



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 18, 2023 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 counted, and the results announced.

Undergrad Student Grant Program

I mentioned in November that our Student Grants Program uses no money from member dues but is funded from three endowment funds.

The Board recently voted to increase the top award to \$750 for supplies and travel related directly to the research project, plus \$50 in unrestricted funds. We expect to make at least six grants. In fact, we received 18 research proposals by the 12/19 deadline. My thanks to the selection committee. Look for reports on the 2022 winners starting here in our February edition.

2024 Eclipse Watch

On December 31st, 2022, it will be just **464** days until the total solar eclipse passes through Rochester on Monday, April 8, 2024. I provided a copy of the

Rochester Eclipse Task Force Poster here last month. I did not have the artist's name but am happy to credit Tyler Nordgren now.

The Task Force recently supplied a promotional photo for eclipse viewing glasses—of which ASRAS has ordered 1000. Yes, even the big guy has these.



See <https://rochestereclipse2024.org>.

If you cannot wait until the total eclipse on April 8, 2024, there is a smaller show that might tide you over and that is the annular eclipse to be seen in the western U.S. on Saturday, Oct. 14, 2023. An annular eclipse of the sun is one in which the edge of the sun remains visible as a bright ring around the moon because the moon is too far from the earth to cover the sun. It will be a partial eclipse here, with only about 25% coverage.



Annular eclipse (NASA)



Partial eclipse at about 25% coverage (credit WIBW, Topeka, Kansas)

So, where's a good place to go to see this one? Choices are limited—it starts in the U.S. in Eugene, Oregon less than two hours south of Portland, then goes to small towns and empty spaces there, and in Utah (it might be spectacular to be in Grand Staircase-Escalante National Monument). So maybe the best choices would be San Antonio, TX or Albuquerque, NM, to which you can easily fly. More adventuresome might want to watch from Mexico's Yucatan Peninsula, Panama, or Brazil. Learn more at <https://solarsystem.nasa.gov/eclipses/2023/oct-14-annular/overview/>

Will Rochester be the best place from which to watch the total eclipse?

Actually, if weather is clear, it will be the second-best place. To get the best view, you will need to book a seat on the *International Space Station*. While millions of people across the United States experienced a total eclipse Aug. 21, 2017, as the umbra, or moon's shadow passed over them, only six people witnessed the umbra from space. The space station crossed the path of the eclipse THREE TIMES as it orbited above the continental United States at an altitude of 250 miles.

Michael Grenier, President RAS

Events for January 2023

Not Meeting in January:

Fossil Section

Anthropology Section

6 Fri: Astronomy Members Meeting

7:30 p.m. – 10:00 p.m. RIT Carlson Center for Imaging Science, CAR-1125. Parking Lot F. ASRAS Board of Directors Elections. Speaker: Frank Bov, ASRAS. Topic: *The Life of Stars*. Contact: Anthony Golumbeck at semp@use.startmail.com

7 Sat: Life Sciences - Herbarium Workshop

10:00 a.m. – 2:00 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. We will be working on re-mounting herbarium specimens; no special experience required. You may bring a lunch or buy lunch at the Cafe. We encourage attendees to be fully vaccinated. If you plan to attend, please send RSVP or any inquiries to Elizabeth Pixley, herbarium curator, at eypixley@gmail.com, or call (585) 334-0977

8 Sun: Astronomy Open House

Open House: 12:00 p.m. - 3:00 p.m. Observatory tours and work parties. Members may bring guests. Farash Center for Observational Astronomy, 8355 County Road 14, Ionia, NY 14475. For weather related cancellations or changes contact site manager Roger McDonough at rdmcdogz@aol.com or see www.rochesterastronomy.org/calendar-of-events

10 Wed: Astronomy Board Meeting

7:00 p.m. Zoom only meeting. ASRAS members are welcome. Contact: Anthony Golumbeck at semp@use.startmail.com

18 Wed: RAS Board Meeting

7:00 p.m. – 9:00 p.m. Zoom meeting only. All ARS members may attend. For details, contact Michael Grenier at mgrenier@frontiernet.net.



Photo: Nick Lamendola

24 Tue: Mineral Section Virtual Meeting

7 p.m. Zoom Meeting. "Field Experiences on Geoscience Education". Field experience is an important part of geoscience education. Geology professors Michael Rygel and Page Quinton of Potsdam College will show us how students with boots on the ground acquire skills in the field. We'll travel virtually with them to several geological study areas, such as the Adirondacks, coastal New Brunswick and the mountains of Montana. Guests welcome. Contact Jutta Dudley (juttasd@aol.com).



Renew Your Membership!

Membership expired December 31, 2022. Please renew your membership at your earliest convenience. Use this link to renew.

<https://rasny.org/how-to-join>

Featured Article

Bob Easterly – RAS, ASRAS

Ice Crystal and Snowflake Formation.

This is the cold wintertime of the year when we, in Rochester, NY become covered in a blanket of snow. Hopefully you are enjoying that event by just watching the snowfall out your window or maybe you love outdoor winter sports – what a joy. So, have you ever wondered on how these snowflakes are formed? Why are there so many different shapes for snowflakes? Do you realize that no two snowflakes are exactly the same? Well, that's what I would like to talk to you about today.

Up in the sky, as the weather above is below freezing, water droplets begin to attach to minute particles of dust or pollen and freeze. As these frozen droplets begin to fall, it attracts more new droplets and together form a hexagonal shape. As new droplets are added to the shape, they adhere better to the corner edges of the hexagon and this six-sided shape begins to build. The final shape of the snowflake is dependent on the temperature, crystallization physics of water molecules, air currents, how long the snowflakes took to fall to earth and to some extent the moisture content in the air.

Interesting fact: Snowflakes are a collection of approximately 100,000 droplets of water.

Not all ice crystals / snowflakes falling from the sky resemble the standard model of a picturesque six-sided "snowflake". If the temperature is in the low 20's F, then ice crystals may be needle shaped or if very cold, then maybe flat plates.

But wait, you may be saying "look, round balls of ice crystals have struck my car or turned my walkway to solid ice. Those aren't pretty snowflakes." You're right. Ice crystals can take many forms, and some can be very dangerous and damaging to property. If for example you are on an airplane and ice crystals form on the wings, that puts tremendous added weight

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Ice Crystal and Snowflake Formation
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on the wings. Ok then, how are those “not so friendly” ice crystals formed? Glad you asked – these round ice crystals called “hailstones”, form during strong thunderstorms with strong intense updrafts. The updrafts pull in large volumes of water droplets upward into the moist clouds. Depending on how many additional water droplets become attached to each other (due to the properties of water and very high humidity), they start forming balls of ice crystals. As more water droplets and ice crystals attract to each other, the result can be large balls of ice. Hailstones can range in size from 0.2” to 6” in diameter. Thunderstorms can occur during any season and therefore, hail can form during any season. The size of the balls of hail are determined by the strength of the winds lifting it up. Once the weight of the hailstone can no longer be carried by the wind, they fall to the ground.

Wait – this article on ice crystals and snowflake formation is for a non-profit academy of science. Ok – so let’s focus on specific research on snowflakes. I would like to steer your attention to research of Wilson Alwyn Bentley (1865 to 1931) – who was known as Snowflake Bentley. He was a farmer, meteorologist and photographer that developed techniques on how to photograph snowflakes that are still in use today.



Figure 1: Young Wilson Bentley [6]

Bentley donated his collection of photographs (on original glass plates) of snowflakes to the Buffalo Museum of Science. Bentley’s hometown of Jericho, Vermont has a large collection held by the Jericho Historical Society with many digitized and displayed on their webpage.

Bentley has captured over 5000 snowflake images in a lifelong endeavor, with his first photos starting at the age of 19. Bentley is famous for articles he published in the National Geographic, Scientific American, and Nature, where he stated that “no two snowflakes are exactly alike”.



Figure 2: Bentley demonstrating snowflake capture. [3]

Snowflakes take on many different shapes. As we discussed earlier, the snowflakes can be radically different in

style according to just a change in temperature. If the temperature is 20° F, they can form ice needles or bars and below that can form plates.

Figure 3 below illustrates how the specific crystalline structure produced during ice crystal formation is a predictable consequence of air temperature and water vapor supersaturation.

All the snowflake photomicrographs below were taken by Wilson Bentley during the winter of 1901-2 and are public domain. Credits: Bentley Snow Crystal collection - New York Heritage Digital Collections, Glass plates from the Buffalo Museum of Science.



Figure 4: Dendrite Star when temperature is at or slightly below freezing.

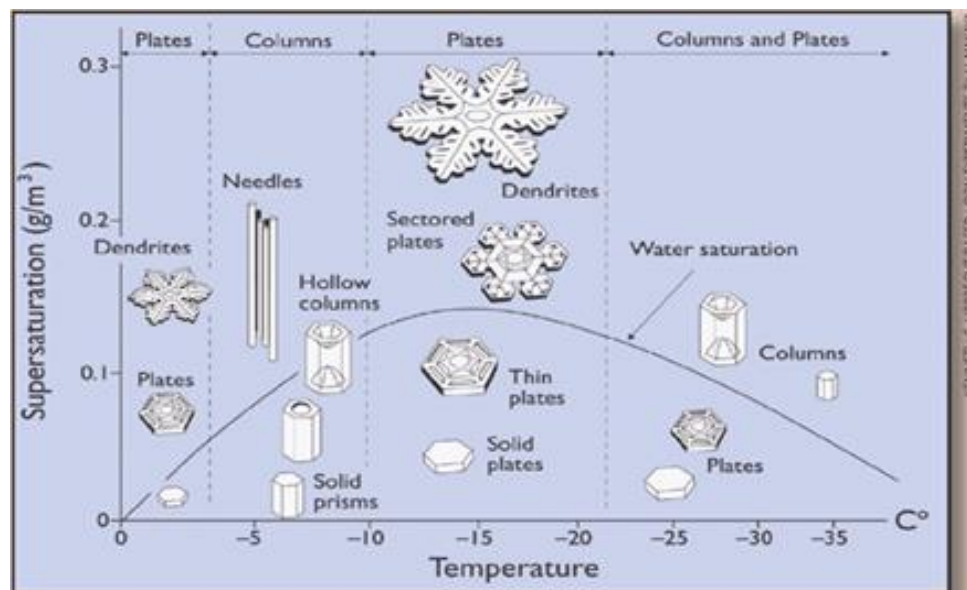


Figure 3: Ice crystal shape depends on temperature.

Photo Credit: <https://atmos.washington.edu/~hakim/101/snowflakes/>

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Figure 5: Six sided stars.



Figure 6: Cylinders with caps can form under the right conditions.

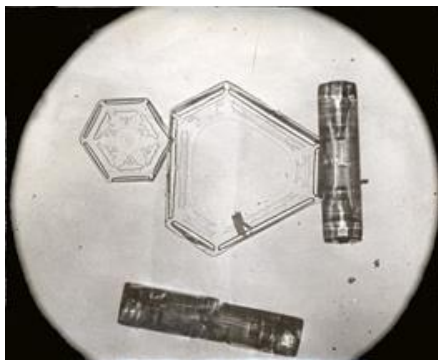


Figure 7: Plates and columns.

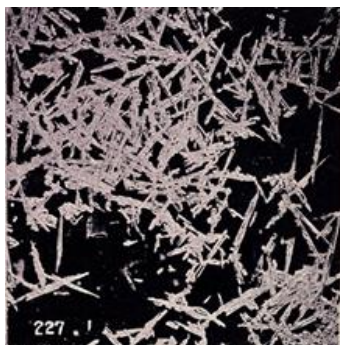


Figure 8: Needles are formed in very cold upper air conditions.



Figure 9: Modified plates.



Figure 10: Star and plate combinations.



Figure 11: More examples of wide six sided with unique center. Some centers can have color or be multi-layered and form optical prism with a rainbow as light reflects off the surface.

So then, is it true that no two snowflakes are exactly alike?

I found some of the best articles on this subject in the research section at the Library of Congress.

From the Library of Congress, Meteorology, Climatology 11/19/2019: The scientific consensus that the likelihood of two large snow crystals being identical is zero. Each winter, about 10^{24} snow crystals drop from the sky. We rely on cloud physicists, crystallographers, and meteorologists to study snow crystals and explain to us why there are no two snow crystals alike.

First, not all water molecules are identical. Water molecules have two Hydrogen atoms and usually one ^{16}O Oxygen atom. The number "16" in superscript before the word Oxygen refers to the fact that Oxygen has three isotopes of atomic mass 16, 17 or 18. Therefore, not all water molecules will ^{16}O Oxygen in their arrangement; some will have ^{18}O Oxygen. Furthermore, a few water molecules have one or even two atoms of Deuterium (the ^2H isotope of Hydrogen) in place of the usual ^1H Hydrogen. So, Oxygen with atomic mass of 16, 17 or 18 and can be combined with Hydrogen or possibly Deuterium. Each such combination of atoms has a slightly different size and interatomic bond angle when forming a single molecule of water and therefore also when forming into ice crystals.

I remember articles written about 15 to 20 years ago stating that the "No two snowflakes are alike" statement may not be true. But as reported in the 2019 research from the Library of Congress reports, they were talking about ice crystals of small size (about 10 molecules). At that stage in development could look very much alike. The snowflakes we are referring to have many thousands of molecule combinations attached during very different paths in the sky, at slight differences in temperature. In summary – quote from Wilson Bentley "No two snowflakes are alike". Plus, I have to add that it would take a lot of photographs and many years of measurements to prove otherwise.

(Continued on p.5)

Ice Crystal and Snowflake Formation

(Continued from p.4)

References:

- [1] The Snowflake Man – A Biography of Wilson A. Bentley by Duncan C. Blanchard 1998.
- [2] Snow Crystals by Wilson Alwyn Bentley and William Jackson Humphreys 1931.
- [3] <https://snowflakebentley.com/>
- [4] Jericho Historical Society for background on Wilson Bentley
- [5] Wikipedia – Wilson Bentley
- [6] Smithsonian Institution Archives: Pioneering photomicrographs of Wilson Bentley <https://siarchives.si.edu/history/featured-topics/stories/wilson-bentley-pioneering-photographer-snowflakes>

Additional Information

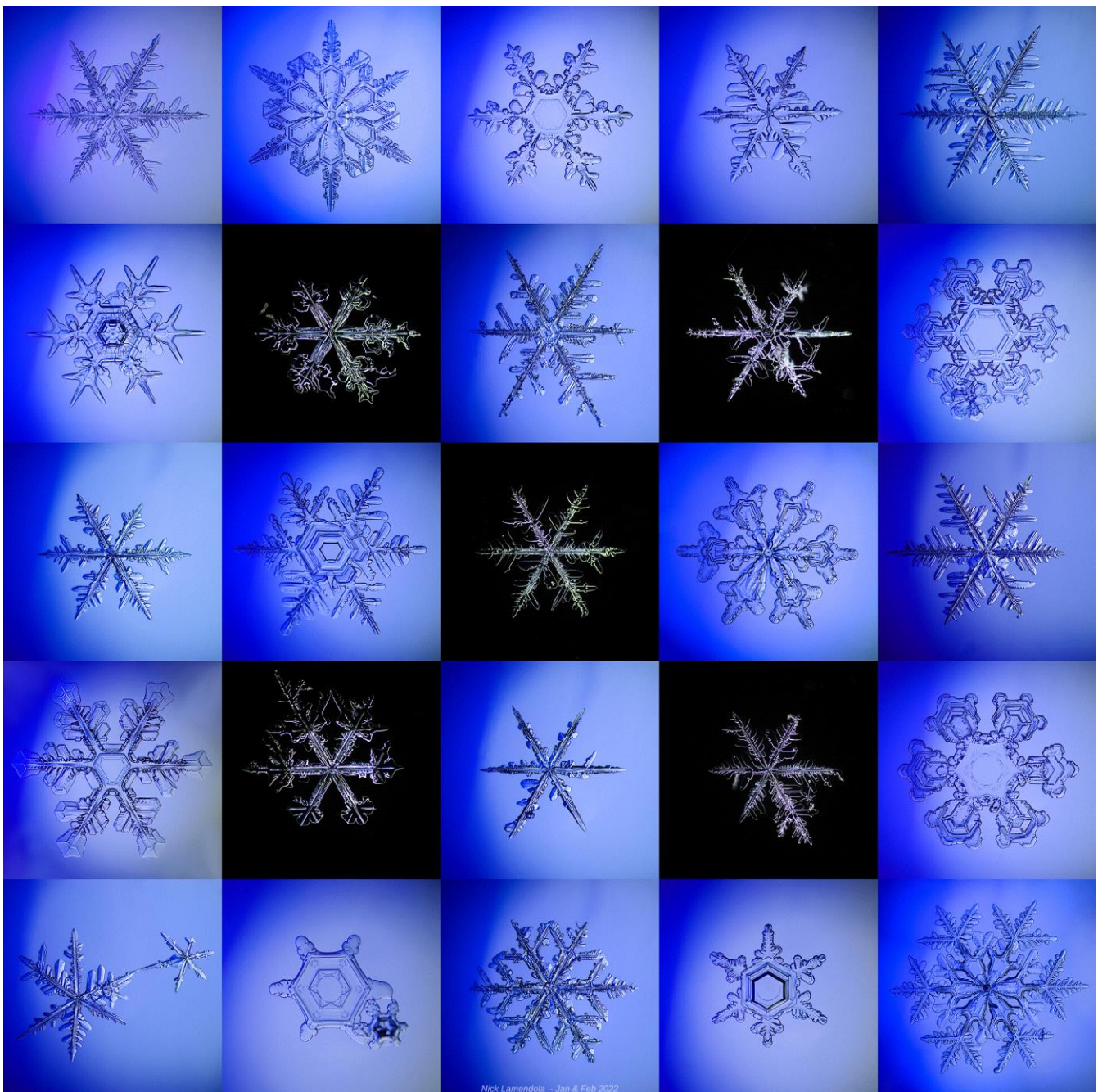
(Some fun and educational YouTube videos to watch.)

- [1] Veritasium Youtube channel. “Why are snowflakes like this?” <https://youtu.be/ao2jfm35XeE>
- [2] BBC Youtube Channel. “Instant Ice Crystals –The Secret Life of Ice” <https://youtu.be/3Qasw7lb2UM>
- [3] Storyful Viral Youtube Channel. “Timelapse of Snowflakes through a Microscope.” <https://youtu.be/bDPczGUovzE>
- [4] NOAA: Ice and Snow <https://www.nesdis.noaa.gov/our-environment/ice-snow>
- [5] NOAA: How do Snowflakes Form? <https://scijinks.gov/snowflakes/>

[6] NASA: Hubble Catches Cosmic Snowflakes <https://www.nasa.gov/image-feature/goddard/2020/hubble-catches-cosmic-snowflakes>

[7] Sky & Telescope. Stars and Snowflakes <https://skyandtelescope.org/astronomy-blogs/stars-and-snowflakes/>

[8] FOR KIDS: you should investigate the many properties of the water molecule that allow life on earth. Study the 105° H-O-H bond and how one molecule attracts another water molecule via adhesion. Why does water expand when it freezes? Amoeba Sisters Youtube Channel: Properties of Water <https://youtu.be/3jwAGWky98c>



Nick Lamendola - Jan & Feb 2022

Snowflake Images by Nick Lamendola, 2022 ASRAS Outstanding Astronomer of the Year Award Winner.

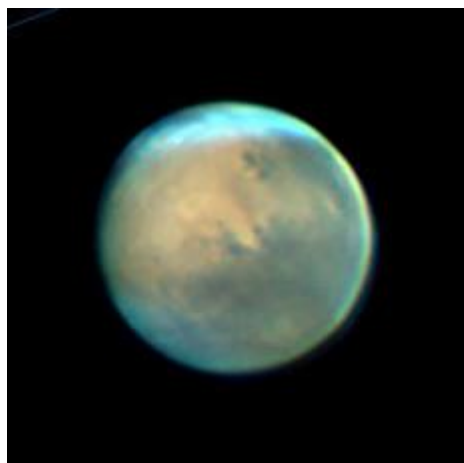
ROCHESTER AREA RESEARCH IN REVIEW

Yes, Western New York – there REALLY is a Sun still up there!



Photo Credit: Douglas Kostyk, Solar Activity 29 December, 2022. Imaged at the Solar Observatory at the Farash Center Using an ASRAS 0.5 Angstrom bandpass hydrogen alpha 100mm Lunt telescope.

RAS Member Photo



*Mars, December 22, 2022.
Photo credit – Kevin Lyons, ASRAS.*

[Do polar bear paws hold the secret to better tire traction? December 19, 2022, Syracuse University](#)

[Light from outside our galaxy brighter than expected: Study led by RIT scientists uses data taken by LORRI on NASA's New Horizons mission, December 16, 2022, Rochester Institute of Technology](#)

[National Ignition Facility achieves fusion ignition, December 13, 2022, University of Rochester's Laboratory for Laser Energetics.](#)

[Ingestible biobatteries could allow new view of digestive system, December 12, 2022, Binghamton University, SUNY](#)

[Researchers reveal how trauma changes the brain, December 7, 2022, University of Rochester Medical Center](#)

[Soft robot detects damage, heals itself, December 7, 2022, Cornell University.](#)

[Jawbone may represent earliest presence of humans in Europe, December 6, 2022, Binghamton University, SUNY](#)

[New tool twice as accurate at predicting antibody resistance among US children with Kawasaki disease: Scoring system lays groundwork for North America's first test to predict therapeutic resistance for the rare disease, December 5, 2022, University at Buffalo.](#)

[How metastatic cancer causes leaky blood vessels: Direct contact between cancer and blood cells changes their normal clockwise orientation to a more metastasis-prone counterclockwise position, December 5, 2022, Rensselaer Polytechnic Institute, University at Albany](#)

[SARS-CoV-2 variants are still transmissible between species, study indicates: Computer simulations show there is a still significant risk of mammalian cross-species infectivity, December 2, 2022, Rochester Institute of Technology](#)

[New programming tool turns sketches, handwriting into code, Nov. 28, 2022, Cornell University](#)

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>.

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