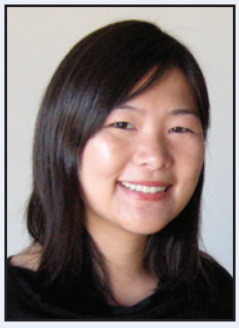
The Art and Science of Cell Biology (ASCB²)

This President's Column was written by guest columnists Janet Iwasa and Graham Johnson.

Captivating imagery has always complemented cell biology. Two new events at the ASCB 2012 Annual Meeting in San Francisco will explore issues at the interface of science and art that increasingly affect our field:



Janet Iwasa

Graham Johnson

1) *From Histograms to Animations*, a Working Group focusing on visualization, will delve into ways for researchers to clarify complex data for analysis and communication.

2) A scientific art show will serve as a prototype for a traveling gallery intended to immerse the public in the visual language of cell biology.

Since the time of Leeuwenhoek and Hooke's simple lenses, the beauty and mystery of life viewed under the microscope has inspired young scientists. Early microscopists' detailed illustrations, such as those published in Hooke's *Microscopia* (1665), fascinated both scientists and the public. Whereas these illustrations yielded both questions and answers for biologists, the public admired and discussed these images as art.

Today, individuals from diverse backgrounds make up a vibrant community growing at the intersection of art and science. From fine artists creating biology-inspired works, to scientists using art to better understand or communicate their own research, many noteworthy and exciting trends are evident. Through new ASCB events, we will address two issues of interest to cell biologists:

1)What can cell biologists gain from improved visualization tools and techniques?

2) How can we better engage the public and maintain their interest in cell biology?

The Scientist as Artist: Tools to Enhance Research and Creativity

Visualizations of biological data range from 2D bar graphs and charts to intricate molecular animations encapsulating decades of research. A well-conceived, well-executed presentation can be a powerful, lasting tool—not only to communicate results and theories but also to bring about new ideas.

As scientific illustrators, we frequently see that researchers gain new insights and testable theories during the course of their collaboration with us, ultimately leading to detailed models and animations. One portion of our Working Group, *From Histograms to Animations: Effective Visualization Makes Complex Data Clear*, aims to give researchers more direct access to these visualization processes through relatively easy-to-use software, storyboarding protocols to plan projects efficiently, and other resources and techniques. For more intricate systems or larger projects, we will demonstrate more advanced tools and general protocols to enable researchers to work effectively with visualization experts.

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Molecular viewer software limits the types of visualizations that can be produced, and professional 3D animation software typically presents a dauntingly steep learning curve for nonspecialists. We will present new tools to reduce these technical barriers but will also focus on the more critical aspects of creating effective animations: what to include, what to leave out, and how to organize a story. We help our collaborators decide on all aspects of an animation, such as the number,

The American Society for Cell Biology

8120 Woodmont Avenue, Suite 750
Bethesda, MD 20814-2762, USA
Tel: 301-347-9300
Fax: 301-347-9310
ascbinfo@ascb.org, www.ascb.org

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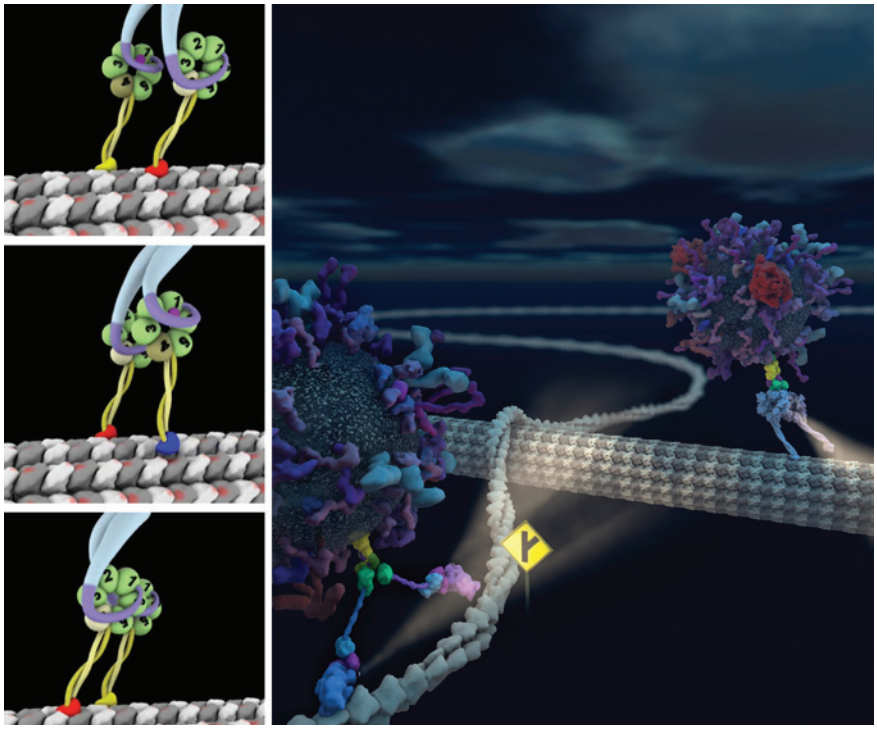

(Left) An articulated model can act as a virtual protein "puppet" that allows researchers to visualize complex processes in 3D, such as the walking cycle of the motor protein dynein. (Created by Iwasa in collaboration with the Reck-Peterson group at Harvard Medical School.)

(Right) From ASCB², this editorial image uses the structure of dynein to grab audience attention and summarize the key point of a research article. The illustration depicts molecular motors carrying cargo vesicles along different cytoskeletal substrates, with an intersection symbolizing the cargo's ability to transition between actin filaments and microtubules at specific molecular junctions. (Created by Johnson for Frank Heisler et al. for the April 14, 2011, cover of Neuron. *©G. Johnson and Elsevier, Inc.)*

By immersing a new audience in cellular and subcellular imagery without any attempt to overtly educate, we hope to remedy this unfamiliarity [of the public with cell biology], slowly connecting the world of cells and molecules to daily experiences.

shape, size, dynamics, kinetics, and localization of molecules. Although experimental evidence will guide many of these decisions, many questions inevitably remain, from visible gaps in structure to gaps in biochemical details. Recognizing these gaps in our knowledge, and attempting to fill them with hypothetical possibilities, can lead to new ideas and experiments. The final animation acts as a visual hypothesis—a dynamic model figure of sorts—that colleagues can readily view (and critique). As an example of this process, the accompanying figure shows a few frames from an animation of a 3D dynein model. Our session will also cover new, multiscale efforts under development that will allow sharing and iterative community improvement of such model figures.

Although relatively few cell biologists have experience with 3D animation (a fact that we hope to remedy), nearly all of us have created other forms of data visualization, such as charts and graphs of abstract data and vector-based illustrations for model figures. We often create these visualizations initially to explore and make sense of data, and then refine them to communicate ideas in a publication. Ideally, data visualizations clarify trends and outliers. Sometimes, however, poor representations of data lead to confusing—or worse, misleading—figures. Even though cell biologists rely heavily on data visualization, few have received any training on visual representation of data.

Bang Wong's "Points of View" series in *Nature Methods* shows that understanding basic design principles is essential to creating effective scientific figures. In our session, Wong will highlight many key concepts from these columns to help researchers create effective 2D and 3D visual communications.

We invite you to come to our Working Group and share some of the challenges that you have faced while making representations of your data.

The Art and Science of Cell Biology (ASCB²): An Art Show at the Annual Meeting

With the support of ASCB President Ron Vale, we have planned a new event at the ASCB Annual Meeting. The Art and Science of Cell Biology (ASCB²) will be an art gallery spread across two open spaces in the Moscone Center, featuring large-format prints of molecular and cellular images.

Scientific visualizations can reach far beyond our laboratories. Popular, public-facing efforts to highlight visually striking scientific images have increased. Competitions such as the National Science Foundation–American Association for the Advancement of Science International Science and Engineering Visualization Challenge, Nikon's Small World microscopy competition, and ASCB's Celldance, as well as the cover illustrations of many research journals (see accompanying figure), and encourage scientists to evaluate their visual work with an aesthetic eye. As with the illustrations of Hooke, diverse audiences can appreciate the images and illustrations in these contests. Jargon-filled descriptions aren't necessary to appreciate these images; they simply engage a broader audience with aesthetically pleasing or curiosity-inducing qualities.

These examples highlight an issue we faced when presenting our molecular-scale work to

general audiences. Whereas astronomers can awe the public with images of galaxies and the surface of Mars, and hands-on physics exhibits at children's science museums attract hordes of school kids, using cell and molecular biology to draw and maintain the attention of general audiences is much harder. Although faceless molecules may never compete with dinosaurs, all these other branches of science have a commonality that gives them an advantage. Astronomy and physics exhibits can capitalize on everyday human experiences and a cultural vocabulary. We can look into the night sky to see constellations and our own Milky Way, making it a short leap to yearn to explore detailed findings from the Hubble telescope. But cell biology is often too alien for general audiences, both visually and semantically, leaving viewers more overwhelmed and confused than awed or inspired. We take for granted that outside our professional circles, the word *protein* usually brings to mind a juicy cut of beef rather than a folded polypeptide chain.

By immersing a new audience in cellular and subcellular imagery without any attempt to overtly educate, we hope to remedy this unfamiliarity, slowly connecting the world of cells and molecules to daily experiences. The inspiration for this immersive approach stemmed from a recent experience that Graham Johnson had during an exhibition of his artwork and a shared seminar with Ron Vale, which Janet Oliver of the University of New Mexico organized in conjunction with the Santa Fe Complex. The exhibit, consisting of molecular illustrations enlarged and hung as fine art, drew art lovers, scientists, and curious passersby. Although aesthetics, composition, value, and color initially drew viewers to study any given piece, discussion inevitably moved to biological content and context. Conversations and theories often headed down bizarre paths, but scientists mixed into the room would overhear and steer these conversations or would answer questions asked from a motivated, rather than a captive, audience.

This is an exciting time to work at the art–science junction, particularly as cell and molecular biologists. We hope that practical techniques learned in the Working Group will couple with inspiration from the gallery to help researchers create enduring visualizations. From this small beginning, we hope to expand into an annual event to branch out into local art galleries, where the public might join researchers to appreciate the beauty of cells and molecules and delve further into biology. We expect the events to create a fertile new ground for conversations about scientific visualization and a renewed appreciation of the beauty of cell biology that will eventually spread to the general public.

We hope that, with repeated exposure to such events, viewers will gain familiarity with the forms of molecules and cells, and then acquire a language with which to associate those forms. Viewers will better understand the context of these images as an extension of their daily experiences and gain the motivation to go from asking *What is it?* to *Why do I care?* and perhaps even to *How can I find out more?* ■

—Janet Iwasa, Harvard Medical School, and Graham Johnson, University of California, San Francisco

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New! Free Career Webinars Being Offered in the Fall

Four Career Development Webinars will be offered free to ASCB members and member applicants this fall.

- Career Planning for Cell Biologists: Industrial Opportunities in the Current Economy. Thursday, October 11, 2012, 12:00 pm EDT
- Developing Your 30-Second Value Statement. Tuesday, October 23, 2012, 12:00 pm EDT
- Network Yourself to a Great Career. Thursday, November 15, 2012, 12:00 pm EST
- Identifying and Seizing Value from Conference Participation. Tuesday, November 27, 2012, 12:00 pm EST

For more information and to register, visit ascb.org, click on "Careers & Education," then "Career Webinars." ■

—Thea Clarke