Musings on 20 years of *RNA*

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It's hard to believe it has been 20 years since *RNA* was first published. I still recall picking up that first issue as a graduate student and thumbing through its pages. I could not then have imagined or predicted that in the following 20 years I would publish 13 papers in the journal, serve on the Editorial Board, and be one of the Editors of *RNA*. Needless to say, the journal has become an important facet of my life, and I believe a cornerstone of the RNA Society and the RNA field in general. Here I reminisce about how my career in RNA evolved, reflect on the journal, and outline what I consider to be some of the biggest changes in the field over the past 20 years and some of the most exciting things we have to look forward to.

My interest in RNA biology, in fact my entire career, started by accident. I entered the University of Colorado, Boulder with every intention of majoring in journalism so that I could become a newspaper reporter or editor (thank goodness that didn't happen!). However, because seniors were given priority so they could graduate all of the journalism classes I wanted to take were full. To get my core curriculum classes out of the way I enrolled in environmental biology because I always wanted to be Jacques Cousteau and the course sounded easy. On the first day of class, I realized that I had mistakenly entered the course number for molecular biology rather than environmental biology when I registered. However, I quickly fell in love with the subject and realized that I had found my calling in life. That course was taught by David Prescott, and I ended up working in David's lab from the end of that first semester until I graduated.

David's lab studied telomerase and the mechanism of DNA rearrangements in ciliates. Though we had no clue at the time, both of these processes are now important aspects of the RNA field—telomerase of course is now known to carry its own RNA template and the DNA rearrangements that occur during macronuclear development are mediated by an RNAi-like mechanism. More important and influential than my lab work was the environment. I vividly recall one day I was attending a meeting of the undergraduate biochemistry club when a tall man with glasses walked up and said "Hi, I'm Tom." This was Tom Cech, of course, and it was only a few days after he was awarded the Nobel prize. The RNA faculty

at Boulder were among the best in the world—Tom, Olke Uhlenbeck, Mike Yarus, Larry Gold, and Karla Kirkegaard to name a few. However, my main interactions were with the postdocs and graduate students—Alan Zahler was a graduate student in David's lab, Jamie Williamson was a postdoc with Tom and was collaborating with Alan, Sean Eddy was in Larry Gold's lab and the TAs of one of my biology courses. It was an amazing environment to be in and played a major role in shaping me as a scientist.

I attended graduate school at the University of Vermont and did my PhD thesis with Greg Gilmartin studying RNA sequences and structures that enhance cleavage and polyadenylation. Again, it was the people in the community who made it such a great experience—faculty such as Greg, John Burke, and Chris Francklyn, graduate students such as Simpson Joseph and Sam Butcher, and postdocs such as Nils Walter all of whom are important members of the RNA community. I had many interactions there which seemed unimportant at the time, but turned out to be incredibly valuable. For example, I and several other students attended a lunch with Michael Terns when he and Becky Terns were interviewing for faculty positions. Twenty years later, Mike, Becky and I are collaborating to study CRISPR RNA biology and have published five papers together—all because of a friendship that started at a lunch when I was a graduate student!

I did my postdoctoral research with Tom Maniatis at Harvard University where I began working on the biochemistry of alternative splicing. Once again, it was an amazing environment and resulted in lifelong friendships with the people I overlapped with. In addition, in a lab like Tom's, and many other founders of the RNA field, you develop bonds with everyone who's ever been in the lab. I left Tom's lab after 3 years to start my own lab at the University of Connecticut Health Center where I have continued to work on RNA, but in ways that I never expected to.

My reason for detailing my background is to provide a basis for career advice for younger people in the field. First, we RNA biologists are lucky to have a very friendly and collegial community and you should take advantage of that. Some of the most important conversations I have had in

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my entire career occurred at the bar at Cold Spring Harbor Laboratory. So, go to the bar after the talks are over and talk to everyone—that graduate student who just gave a great talk could turn out to be the next hotshot in the field, the PI you talk to could end up being your postdoc advisor, the postdoc next to you could end up being your department chair. Nourish your relationships with people in the field. Second, work on something you are passionate about. I don't think anyone can predict what the next hot thing will be, so you should at least love what you are working on. I decided to work on alternative splicing simply because I found it fascinating, not because I thought it was going to be the next hot thing. When I started to work on splicing people thought only about 1% of human genes encode alternatively spliced transcripts—obviously, things have changed. Third, and most important, be prepared for and don't hesitate to take opportunities that present themselves. Doing this will shape your career—it is what morphed me from a journalism major to what I do now, what moulded my research from biochemistry to bioinformatics to *Drosophila* genetics, what led me to work on organisms such as ciliates, flies, worms, planaria, squid, yeast, bacteria and even humans, and my interest in *Dscam*, *trans*-splicing, 3' end formation, miRNAs, piRNAs, CRISPRs, and RNA editing. I think I know what I will be doing tomorrow, maybe next week. Next year is a bit fuzzy and I have no clue what I will be working on in five years. Constant change and evolution is one of the best things about an academic career in science—embrace it!

What about the journal? I think *RNA* is an outstanding journal and one of the strengths of the RNA Society. I was truly honored when I was asked to become a member of the Editorial Board in 2005 and to be included alongside many of my scientific heroes and friends. In 2011, a dozen outstanding colleagues and I were invited to become Editors of *RNA* and to assist Tim Nilsen in ushering manuscripts through the review and publication process. This involves screening new manuscripts to determine whether they are appropriate to be sent out for peer review, enlisting reviewers, and making editorial decisions after receiving the reviews. After doing this for the past four years, I am astonished that Tim Nilsen, and his indispensable assistant Ann Marie Micenmacher, did this job alone for over 15 years. A quick PubMed search indicates that ~2800 papers were published in the first 15 years of the journal. That is a lot of papers they handled and doesn't include all the papers that were submitted but not published!

The most difficult aspect of being an Editor for *RNA* is without doubt rejecting manuscripts. As academic editors, we are keenly aware of how much work can go into a manuscript and the impact these decisions have on the lives of the faculty, graduate students and postdocs. The decision of whether a paper gets published or not can impact getting a job, promotion, tenure, and funding. It is extremely difficult to disappoint people in this way and the entire group of Editors strives to be fair and frequently consult one another when decisions are difficult. All in all, I think the group does a good job and that the quality of the journal is constantly increasing and our goal is to continue this trend.

What has changed the most since *RNA* was first published? In my opinion, nothing has had a larger impact on our field than the incredible advances in sequencing technology. *RNA* is ideally suited for being interrogated by sequencing and these technologies have truly transformed our understanding of nearly every aspect of RNA biology. We now have an unprecedented ability to identify unknown genes and transcripts, including small and large noncoding RNAs, examine differences in transcript expression levels, alternative splicing and 3' end formation, to pinpoint which portions of RNAs are translated, probe RNA structures, and countless other approaches. Parallel advances in bioinformatics have been equally important and influential. In fact, bioinformatics is now an essential part of the RNA biologists toolkit. If you are a student, postdoc or even a faculty member, do yourself a favor and learn to write code so that you can analyze your own data. The need for this is not going to decrease in the future and will only become more important. It is of utmost importance to be knowledgeable in both the experimental and computational aspects of your science. Understanding only one of these will limit your ability to properly design your experiments and accurately interpret your results.

What do we have to look forward to? Personally, I am excited for the day when you can directly sequence full length RNAs directly, without first making a cDNA library, and in such a way that modified RNA bases can be accurately detected. If you don't think we will get there within the next 10 years, there are now sequencers you can hold in your hand and plug into the USB port of your laptop. Direct RNA sequencing will have a radical impact on the RNA field and ultimately lead to discoveries that we can't even anticipate.

It has been an exciting 20 years in the field and *RNA* has been a key part of the ride. Happy birthday to the journal and here's to the next 20!

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A PUBLICATION OF THE RNA SOCIETY

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