp, whose one true desire is to become a daytime
What are your research interests and why is it inspiring?
My research interests lie in the chemistry and biochemistry of nucleic acids, particularly RNA. We synthesize DNA and RNA with modified residues made in our lab and see how the properties of the ribozymes (RNA enzymes) are affected and try and understand these. This research is inspiring because nucleic acids are building blocks for life and we get to learn more about their intrinsic properties and how they function and can devise new ways by which they can react and interact.

Why did you want to become a professor?
I wanted to work on research projects with students and colleagues who are geared towards learning and also in an environment where everyone is constantly learning and having fun doing so.

Why did you come to Carnegie Mellon?
Carnegie Mellon’s Chemistry department is an exciting research and learning environment. The atmosphere here is more collaborative than other places that make similar claims. The level of science is equivalent to any other top university.

What is your favorite sport?
I used to play a lot of volleyball.

What is your favorite hobby?
I cook, molecular cuisine and smoke (barbeque) food. I also have two kids to share my hobbies with.

What is your favorite blog?
Don’t really read blogs but when I can remember, Bad Science (badscience.net) which looks at the reporting of science in the news. Also, not really a blog, but a discussion site - LTHforum.com.

What is one thing that most people don’t know about you?
I used to speak Swahili fluently until the age of five.
Oh no! In some freak accident, the first 5 elements underwent rapid nuclear fusion and fission. To restore balance to the universe, fill the grid with these elements so as to not repeat an element in any row or column, and that elements in each heavily outlined box produce the target element in the corner using the indicated operators on their atomic numbers. (Hint: the first five elements are Hydrogen, Helium, Lithium, Beryllium, and Boron.)

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Answers on page 10
Tuesday, January 12, 2010 marked the devastating tragedy of a 7.0–magnitude earthquake that calamitously hit the town of Leogane, a town 16 miles west of Haiti’s capital, Port-au-Prince. This unforeseen misfortune resulted in a death toll of approximately 230,000 people, leaving 300,000 people injured and more than 1 million civilians homeless. The plight of the numerous affected people has prompted a widespread humanitarian response. Several countries and organizations throughout the world have actively been helping Haitian earthquake victims by various means ranging from dispatch of military personnel to donation of food and money.

The dreadful aftermath of the earthquake has deprived residents of not only their homes but the basic necessities including food and water. Severe disruption of water resources has impeded the recovery process to normalcy. Illnesses such as hepatitis, cholera, and chronic diarrhea among the Haitian victims have increased due to consumption of contaminated water. These ailments are significantly detrimental to the health of the earthquake victims, resulting in an increased rate of mortality. Therefore, many organizations are trying to restore water supplies by repairing broken wells and providing water purification tablets.

Typical water purification tablets contain either iodine or chlorine. Chlorine water purification tablets contain sodium dichloroisocyanurate (NaDCC) which is an organic chlorine donor. When dissolved in water, NaDCC releases chlorine (Cl₂) which reacts with organic materials by attaching itself to nitrogen containing compounds such as ammonium ions and amino acids and leaves free chlorine to carry on disinfection. The chlorine water purification tablets can kill bacteria, and water borne organisms such as Escherichia coli and Salmonella typhi. However, the water purification tablets which contain chlorine cannot be used for extensive purification of water since they cannot guard against viruses. For more effective water purification, iodine water purification tablets are used. The iodine water purification tablets contain tetracycline hydroperiodide (TGHP) which releases 8 ppm of titratable iodine when diatomic iodine (I₂) is dissolved in water, hypiodous acid (HOI) is formed. Since the tablet contains a buffer, the treated water is maintained at acidic conditions (pH level of 5.5). At this level of pH, diatomic iodine is more abundant than hypiodous acid. This mixture of diatomic iodine and hypiodous acid effectively purifies water by removing microscopic contaminants, viruses, and bacteria. However, both chlorine and iodine water purification tablets can only be used for purification of well water since they cannot kill parasitic and disease-causing protozoa such as Giardia. Currently, chemists are still trying hard to find water purification tablets which are effective as well as inexpensive.

In spite of continual efforts to help Haiti and its poverty-stricken victims, the current dire situation isn’t going to improve overnight. We can help these people endure this disaster by paying more attention and making small, yet whole-hearted donations.
Rachel Carson, environmentalism, and chemistry
By Shaina Stacy

I have a memory of myself as a child coming across a dead bee on my porch at home, picking it up with tweezers and viewing it underneath a toy microscope that I received as a gift. I don’t know why, out of all of my childhood experiences, I remember doing this so clearly. Lately, though, I’ve been thinking back to my elementary school days, when I watched Bill Nye the Science Guy and wanted a chemistry set for my birthday. It seemed to be full of scientific curiosity.

However, this year I’ve been wondering if chemistry is really what I want to be doing after I graduate in May. Even though I was considering paths where I could still utilize my chemistry background, I started to feel like I had lost something that had been with me since I was a child.

Then, a funny thing happened. This semester I am taking 79-336 Environmental History and Politics since Silent Spring. One of the first books we read, of course, was Rachel Carson’s Silent Spring. Although there is still some controversy today surrounding Silent Spring, it launched the environmental movement. Carson brought the nation’s attention to the potentially harmful effects of the overuse of pesticides and voiced her case through eloquent prose. She found a cause she truly believed in and devoted the rest of her life to it.

Reading Silent Spring and learning about Carson’s life and work inspired me. Not only was I enthused by the passion evident in her writing, but I also realized the importance of environmental health. As chemistry majors, we understand the fascinating interactions that can occur between chemicals; however, it is also important for us as residents of planet Earth to realize how our actions impact our environment.

To those of you who still have a few years left to go at Carnegie Mellon, I have some last words of advice. Some of you may already know exactly what you want to do after you graduate. Some of you don’t (and that’s ok). No matter which category you fall into, remember to carefully consider the courses you take outside of the department. Take electives because they sound interesting to you and not just because they fulfill a certain requirement. You may certainly find inspiration in your chemistry curriculum, but the other places you find it may surprise you. Also, read Silent Spring. It captures a relatively recent period of history and brings to life the idea of an “intricate web of life whose interwoven strands lead from microbes to man.”

Letter from the Editor

We hope everyone has had a wonderful start to their spring semester. It’s that time of year: time to think about jobs, housing, applying for research grants, maybe even grad/med school, on top of all the regular schoolwork and exams! But spring break is right around the corner, so hang in there.

February is turning out to be one of the snowiest months ever, but at least we got three snowdays out of it. Check out the chemistry behind snow on page 9.

The annual Murder Mystery Dinner took place on February 23, 2010 and was a real success. We’d like to applaud everyone who worked so hard on the event to make it truly enjoyable.

We’re excited to share an interview Assistant Professor of Chemistry Dr. Das has kindly done for us. Curious about his research and hobbies? Check it out on page 2.

One major world event that kicked off our semester was the tragedy in Haiti, where a huge earthquake destroyed the capital of the poverty-stricken nation. One pressing need after such an event is clean water, and one of the most convenient methods to get some is by using water purification tablets, explained on page 4.

Quite unexpectedly, but quite delightedly, we seem to have started a column featuring chemistry seniors exploring alternative directions in chemistry. Alanna shared her thoughts on chemistry in terms of her future in our last issue, and Shaina picks up the mantle this time around, with an environmental spin on page 5.

We hope you enjoy this issue, and that the rest of your semester goes well. Have a safe and happy Spring Break!

-Neeta & Helen
television star on earth. Her slimy tentacles show an amazing ability to slip out of handcuffs, and her favorite earthling is Angelina Jolie. Lady Gaga is also popular amongst the aliens of the play, possibly due to her frequent resemblance to them.

Earthscientist Helen Ripley is responsible for creating Terminator X, whose main function is to end lives. His thick accent is reminiscent of another Terminator we all know and love and, in spite of his artificial state, his body is well-suited for the sexy dance he may or may not be programmed to do. He and Helen Ripley frequently engage in...er...Subroutine H.

First Mate Ms. Shady von Villaintype, with her goth getup and maniacal laugh, is certainly the creepiest of the crewmembers and outwardly the most likely to murder someone. But she catches the interest of Dr. Doctor, the ship’s medical officer, who has a penchant for “herbal remedies” that leave him rather useless as a doctor. Of course, it’s implied he is not licensed, so he may not have been useful even when completely sober.

With all the couples pairing up on board, single ladies Minnie Driver, the ship’s navigator, and Madame Femme Fatale, Captain McManmuffin’s bodyguard, remain romantic-interest-free. Madame Femme Fatale is particularly bitter about this, and is perhaps more concerned about this than the fact that Captain McManmuffin was murdered on her watch, and as such she is one of the prime suspects. But she’s not desperate enough to accept the decidedly unromantic overtures of Spacepirate John “Smitty” Smith.

Captain Pepto and Lieutenant Ex-Lax certainly had their hands full. They latched onto a false lead when Terminator X confessed, loud and proud, that he murdered Captain McManmuffin, but it turns out, thanks to Helen Ripley’s vehement protests, that this just stemmed from his insatiable desire to murder any living thing.

It turned out that the true murderer was Gleep-Glarp, who believed this publicity stunt would make her famous (or infamous, as it were). This crushes Craig the Intern but he, and the audience, was cheered by a couple of song-and-dance numbers that closed the show.
Murder Mystery, cont.

The couples discuss their relationships.

Captain Pepto and Lieutenant Ex-Lax question Terminator X and Earthscientist Ripley.

Could the culprit be Spacepirate John “Smitty” Smith?

Gleep-Glarp’s slimy tentacle arms drew mixed reviews from the crew of the USS Fancypants.

Terminator X leads the cast in an entertaining dance.

Madame Femme Fatale may be desperate, but she still has standards!
Oh no! Yet again, a freak nuclear reaction has turned all of the letters in the alphabet into elements! Restore harmony to the universe by solving the quote below for its original letters. Hint: He = S.

F Li C Zn W H: Zn O F Zn Co I Zn C P He O

K Co Li C Li No O Fe P Co.

F Hg B Fe P Ne Li Co: K Fe Li Hg P W He W Fe Li ?

F Li C Zn W H: Hg Li He, Zn ' H Au P He Zn O Zn N Li!

Answers on page 10
Everyday Chemistry: Snow
By Neeta Kulkarni

In honor of Snomaggedon and CMU’s epic three-day-long snow break, we would like to present to you the second topic of Reactions’ new section "Everyday Chemistry," the chemistry behind snow!

Snow is a significant part of winter in the regions of the world lucky enough to receive pretty snowflakes from November to March. Snowmen, snow angels and snowball fights were all integral parts of my childhood (and adulthood), but it’s not very often that one stops to think about how snowflakes form.

Our story begins inside a cloud, which is composed of millions of liquid water droplets nucleated on dust particles. Assuming the cloud isn’t moving, the water droplets supersaturate the air in the cloud, and when the temperature drops to around -10°C the droplets will begin to freeze. The dust particles serve to nucleate the water droplets, but some are better than others, causing not all droplets to freeze at the same time. The air surrounding these droplets remains supersaturated due to the unfrozen water droplets, and the frozen droplets rapidly grow by accumulating water vapor from the air. The tiny ice crystal takes on a hexagonal shape due to the angles of the water molecule and the hydrogen bonding that occurs when the molecules come together. (Ice and snow have the same molecular arrangement, but snow is formed by water vapor freezing, bypassing the liquid state.) As the snow crystal begins to grow, it takes on a hexagonal prism shape. Branches are formed due to diffusion, which limits the growth of the crystal as it grows larger, and the snow crystal begins to take on a 6-point star shape. Often, abrupt motion in the cloud will cause all six sides to grow arms at the same time.

Snow crystal growth is very sensitive to the local environment, especially temperature, humidity, and air currents (see diagram). As the budding snowflake travels through the cloud, the six arms of the crystal experience the same changing conditions, resulting in all six arms developing roughly the same complex growth pattern. The end result is a snowflake with complex branches and six-fold symmetry. Since each snowflake travels a slightly different path through the clouds, each individual crystal looks different. The different environmental conditions can cause the snowflake to melt or grow, and if there are too many dirt or dust particles mixed up in the water vapor, this can also change snowflake shape and size. Dust particles increase the weight of the snowflake, and can induce cracks and breaks in the crystal during formation, as well as making it easier to melt. As the other liquid water droplets undergo the same process, the liquid water in the cloud continues to be transformed into the solid state and falls to the ground below as snow!

The morphology diagram shows the different types of snow crystals that form under various conditions. According to the diagram, snow crystals form simpler shapes such as prisms and plates when the humidity (supersaturation) is low, and more complicated shapes like needles and stars at high humidity.

![Snowflake Growth Diagram](image)
Faculty advisor: Karen Stump
Editors in chief: Neeta Kulkarni, Helen Park
Editor: Nicole Rajasekera
Writers: Neeta Kulkarni, Kush Mangal, Michelle Noh, Helen Park, Shaina Stacy
Games: Swati Varshney
Layout: Helen Park, Alanna Schwartz
Photography: Hye In Kim

Hydrogen: Are you sure?
Helium: I think I lost an electron.
Helium: Yes, I'm positive!