Video Views and Reviews

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Most of us who teach undergraduates are constantly searching for better ways of making complex cellular phenomena more accessible and understandable, especially at the introductory level. Our instructional efforts are especially taxed when trying to convey with static diagrams or cartoons such *dynamic* events as membrane ruffling, endocytosis and exocytosis, and vesicular and protein targeting. Since 1998, when they first began appearing in electronically archived issues, I have used research videos from *Molecular Biology of the Cell* (MBC) as teaching aids, and I have agreed to write a column periodically reviewing the videos published in current issues of this journal and in other sources for the readership of *Cell Biology Education*. The majority of such records present the behavior of chimeric proteins that have been expressed linked with Green Fluorescent Protein (GFP), and examples of how such videos can be used in cell biology problem sets may be viewed at <http://cr.middlebury.edu/biology/scb/or.../scb2/>.

Several caveats, however! These essays primarily reflect my judgment about the suitability of particular videos as *teaching aids* and not about their scientific merit or that of the parent article; the latter quality presumably has already been established by their publication. In this regard, my students and I have found it especially important to remember that many published videos are *research* records; that is, they often seem like notebook entries rather than well-polished figures that usually accompany journal articles. Also, because students using the videos will likely refer to the parent publication for ancillary information, I try to note which video-containing articles seem readily accessible to undergraduates and which require additional explanation and explication. Readers should also be aware of my educational horizons, as well as my views about teaching, reflect to some extent my experience working with undergraduates at Middlebury College, a small New England liberal arts institution. What might be suitable here may not work well elsewhere, and *vice versa*. Finally, the opinions expressed are mine (and, in some instances, those of students whose views I have solicited) and not those of the American Society for Cell Biology or of the *Cell Biology Education* Editorial Board.

Caveats aside, one of my top choices from among several good videos published recently in *MBC* concerns the localization and characterization of SEPA, one of the actin-scaffolding proteins called formins, which appeared in an article by Sharpless and Harris in February (10.1091/mbc01.07.0356). Their study used a SEPA-GFP construct to examine formin localization during growth and division in the mold, *Aspergillus nidulans*, and the videos clearly indicate interesting behavior

that nicely supplements the various static figures. SEPA-GFP appears as a circular ring that changes shape in parallel with the actin contractile ring in clip nos. 1 and 2 (and in no. 7 but not no. 8, contrary to text indications). The chimera also appears as points or small crescents at the tips of growing hyphae in movie nos. 3 and 4 (also no. 8). The inhibitory effects of cytochalasin A on both phenomena are nicely illustrated in video nos. 5 and 6, for contractile ring and hyphal crescent, respectively. Following cytochalasin application, thoughtful students, noting at the end of video no. 5, both the appearance of disrupted SEPA ring particles and their separation by a transverse septum, might think cytokinesis and septum formation have been successfully completed in the absence of a constricting SEPA ring. To use the videos effectively, many students will require background orientation concerning the role of actin in coordinating mold growth and, especially, septum formation following the completion of mitosis. Otherwise, the text and figures are readily accessible to intermediate and advanced undergraduates with some prior exposure to molecular and cellular biology.

Unfortunately, there are problems with the way in which the video records have been archived with the SEPA study, which tend to make them less accessible. Although visually instructive, the videos are not well integrated into the article, nor is there much information provided about their creation (for example, the video rate). Moreover, the clips seem to have been very arbitrarily hyperlinked with unrelated figures (video no. 1 with Figure 1, etc.), which causes unnecessary confusion as the first-time reader moving linearly through the article tries in vain to match a movie with one or more of the stills in each figure. (Indeed, the first video accompanies Figure 1, which contains no stills or images and consists only of a table.) Also, none of the text figures indicates it is accompanied by a video; they are not flagged, for example, with “view video” hyperlinks as commonly found in other *MBC* articles. Thus, the reader finds each movie either by noting its location later in the text and back-tracking or by clicking on each figure as he/she encounters it in a primitive, hunting-and-gathering fashion. Nevertheless, however they are numbered, a careful reader would discover all eight videos actually illustrate Figures 5 and 7, and might well conclude that number could have usefully been reduced to four and linked respectively with parts A (contractile ring behavior) and B (hyphal tip localization) of Figures 5 and 7. As it is, the reader is forced to scan backward and forward to different figures to access related but often repetitious videos. (This problem is compounded by the unfortunate necessity in all *MBC* articles of moving through three successive frames to pull up any given video.) In short, although informative, half the videos in this article seem redundant, all require too much time to locate, and students especially may be frustrated by

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their poor organization and relative lack of text description and discussion.

In the same issue, I also liked several of the videos accompanying the article by Blanpain *et al.* (10.1091/mbc.01-03-1029). Their article describes the use of monoclonal antibodies to dissect and characterize active states and oligomer formation of CCR5 receptors that were transfected into CHO-K1 cells and expressed fused with GFP. The videos are linked to appropriate figures, the images are well described in text and captions, and for the most part, they clearly illustrate the results and enrich the figures. Especially impressive is the Figure 5 video showing the membrane ruffling and endocytosis that accompanied ligand(RANTES)-induced signaling. The subject of CCR5-mediated signaling and endocytosis is detailed and complex, however, and the technically worded article and complicated experimental design seem better suited for a graduate student audience or an advanced undergraduate seminar in immunology. The videos in this article would also be more useful if they opened in separate frames, which would allow the viewer to readily scrutinize both the movie and the text.

Readers interested in supplementing their lectures on the function of the integrin class of integral membrane proteins (IMP) should explore the two videos in the article by Zhang *et al.* (10.1091/mbc.01-10-0481), which appeared in the January 2002 issue of *MBC*. It is becoming increasingly evident that members of this family of multimeric IMP (here, $\alpha 6 \beta 1$) mediate substrate adhesion and intracellular signaling when transiently associated with other IMP. This article documents the importance of CD151, a member of the tetraspanin superfamily, in facilitating the integrin-mediated attachment of cultured NIH3T3 cells to a Matrigel substratum. The videos, which were made with differential interference contrast (DIC) microscopy, supplement Figure 5 and portray the motile behavior of, respectively, "wild-type" cells and of ones expressing a mutant form of CD151 that is truncated at its cytoplasmic (C-)terminus. When plated, the wild-type cells attach, move, contact each other, and coalesce to form reticular strands, while the mutant cells do not form reticular networks (but in all other respects resemble the wild-type cells in their attachment properties). Introductory students will enjoy the high-contrast and well-resolved videos of cell movement provided by DIC microscopy, while more advanced students will find the Results and the Discussion provocative, insofar as the formation of reticular networks of cells is related to tissue morphogenesis.

No video review would be complete without reference to a microtubule-based motility phenomenon, and the January issue of *MBC* also contains an interesting set of videos from the Gauthier-Rouviere laboratory (Mary *et al.*, 2002; 10.1091/mbc.01-07-0337) describing the shuttling of N-cadherin between a pool of intracellular vesicles and the plasma membrane in a MT- and kinesin-dependent manner. Rat embryo fibroblasts transfected with a plasmid containing N-cad/GFP were grown in culture to confluence. Initially, while the recently attached cells were still isolated, vesicles containing N-CAD-GFP shuttle between the plasma membrane and the Golgi complex with about equal frequency (Figure 5A, video). As cells made contact and became confluent, retrograde transport ceased and anterograde transport became more prevalent (Figure 5B, video); eventually, with

prolonged confluence, all N-cad transport ceased (Figure 5C, video). Such directional shuttling (but not Brownian motion) was completely inhibited by nocodazole (Figure 8B, video, with 8A as the Control) and in cells that had been microinjected with an antikinesin antibody (Figure 9, video). While an advanced student might wish the effect of an antidynein antibody had been tested, most would find the video clips bright, well resolved, and convincing in their detail and the authors' descriptions easy to follow.

Finally, students at all levels will be fascinated by the video clip accompanying a review article on lamellipodia by Small *et al.*, which appeared in the March 2002 issue of *Trends in Cell Biology* (archive/bmn.com/supp/tcb/small.avi). A B16 mouse melanoma cell expressing an actin-GFP construct is shown moving with an extensive lamellipodium and with stress fibers evident in its trailing edge. The advancing edge of the lamellipodium is diffusely lit by what is presumably a network of actin filaments, while bright actin microspikes are clearly seen oriented at right angles to the advancing front. As the lamellipodium moves, the microspikes move laterally, "flickering" and changing their orientation slightly. They occasionally fuse, and for the most part, it is easy to distinguish the bright "flashes" caused by membrane ruffling from moving microspikes. Many undergraduates, however, may be overwhelmed by the level of detail presented in the text and the well-executed figures, concerning the location and identity of lamellipodial factors and proteins (Figure 3) and the functional domains of the individual proteins (Figure 4). Graduate students and some advanced undergraduates, however, could readily appreciate how dynamic changes in the actin network might generate motility in many amorphous cells. However the text is used, I highly recommend the video clip in this article.

There are, of course, many other good video records archived on the Internet, and I welcome your suggestions of videos from peer-reviewed sources for possible inclusion (with acknowledgment) in future essays.

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