



President's Message

Nominations for RAS Board of Directors Now Open

The Nominations Committee (Tim Tatakis, Tony Golumbeck, and Dan Krisher) will present a slate of candidates for office at the January 19, 2022 Directors meeting. If you are interested in running for a position and not already on the slate endorsed by the committee, the Bylaws allow you to be placed on the ballot by submitting a petition signed by ten endorsing members, and sending the petition to Secretary Helen Haller by February 1. Include a brief sketch of your qualifications and desire to serve.

All officer positions (1-year term) and two directorships (3-year terms) are up for election each year. A ballot will be provided in the March RAS Bulletin, a month prior to the Annual Meeting in April, when ballots will be tabulated, and the results announced.

Undergrad Student Grant Program

I mentioned in November that our Student Grants Program uses no money from member dues. It is funded by the earnings of three endowment funds created for that purpose—the Jensen Fund, the Grace Murray Student Grants Fund, and the Grants Program Endowment Fund. We give a top award of \$500 for research supplies and travel related directly to research project, plus \$50 in unrestricted funds. As of October 31, we had \$1607 in our budget for student grants. With this, three other high-quality proposals would divide up the remaining \$1057. In fact, we receive many very good research proposals and usually make at least six awards to

deserving students. This requires us to raise additional funds.

I am thrilled to report that thanks to the generosity of a few members, we will be able to make a few additional awards to students in the Natural Sciences. Look for reports on the 2021 winners starting here in our February edition.

Larry King Memorial Lecture



On November 6th at our *47th annual Scientific Paper Session*, Dr. Howard Lasker delivered the keynote talk on damages to Caribbean coral reefs over the past few decades and the changes in the biological community as they recover. Stony corals return slowly and are largely replaced by octocorals and other organisms. It was insightful to learn how climate change is affecting reefs and oceans around the world. We will have more on this issue in a future edition.

Renew Your Membership

Unless you are a Life Member, note that your membership will expire on December 31, 2021. Please renew your membership at your earliest convenience.

RAS Membership Renewal

Use this temporary link

<https://rochesteracademyofscience.org/daddysites.com/how-to-join>



Best wishes for an active and happy 2022!

Michael Grenier, RAS President

RAS Astronomy Section member Patrick Cosgrove's astrophotograph of the Rosette nebula is featured in the January 2022 issue of Astronomy magazine as the 6th out of 101 must-see cosmic objects. This image was also named a "top-pick" on Astrobin.com.

This image, annotations, and the story behind it can be seen on Patrick Cosgrove's website:

<https://cosgrovescosmos.com/projects/the-rosette-nebula-c49-in-sho>.

Congratulations, Patrick, from RAS!



Page 6 of January 2022 issue of Astronomy featuring Patrick Cosgrove's photo of the Rosette nebula.

Member Photo: Eric Day – NGC 281 in SHO Pallet



“I present to you a multi-year project completed with data from 10 nights between November 2020 and December 2021. It consists of over 500 sub-exposures with a total integration of about 44 hours. I won't go into a lot of detail, as this is multiple nights with multiple exposure times across 3 filters. Equipment consisted of an Orion 8" F/4 Newtonian reflector on an Orion Atlas mount. The camera used is a mono ASI1600MM-Pro with Astronomiks 6Nm filters. (Sii, Ha, Oiii). Location was suburban Brighton NY with 5 nights in late 2020 and another 5 nights in late 2021. The subject is NGC 281, otherwise known as ‘The PacMan Nebula’ so I pushed the final image a little more yellow to match.”
- Eric Day Dec 16, 2021

PacMan Nebula: NGC 281, IC 11 or Sh2-184 is a bright emission nebula and part of an H II region in the northern constellation of Cassiopeia and is part of the Milky Way's Perseus Spiral Arm. This 20×30 arcmin sized nebulousity is also associated with open cluster IC 1590, several Bok globules and the multiple star, B 1. It collectively forms Sh2-184, spanning over a larger area of 40 arcmin. Photo Credit: Eric Day.

Events for January 2022

For updates to events, check the Academy website <http://www.rasny.org> and section websites.

NOT MEETING IN JANUARY

Fossil Section Life Sciences

1 Sat: Astronomy Member Observing

Member Observing: Starting from dusk till last person leaves. [Farash Center for Observational Astronomy](#), 8355 County Road 14 Ionia, NY 14475. For weather related cancellations or changes contact Mark Minarich at mminaric@rochester.rr.com.

2 Sun: Astronomy Open House

Open House: 12:00 p.m. - 3:00 p.m. Observatory tours and work parties. Sledding if snow. Indoors at normal capacity for those already vaccinated, otherwise masks and social distancing or outdoors only. [Farash Center for Observational Astronomy](#), 8355 County Road 14 Ionia, NY 14475. For weather related cancellations or changes contact Roger McDonough, site manager, at rdmcdogz@aol.com.

5 Wed: Astronomy Board Meeting

7:00 p.m. UR Bausch & Lomb Hall, room 480. ASRAS members welcome. Contact: Mark Minarich at mminaric@rochester.rr.com.

7 Fri: Astronomy Members Meeting

7:30 p.m. – 10:00 p.m. RIT Carlson Center for Imaging Science, CAR-1125. Parking Lot F. Meeting will be held in person at RIT as well as virtually via Zoom. Speaker: Matthew East, L3Harris Corporation. Topic: [Astro2020 decadal survey results](#). Contact: Mark Minarich at mminaric@rochester.rr.com.

15 Sat: Herbarium Workshop

10 a.m. – 2 p.m. The Life Sciences section will hold a workshop at the RAS Herbarium, located in the basement of the [Rochester Museum and Science Center \(RMSC\)](#). At RMSC go to the front desk to meet other participants. You must be fully vaccinated, and masks are required for all visitors at RMSC. If you plan to attend, please send RSVP or any inquires to Elizabeth Pixley, herbarium curator, at eypixley@gmail.com, or call (585) 334-0977.

19 Wed: RAS Board Meeting

7:00 p.m. Virtual meeting using Zoom. For details, contact Michael Grenier at mgrenier@frontiernet.net.

25 Tue: Mineral Virtual Meeting

7:00 p.m. [Zoom](#) meeting. Meetings this academic year are held on the 4th Tuesday of the month. [Elisa Bergslien, PhD of Buffalo State College](#) will speak about forensic geology. She'll share how soil analysis and crystalline structure of [cremains](#) are useful for forensic purposes. Members will be emailed a link for the meeting. Guests welcome. Contact: J. Dudley at juttasd@aol.com.



Venus. Credit: Douglas Kostyk, RAS Director.

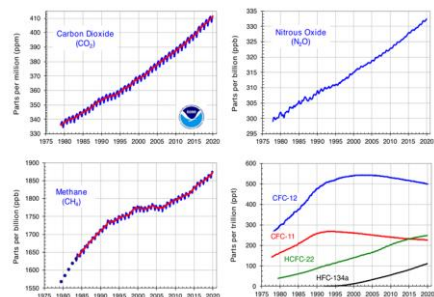
Featured 2021 RAS Paper Session Poster

Reeba Thomas and K.S.V. Santhanam, Ph.D., School of Chemistry and Materials Science, Rochester Institute of Technology.

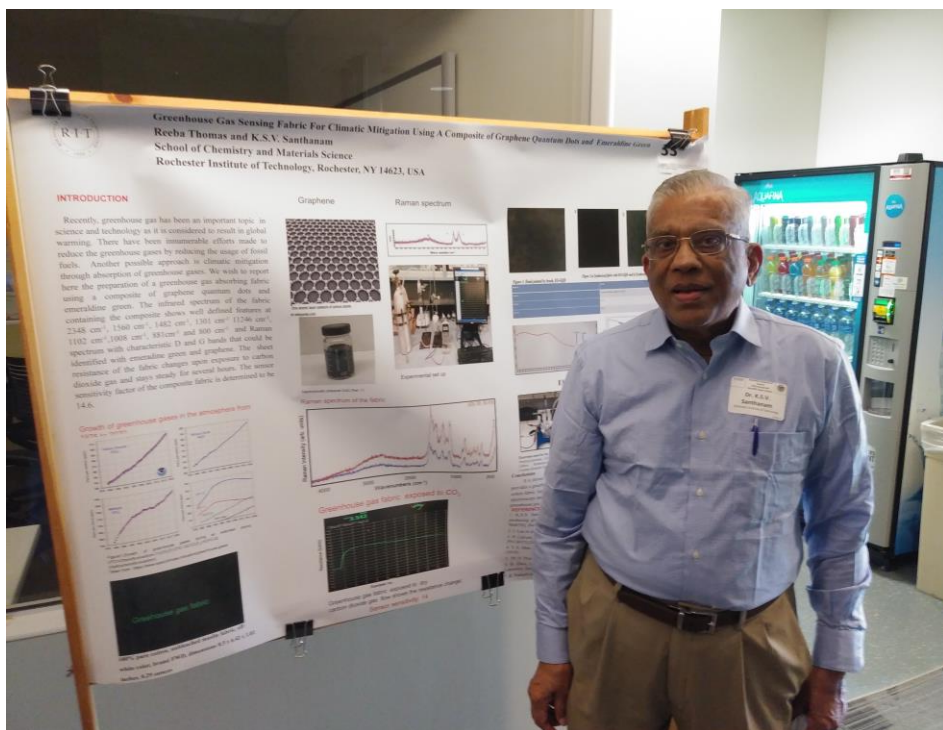
Greenhouse Gas Sensing Fabric for Climatic Mitigation Using A Composite of Graphene Quantum Dots and Emeraldine Green.

Introduction

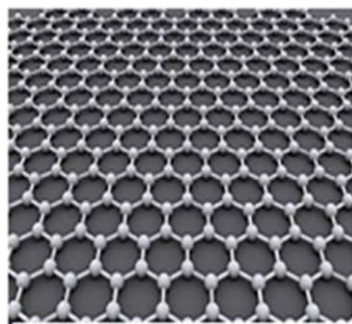
Recently, greenhouse gas has been an important topic in science and technology as it is considered to result in global warming. There have been innumerable efforts made to reduce the greenhouse gases by reducing the usage of fossil fuels. Another possible approach is climatic mitigation through absorption of greenhouse gases. We wish to report here the preparation of a greenhouse gas absorbing fabric using a composite of graphene quantum dots and emeraldine green. The infrared spectrum of the fabric containing the composite shows well defined features at 2348 cm^{-1} , 1560 cm^{-1} , 1482 cm^{-1} , 1301 cm^{-1} , 11246 cm^{-1} , 1102 cm^{-1} , 1008 cm^{-1} , 881 cm^{-1} and 800 cm^{-1} and Raman spectrum with characteristic D and G bands that could be identified with emeraldine green and graphene. The sheet resistance of the fabric changes upon exposure to carbon dioxide gas and stays steady for several hours. The sensor sensitivity factor of the composite fabric is determined to be 14.6.



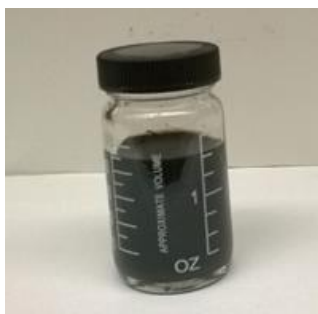
Growth of greenhouse gases in the atmosphere from 1975 to 2020.
Credit: <https://www.epav/climate-indicators/greenhouse-gases>



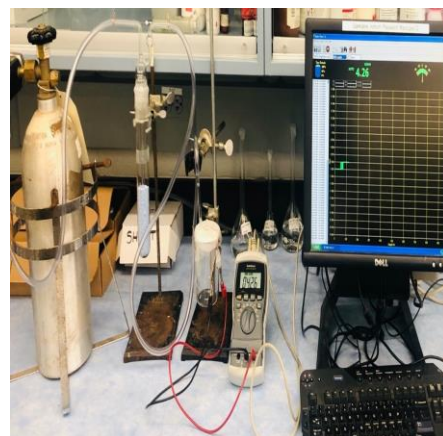
Author in front his poster at the 47th Annual RAS Fall Paper Session held November 6th at Nazareth College.



One atomic layer network of carbon atoms
en.wikipedia.com



Electrolytically prepared GQD [Ref. (1)]

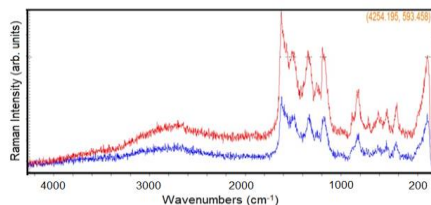


Experimental Setup

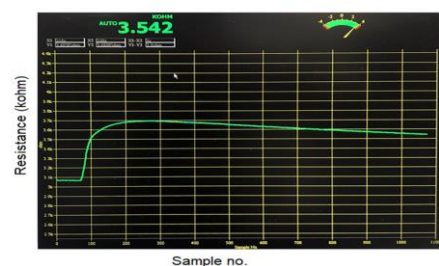


Electrodes used for the measurements
Working electrode – GQD modified Glassy Carbon
Reference electrode: SCE
Counter electrode: Graphite

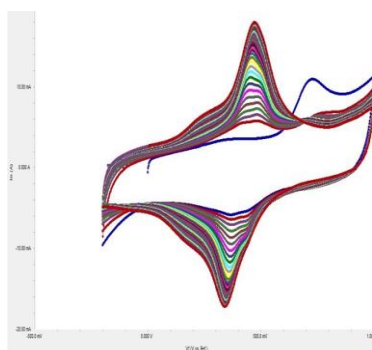
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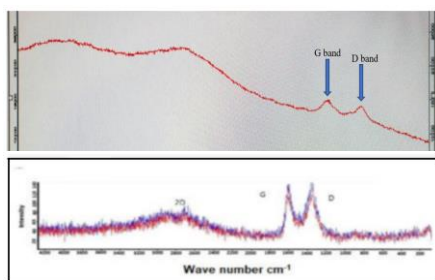
Raman Spectrum of the Fabric



Greenhouse gas fabric exposed to dry carbon dioxide gas flow. shows the resistance change; Sensor sensitivity: 14



Emeraldine green on GQD electrode



Raman Spectrum



Figure 1: Hand painted by brush, EG-GQD

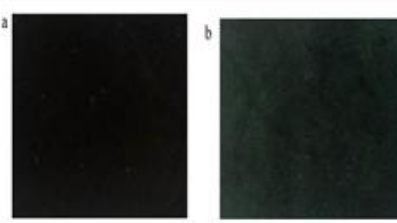


Figure 2: (a) Synthesized fabric with EG-GQD and (b) Synthesized fabric with EG

Material	R(kΩ)
Fabric 1	Uneven Resistances, Regions of infinity
Fabric 2	4-13
Fabric 3	20-22

Conclusions

It is shown that in situ coating of a cotton fabric graphene quantum dots-emeraldine green provides a greenhouse gas sensor (CO₂) with a good sensitivity. Three methods of depositions of cotton fabric have been carried out. The fabric has been characterized by FTIR, Raman spectroscopy, and electrochemical methods. The fabric provides a good platform for sensing greenhouse gas.

References

1. K.S.V. Santhanam, S. Kandlikar, M. Valentina and Y. Yang, Electrochemical process for producing graphene, graphene oxide, metal composites and coated substrates, US patent No. 9840782, December 12, 2017.
2. J. Lee et al., “Conductive Fiber-Based Ultrasensitive Textile Pressure Sensor for Wearable Electronics” in *Advanced Materials*, vol.27, no. 13, pp. 2433-2439, April, 2015.
3. P. Calvert, D. Duggal, P. Patra, A. Agrawal, and A. Sawhney, “Conducting Polymer and Conducting Composite Strain Sensors on Textiles” in *Molecular Crystals and Liquid Crystals*, vol. 484, no. 1, pp. 291-302, April 2008.
4. Y. E. Shin, J. E. Lee, Y. Park, S. H. Hwang, H. G. Chae, and H. Ko, “Sewing machine stitching of polyvinylidene fluoride fibers:

programmable textile patterns for wearable triboelectric sensors”, in *Journal of Material Chemistry A*, vol.6, pp. 22879- 22888, August 2018.

5. M. D. Husain, R. Kennon, and T. Dias, “Design and fabrication of Temperature Sensing Fabric” in *Journal of Industrial Textiles*, vol. 44, no. 3, pp. 398-417, November 2014.

6. B. Zhou, C. A. V. Altamirano, H. C. Zurian, S. R. Atefi, E. Billing, F. S. Martinez, and P. Lukowicz, “Textile Pressure Mapping Sensor for Emotional Touch Detection in Human-Robot Interaction” in *Sensors*, vol. 17, no. 11, 2585, November 2017.

7. W. He, C. Wang, H. Wang, M. Jian, W. Lu, X. Liang, X. Zhang, F. Yang, and Y. Zhang, “Integrated textile sensor patch for real-time and multiplex sweat analysis” in *Science Advances*, vol. 5, issue 11, November 2019.

8. R. Prakash and K. S. V. Santhanam, “Electrochromic window based on polyaniline” in *J. Solid State Electrochemistry* 2, No. 2, pp.123–125, October 1998.

Discover David Bishop's Latest Supernovae Website

[Editor's note: this article is reprinted with permission from Doug Rich who first printed this article on January 2008 on his blog:

<https://www.richobservatory.com/Site/Article.htm>.

David Bishop's Supernovae database can be found here:

<https://www.rochesterastronomy.org/snimages/index.html>.

David Bishop is a RAS Fellow as well as the current vice-president of the Astronomy Section of RAS.]

A supernova has just been discovered in a well-known galaxy, and right away there are questions. An amateur may wonder if his Dobsonian telescope is large enough to see the supernova visually. How bright is this new stellar firecracker? Are there finder charts? Professional astronomers and more advanced amateurs want to know: is there a recent, pre-discovery image of the host galaxy? Has the supernova's spectrum been taken? A visit to David Bishop's [Latest Supernovae web page](#) will answer these questions and will also provide a library of information about other bright supernovas discovered since January 1996.

How Bishop's web page evolved

By the early 1990s several dedicated amateur astronomers were engaged in active supernova search programs. Following in the footsteps of the legendary discoverer [Robert Evans](#), some of these amateurs searched visually. Others used digital CCD cameras to look deeper into space. Around this time, [Mirko Villi](#), an Italian astronomer, started the [International Supernovae Network](#) (ISN). The ISN was a group of amateurs who, by using the internet, shared discovery data and helped each other with the supernova confirmation process. This concept was especially helpful when a discoverer's follow-up observations were not possible because of bad weather. The ISN also had an internet web page that displayed

images of new discoveries. It included the supernova's name and type, discoverer's name, discovery date, and host galaxy. In 1993, Spanish amateur [Francisco Garcia Diaz](#) found a very bright and peculiar supernova in M81 – named SN1993J. David Bishop, at the time a young astronomer from Westmoreland, New York, heard about the discovery. Dave is not a supernova hunter but does have an affinity for exploding stars and a background that includes working with computers and software. He checked the ISN page and other sites, looking for details about this new discovery. He found bits and pieces of information about SN1993J at many different web locations. Then in 1996 another unusual supernova in NGC5584 caught Dave's attention. Again, the details were scattered. Driven by a desire to have all supernovae discovery information consolidated and accessible from one internet site, he created the **Bright Supernovae** web page. His new site expanded upon data already displayed on the ISN web page, which later became inactive. It also featured discoveries from professional search programs. At first the **Bright Supernovae** site listed all bright supernova discoveries (mag. 18 or brighter) found only in NGC and IC galaxies. By 1998, the page included bright discoveries in galaxies from all catalogs. He also changed the site name to the [Latest Supernovae web page](#).

What information is displayed?

If it's your first cyber-trip to the **Latest Supernovae** website, you'll notice a few paragraphs at the top of the page laced with general supernova facts and discovery statistics – a little supernova history, how many discoveries so far this year, how many last year, the brightest supernova, etc. After reading a couple of sentences you definitely get the feeling that this website creator is committed to the topic.

To the left of the top page is a quick reference column of all active supernovas brighter than magnitude 17.

The meat of the **Latest Supernovae** website consists of

images of supernovas and associated information listings in the order of discovery – the most recent being at the top. Each thumbnail image is usually the actual discovery image (inverted form) sent in by the amateur or professional discoverer(s).

To the right of the thumbnail, the data block includes pertinent material such as the supernova's name and official announcement link (to the [Central Bureau of Astronomical Telegrams](#)). Also listed is the date of discovery, discoverer, host galaxy, exact position, type, and magnitude of the find. In addition, there are links to a galaxy data base, finder charts, photometry reference frames, light curves, spectra, and additional CBAT notices.

Appended to the data blocks are links to after-discovery images submitted by amateurs and professionals. Dave encourages follow-up images and photometric measurements on active supernovas, so that he can update their changing magnitudes.

Posted on another page of the site are extragalactic novae found in neighboring galaxies M31, M33, and M81. The images and data are archived back to 1998.

If you are looking for information about a recent or even not-so-recent exploding star, the **Latest Supernovae** web site is your one-stop destination

Wide range of users

Anyone fascinated by astronomy will enjoy browsing the **Latest Supernovae** web page. Seeing a new "guest star" in a beautiful spiral galaxy can evoke a sense of wonderment and intrigue.

Supernovas come and go quickly. Usually, they're discovered in very distant galaxies, and fade in just a couple of months. When looking for a possible "target" for study, university students and their professors check with Dave's site for the best possible subject – a

(Continued on p. 6)

Supernovae Website

(Continued from p. 5)

supernova that is new and bright and in a convenient section of the sky for CCD imaging.

In the course of their search programs, amateur supernova sleuths often come across “suspects” that have already been discovered.

Prompt determination can be made by using Dave’s “site search” feature. When the parent galaxy is entered into the search window, the utility displays all supernova information linked to this particular galaxy.

“I find Dave’s site to be excellent,” states [Tom Boles](#), a UK amateur with more than 100 discoveries. “I often use it to see what a previous discovery looks like in case there is a second candidate in the same galaxy. It saves doing astrometry.”

[Robert Evans](#), the amateur searcher who holds the record for the most visual finds (41 to date), comments, “I use David Bishop’s website a good deal.... When starting a period of observing, I check to see if there is a supernova that I might come across, but which I did not already know about.”

Quick access to reliable supernova data is essential for all astronomers who examine exploding stars – including the professionals. “David Bishop’s web site is incredibly useful,” remarks [Alex Filippenko](#), Principal Investigator with the Lick Observatory Supernova Search Program (LOSS). LOSS operates the [Katzman Automatic Imaging Telescope](#) – the world’s most successful nearby supernova search engine. Filippenko adds, “My team consults Dave’s website every time we want to get spectra of nearby supernovae with the Lick 3 meter and Keck 10 m telescopes. The finder chart for each supernova is at our fingertips, and there is information (with appropriate links) on its discovery, host galaxy, etc. Having access to his site saves us a large amount of time.”

“David’s website is an invaluable help to the supernova community, professional and amateur alike,”

notes [Stephane Blondin](#), a Center for Astrophysics Scientist who manages the spectroscopic follow-up campaign of nearby supernovae with the [Fred Lawrence Whipple Observatory](#) 1.5 meter telescope. “Moreover, the website constitutes an impressive database of bright supernovae, which is a fundamental aid in my daily professional activities.”

Normally the site receives about 5000 “visits” each day. That daily number can increase to around 50,000 when an unusually bright discovery is made.

Site maintenance and costs

How difficult is it to keep this complex, dynamic website up to date? “Not hard at all,” says Dave, a chip designer and engineer for Kodak who now lives in Hilton, New York. Software programs developed by him do most of the revision work. “I just plug in the changes on my computer. It’s pretty straightforward.” A family man and father of two, Dave spends a little more than an hour each evening updating his website – “usually after the kids go to bed.” A time-critical change can be made anytime, and almost anywhere, thanks to wire-less technology. “I once updated the site during a coffee break while at a business meeting in California,” Dave quips.

I wondered about the major costs incurred in operating such a website – a site that contains 2 gigabytes of data. The web host server gives Dave free hosting with unlimited bandwidth. His subscription fees to receive the Central Bureau (CBAT) discovery announcements (via internet) are also taken care of by an appreciative amateur astronomer. Half-jokingly, I asked Dave what he would accept as payment for providing us supernova

hunters such dedicated service for more than a decade. “When you’re out there searching – if you happen to find an undiscovered asteroid – you can name it Bishop,” was his reply.

Update – February 2009: supernova and asteroid discoverer Michael Schwartz of the [Tenagra Observatories](#) has named [asteroid 70401 Davidbishop](#). Congratulations Dave!

Update – December 2021: “Since this article was originally published, Dan Milisavljevic of Purdue University, has decided to sponsor the supernova page. He has generously given me a mirror site on Purdue University’s web server: <http://www.physics.purdue.edu/brighsupernovae/>

Other mirror sites, collaborations, and researchers come and go on a regular basis over the decades. Finally, after 25 years the format of the page is starting to show, as database-managed web designs become more common. My site still is the only one offering links to images, and updated magnitudes for the latest in supernova. However, maintaining the site has become an issue. Back in 1997 there were 163 total discoveries. In 2021, I have cataloged 22,748 so far. Several objects discovered at a very dim Mag 18, have brightened into something findable with an amateur telescope. People would never know about these if it were not for my web page. The occasions when I am sited in astronomy magazines, or my page is referenced in papers, keeps me going and maintaining the page every day when I can.”

- David Bishop, December 27, 2021



Image left is of AT2021afdx, a supernova reported on November 24, 2021, on David Bishop’s Latest Supernovae Website.

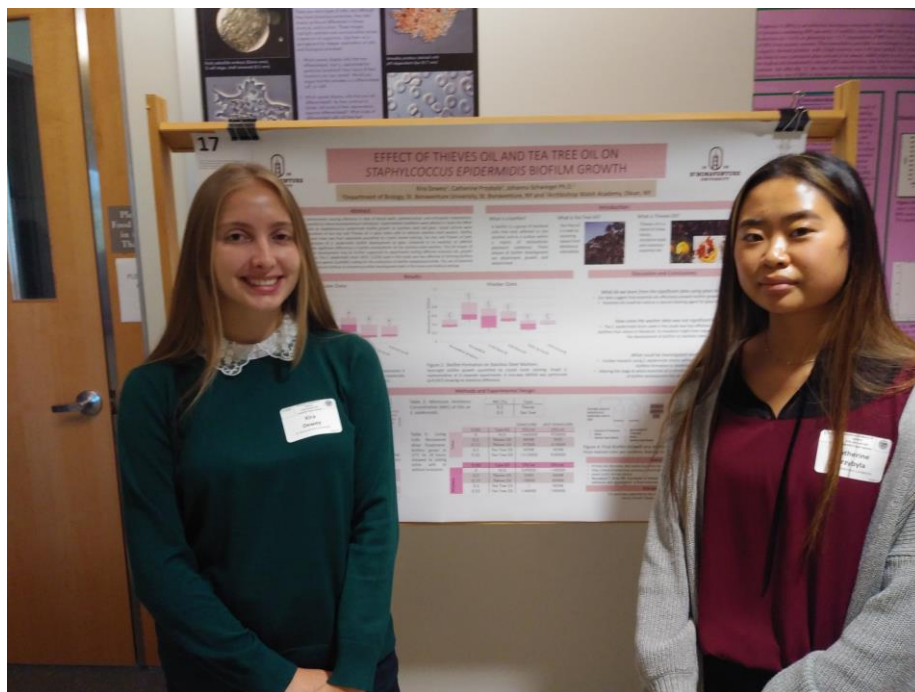
Featured 2021 RAS Paper Session Poster

Kira Dewey, Catherine Przybyla, and Johanna Schwingel, PhD, Department of Biology, St. Bonaventure University and Archbishop Walsh Academy, Olean, NY.

Effect of thieves oil and tea tree oil on Staphylococcus epidermidis biofilm growth.

Abstract

Biofilms are ubiquitous in our environment causing infections in sites of dental work, catheterization, and orthopedic implantation. Biofilm infections are particularly harmful to immune-compromised individuals. Experimental conditions were piloted to study the effect of tea tree and Thieves essential oils on *Staphylococcus epidermidis* biofilm growth on stainless steel and glass. Liquid cultures were grown overnight in varying concentrations of tea tree and Thieves oil in glass tubes with or without stainless steel washers. Biofilm development on both the washers and tubes was then separately quantified by crystal violet staining. Tea tree and Thieves oil both caused a statistically significant reduction of *S. epidermidis* biofilm development on glass compared to no essential oil (ANOVA $p=0.00004$). There were no statistically significant differences in biofilm development on the stainless-steel washers. The full impact of essential oils on *S. epidermidis* biofilm development may be further supported by experiments testing different essential oils, growth surfaces, and different bacterial strains. The *S. epidermidis* strain (ATCC 12228) used in this study was less effective at forming biofilms than others in literature as it lacks the *ica* operon (*icaADBC*) coding for the production of biofilm exopolysaccharide. The use of essential oils could prove to be an effective and natural method of preventing biofilm development both in the home and medical settings.



Authors Kira Dewey and Catherine Przybyla in front of their poster at the 47th Annual RAS Fall Paper Session held November 6th at Nazareth College.

What is a Biofilm?

A biofilm is a group of bacterial cells that exist adhered to one another and to a surface within a matrix of extracellular polymeric substance. Three phases of biofilm development are attachment, growth, and detachment.

What is Tea Tree Oil?



Tea Tree oil is made by steaming leaves from *Melaleuca alternifolia*.

What is Thieves Oil?



Thieves oil is a blend of clove, lemon, cinnamon bark, and rosemary essential oils

Discussions and Conclusions

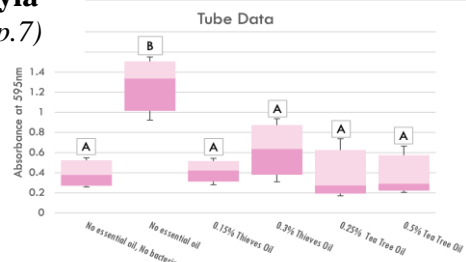
Did treatment kill cells? Or prevent adherence?

We sonicated the tubes and washers (setting? Time?) after washing three times with phosphate buffered saline (PBS), then plated varying dilutions. We also plated dilutions of the PBS without sonication. The plates showed that *S. epidermidis* cells were still living even after treatment with .3% Thieves oil and .15% Thieves oil. This oil may have inhibited attachment but did not kill all cells. Not as many living cells were recovered from tubes and washers treated with tea tree oil.

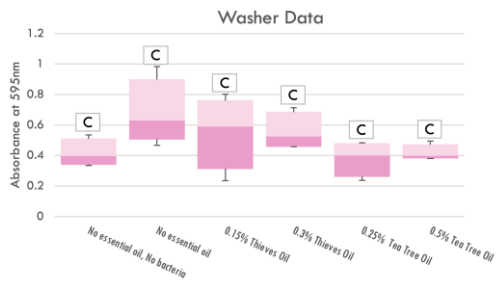
How come the washer data was not significant?

The *S. epidermidis* strain used in this study was less effective at forming biofilms than others in literature as it lacks the *ica* operon (*icaADBC*) coding for the production of biofilm exopolysaccharide. This mutation might have negatively impacted the development of biofilm on stainless steel.

(Continued on p.8)



Above Figure: Tube Data Averages. By a Tukey Kramer test, group B was found to be statistically different from groups labeled A. $p = 0.000041$ by one-way ANOVA. Absorbance Measured by crystal violet staining.



Above Figure: Washer Data Averages. A one-way ANOVA was conducted, with $p=0.097$ ($p>0.05$.) No pairs were found to be statistically different from one another by crystal violet staining

What do we learn from the significant data?

Our data showed that essential oils effectively prevent biofilm growth on glass. Essential oils could be used as a natural cleaning agent for glass surfaces.

Further Instructions:

The full impact of essential oils on *S. epidermidis* biofilm development may be further supported by experiments testing different essential oils, growth surfaces, and different bacterial strains. The use of essential oils could prove to be an effective and natural method of preventing biofilm development both in the home and medical settings.

[References available from editor upon request.]

ABOUT THE ACADEMY

The Rochester Academy of Science, Inc. is an organization that has been promoting interest in the natural sciences since 1881, with special focus on the western New York state region. Membership is open to anyone with an interest in science. Dues are minimal for the Academy and are listed in the membership application online. Each Section also sets dues to cover Section-related publications and mailings. We are recognized as a 501(c) 3 organization.

For information, contact President Michael Grenier at (585) 671-8738 or by email paleo@frontier.com.

The Academy Internet website is <http://www.rasny.org> or see us on Facebook at <https://www.facebook.com/Rochester-Academy-of-Science-792700687474549>.

This "BULLETIN" is produced monthly, except July and September, by the Astronomy Section, Rochester Academy of Science. Submissions are due by the 10th of the month and may be emailed to editor@rasny.org.

The Academy postal address is P.O. Box 92642, Rochester NY 14692-0642.

ROCHESTER RESEARCH IN REVIEW

[December 22, 2021, Cornell University, Semiconductors reach the quantum world.](#)

[December 22, 2021, ESO, Astronomers uncover largest group of rogue planets yet.](#)

[December 21, 2021, Cornell University, Looking at factors that accelerate mass extinction in the fossil record as climate changes.](#)

[December 21, 2021, University of Rochester Medical Center, Honing in on shared network of cancer genes.](#)

[December 17, 2021, University of Rochester Medical Center, How the brain understands one voice in a noisy crowd.](#)

[December 13, 2021, SUNY Polytechnic Institute, Utica, NY, Discovery of 'split' photon provides a new way to see light.](#)

[December 3, 2021, University at Buffalo, How to freeze-dry a potential COVID-19 vaccine.](#)

[December 2, 2021, University of Rochester, Novel 3D printing technique to engineer biofilms.](#)

[November 29, 2021, Cornell University, Recycling of tectonic plates a key driver of Earth's oxygen budget.](#)

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Douglas Kostyk	Director '23	943-3419
Karen Wolf	Director '23	670-9709// 273-4500 (w)
Elizabeth Pixley	Herbarium	334-0977
Jutta Dudley	Publications	385-2368
Ted Lechman	Bulletin Editor	490-1132
William Hallahan	Student Grants	624-1628
Paul Dudley	Website	385-2368