



episode 5 (2018 May) *Doing Science, or Scientific Sightseeing?*

*Heather:* Hello everyone! Welcome to the fifth episode of the RASC 150 History Podcast, in which we attempt to avoid asking the wrong questions while handling events both fortunate, and unfortunate. My name is Heather Laird, I am a Director of The Royal Astronomical Society of Canada, and my co-host is the RASC Archivist, Randall Rosenfeld. Say hello, Randall!

*Randall:* [some mumbled greeting, or other].

*Heather:* So Randall, have you actually done any astronomical science, harvesting data through experiment which has ended up available to the community in peer-reviewed form?

*Randall:* Ah, I feel a bit guilty about that; yes, I have, but not to the extent that I ought to have contributed. I suspect I'm not the only amateur astronomer who feels that way. Such projects are enjoyable, and there is a thrill in seeing the results finally appear, even if, as in my case, none of them were media-worthy discoveries. The matter of science and the doing of science are of high intrinsic interest, as any of the active members of the American Association of Variable Star Observers, or Galaxy Zoo, or Planet Hunters, or a host of other real scientific endeavours can attest. So far, I've been speaking from the standpoint of an individual. Many astronomical associations have among their core purposes the promotion of active participation in research. The RASC is no exception, although its early statements were somewhat indirect. The Society's meetings of 150 years ago were planned to include the [quote] "*reading [of] original papers*" [close quote], and the [quote] "*suggesting [of] experiments*" [close quote]; the By-laws of 1890 had among the Society's objectives [quote] "*to promote and increase knowledge in astronomy and related sciences*" [close quote], and to [quote] "*render assistance to individuals and institutions engaged in the study and advancement of astronomy*" [close quote]; and the very first number of the *Journal of the Royal Astronomical Society of Canada* in 1907 proudly bore the slogan:

[quote] “*Devoted to the Advancement of Astronomy and Allied Sciences*” [close quote]. It takes little imagination to see these statements as an expression of support for amateurs as participants in making science, rather than solely as passive bystanders, and consumers of science.

*Heather*: And the RASC was hardly alone in the desire to see its membership harvesting scientifically useful data. In 1890, The British Astronomical Association listed as its first, and primary objective: [quote] “*The association of Observers, especially the possessors of small telescopes, for mutual help, and their organization in the work of Astronomical observation*” [close quote], but even before the framing and publication of their official rules, one of the founders, Walter Maunder of the Royal Observatory, Greenwich (who was also to become a RASC member), reached out to: [quote] “*a number of gentlemen interested in Astronomical research*” [close quote] for their advice. Since 1947, the Association of Lunar & Planetary Observers has existed: [quote] “*to stimulate, coordinate, and generally promote the study of these bodies using methods and instruments that are available within the communities of both amateur and professional astronomers*” [close quote]. In 1988 the International Meteor Organization was formed among serious amateur meteoriticists for: [quote] “*the international coordination of meteor work and uniform observing standards, allowing in turn for global analyses of observational data*” [close quote]. And, in about 2005, the C.A. Muller Radio Astronomy Station, or CAMRAS, was formed by amateurs to recommission the 25-metre steerable Dwingeloo Radio Telescope of 1956, which, for a short period sixty-two years ago, was the world’s largest fully-steerable radio telescope, at least before the Lovell Telescope at Jodrell Bank saw first light. CAMRAS intends the telescope: [quote] “*for certain types of research such as long-term monitoring, [given that] professional telescopes and astronomers are too expensive, but there may be opportunities and discoveries for amateur astronomers; [and for] redoing scientific research, so-called ‘retro-science’*” [close quote]. There are other examples we could cite. The point is, contributing to meaningful astronomical research, doing observing which counts, has been stated as basic to the core existence of many amateur astronomical organizations.

*Randall*: Many professionals have seen the benefit of cooperating with trained, and disciplined amateur researchers.

Jean-Claude Pecker, former Secretary-General of the International Astronomical Union, Director of the Nice Observatory, and Professor of Theoretical Astrophysics at the Collège de France, remarked at the IAU's Colloquium 98 in 1987, that, with the astronomical rise in the cost of time on the most advanced professional equipment: [quote] “*a new niche became obvious, twenty or thirty years ago, for amateur astronomers again to contribute to the progress of scientific knowledge, on the same terms as professionals*” [close quote]. This is not all that different in spirit from the advice the Director of the Harvard College Observatory, RASC member Harlow Shapley, gave in the 1933 foreword to the highly influential Scientific American book *Amateur Telescope Making*, when he encouraged amateur astronomers with equipment to use it productively in gathering data useful to the professionals. And another RASC member, George Ellery Hale, the man most responsible for the advent of the truly big-science astronomical installations which set the trend Jean-Claude Pecker mentioned, said in the same publication: [quote] “*No chapters in the history of science are more inspiring than those which recount the discoveries of amateurs... [the amateur] works because he cannot help it, impelled by a genuine love for his subject and inspired by an irresistible influence, which he seeks neither to justify nor explain. His reward lies in the work itself and in the hope that it may contribute something to the advancement of knowledge*” [close quote].

*Heather:* Many amateur astronomical organizations have maintained a consistent commitment to doing science for more than a century. Here, one only has to mention the constant record of the American Association of Variable Star Observers, the British Astronomical Association, and the Société Astronomique de France. What of the RASC? How well over the century and a half since 1868 have we done in nourishing a culture proactively helping amateurs to become contributors to the advance of science? Do we have any continuous traditions which have accumulated, reduced, and published useful data sets?

Before looking at the RASC's record, we ought to issue a qualification. If one viewed the Society from the outside during the approximately seven decades from 1905 to 1971, it would appear that the RASC *did* contribute real science, and did so continuously. That impression was a true one, but it wasn't necessarily due to the achievements of advanced amateurs. During those years, the RASC was the only national astronomical organization in Canada, and *ipso facto* represented both

professionals *and* amateurs. Looking back now, it was in some ways a golden period, for the quality of the astronomy in RASC Centres with strong professional engagement was high. We'll not be discussing the contribution to science of the professional RASC members during those years, but will be concentrating on the record of the amateurs.

*Randall:* The founders of the Society, the people we discussed in our first podcast, we very keen to do real science. The opportunity came within their first year, with the total Solar eclipse of August 7, 1869. The members made up an observational team, and apportioned members to the several tasks, such as timing, and observing and recording particular eclipse phenomena. In the event, expectations exceeded abilities, but the process seems to have been judged worthwhile by those involved; their data, whatever its merits, was never really made available to the wider community. It seems that the members of 1868 valued the idea of contributing to science, but lacked either the local guidance or the internal resources necessary to truly make a success of it. We lack good records for any other collective campaigns to perform serious science which they may have then attempted.

To this we can add the individual efforts of Daniel Winder, the Society's inaugural president, who was apparently one of the first in North America to attempt spectroscopic observations and analyses of the chemical constituents of the aurora, although his published work attracted little or no contemporary scientific notice.

*Heather:* More informative information survives from the period of the Society's revivification, possibly in the 1880s, but certainly by 1890, and two figures stand out: Allan F. Miller, and the impressive but enigmatic J. Miller Barr.

Allan F. Miller made spectroscopic observations of a nova, photographed the solar spectrum, and was likely the first person, or one of the first people, to study solar prominences in Canada. A correspondent of George Ellery Hale, mentioned above, Miller was elected to the International Astronomical Union, an unusual honour for a Canadian amateur of the time.

J. Miller Barr was even more impressive. It is thanks to the work of Alan Batten and John Percy that we know the little about Barr that we do. John Percy points out that between 1887 and 1910 Barr: [quote] "*published over a dozen professional-quality papers in respected journals*" [close quote], and that "*his 1908 paper on*

*"The Orbits and 'Velocity Curves' of Spectroscopic Binaries"* appears on the list of the top ten astronomy-related papers of the year by citation, along with three by a gentleman by the name of Einstein" [close quote]. He wrote the best contribution to what became the first of our annual *Observer's Handbooks*, an introduction to observing variable stars, which C.A. Chant greatly admired. His lasting claim to fame is his discovery of the Barr Effect, a spurious non-random distribution of the orientation of the orbit of spectroscopic binaries. Barr's discovery caught the interest and respect of Otto Struve in 1948. Keep in mind that Barr did all this as an amateur. And we know next to nothing about his education, and we have no direct information on the astronomical resources which were available to him for his work. From the indirect evidence of his publications, those resources must have been very good.

*Randall:* In addition to Barr, we can instance some other individual RASC members who've made significant contributions to the work of the AAVSO, such as Bert Topham in the first half of the twentieth century, and, more recently, observers like Vance Petriew, Rick Huziak, and Walter MacDonald. We also had a fairly strong showing in the programs of the International Geophysical Year, running officially from 1957 to 1958, for which our amateur members contributed meteoritical and auroral work.

*Heather:* And, speaking of things meteoritical, there have been some RASC members who have made worthwhile contributions. In the early 1950s Frederick Keith Dalton published quality research on microhardness testing of iron meteorites, in the 1980s and 1990s Christopher Spratt produced interesting review papers, and from the 1970s up to the early 2000s Ed Majden took valuable meteor spectra, at a time when such work was technically more difficult to accomplish than it is now. And in 2009 Anthony J. Whyte published his well-received and useful monograph on *The Meteorites of Alberta*. Not to mention that many RASC members who volunteer for meteorite recovery programs when the call goes out.

The nearer and brighter solar-system objects are among the first bodies amateurs observe when they acquire their instruments. Some go on to participate in serious planetary monitoring programs. Probably the best and most sustained episode of planetary observation occurred in the RASC during the late 1950s and early 1960s. The effort was based at the Montreal Centre, and the various campaigns to record

phenomena on the surfaces of Venus, Mars, and Jupiter were designed and lead by Geoff Gaherty. A considerable amount of data was produced during the four or five years the program ran. Geoff even had enough data to compile a creditable map of Martian albedo features. But the program only lasted for those few years. It effectively collapsed when Geoff left the city to pursue graduate work. Often in the history of the RASC's serious observing efforts, it seems that individuals were key to the establishment, quality, and continuance of the observational programs. That fact is usefully diagnostic. It reveals a serious structural weakness in the astronomical culture of the Society. Our programs ought to be robust enough to successfully outlive their developers.

How far back can we trace this problem?

*Randall:* The problem goes back in the Society to the second half of the nineteenth century. The two keys to the success and longevity of the BAA's serious observing programs are: 1), the early establishment of specific observing sections with clearly defined observational missions; and 2), a constant attention to the quality of the work that is done. Early on in the RASC's revival, coterminous with the establishment of the BAA, we too had observing sections—or tried to. None of them were a success, none of them have left us data which survives, and none of them have left a lasting legacy. The Canadian observing section most likely to have succeeded was the lunar section. It was founded with great hopes in 1895, only to go inactive sometime later that year. Revived in 1896, it may have lasted to 1897. The Directors even consulted with the then Director of the BAA Lunar Section, Gwyn Elger, a widely respected lunar observer, and we even undertook directed observations at his request. But it was to no avail. The Society's Lunar Section, unlike its British counterpart, quietly and quickly slid into the mists of failed selenography.

*Heather:* We don't know why observing sections didn't take in the RASC. There is no reason they shouldn't have prospered. This is an aspect of the Society's history which could benefit from more research. At present, it remains a conundrum.

*Randall:* Around the time the Society attempted to found observing sections, RASC member and meteor expert William F. Denning, in his *Telescopic Work for Starlight Evenings* of 1891, gave it as his opinion that: [quote] “*Not only have*

*telescopes become cheaper, but they have greatly improved in performance...Hence we find moderately-powerful instruments in the hands of a very large number of observers. Astronomical publications have proportionately increased, so that amateurs of to-day can boast of facilities, both of making and recording observations, which were scarcely dreamt of a century ago...It must be admitted, however, that the results hardly do justice to the means available. Such an enormous number of telescopes are variously employed that one cannot avoid a feeling of surprise at the comparative rarity of new discoveries, and, indeed, of published observations generally. It is certain that the majority of existing telescopes are either lying idle or applied in such a desultory fashion as to virtually negate the value of the results. Others, again, are indiscriminately employed upon every diversity of object without special aim or method, and with a mere desire to satisfy curiosity. Now it is to be greatly deplored that so much observing strength is either latent or misdirected. The circumstances obviously demand that an earnest effort should be made to utilize and attract it into suitable channels. To do this effectually, the value of collective effort should be forcibly explained, the interest and enthusiasm of observers must be aroused in a permanent manner, and they must be banded together according to their choice of subjects” [close quote].*

These words are as apt for the present as they were for the 1890s.

*Heather:* What is striking, is that when the RASC has had successful programs to harvest scientific data, the programs depended very much on the active involvement of skilled, and committed individuals, and when those individual members who were the drivers of the programs were no longer involved, the programs faded away. And there are indeed impressive holes in the record of the RASC’s commitment to producing science. We seem to lack the serious infrastructure and culture to consistently produce significant amateur-generated science.

*Randall:* It is possible that the particular conditions of amateur astronomy in North America have worked against the development of lasting home-grown science programs within the RASC; variable star observers join the AAVSO, planetary observers join ALPO, meteor observers join the IMO, those interested in web-based citizen science join the Zooniverse projects, and so on. Some of the blame

surely rests on the shoulders of those who in the 1980s, 1990s, and 2000s, actively encouraged amateurs not to aspire to contribute to science, but to see their highest calling as mere tourists of the night sky, aiming their expensive equipment up into the empyrean to capture the same pretty pictures of celestial scenery taken by all the other tourists of the night sky. Casual stargazing is worthwhile, everyone should do it at some point and every now and again, but it should not constitute the acme of amateur astronomical aspiration. It is hardly reaching for the stars, after all.

The results for Canadian amateur astronomy have not been good. At the same IAU colloquium where Jean-Claude Pecker praised amateur astronomy's potential to contribute to the progress of scientific knowledge, Brian Marsden, then the Director of the Minor Planet Center (MPC) at the Harvard-Smithsonian Center for Astrophysics, described the countries with the most robust amateur cultures contributing to astronomical science; Canada was not among them.

*Heather:* These are likely reasons, but likely reasons do not excuse us from establishing a good culture of inculcating science to produce science that counts. We could change, and ought to change that state of affairs. We should continue to practice education and public outreach, but we need to restore a balance in the range of astronomical activities we do, by really supporting amateur research, and making it possible through better designed and delivered inreach. That will benefit all of our programs.

*Heather:* Thanks to everyone who tuned in, and we hope you enjoyed this podcast. If you have any questions, please visit [www.rasc.ca/rasc-2018-podcasts](http://www.rasc.ca/rasc-2018-podcasts) for contact details.

Our next podcast is scheduled for a month from now, and is on mapping the heavens.

Our sound engineer is Chelsea Body, and our theme music is by Eric Svilpis.