

interests of the two parties from the start will a video truly have an impact.

Encouraging Science Communication

Because of the benefits we have observed for both video creators and viewers, and because of the importance of communicating science clearly and more broadly, we call here for a ‘whiteboard revolution’. We encourage institutions to introduce students and postdocs to whiteboard videos as part of their curriculum – in the context of a journal club or on publication of their research – and to reward principal investigators who encourage their trainees to take part in these programs. Whiteboard videos produced by scientists will benefit their career, enhance public access to science, and constitute a valuable resource for institutions to promote the high-caliber science they conduct.

We also encourage journals to sponsor video competitions explaining recently published findings. Having a hard deadline, the prospect of a monetary prize, and receiving assistance with dissemination will motivate students to produce their first science communication video, while increasing viewership of the journal. Furthermore, journals can provide resources to help scientists create more approachable pieces, including interactions with scientific editors.

Lastly, we challenge all scientists to collect a piece of paper, some colored pens, a camera, and a microphone and design your toughest experiment yet: tell the story of your research that your avid and curious grandmother could understand in 500 words or less. We acknowledge that this will delay some western blots or qPCR reactions, but the time investment is well worth the return. Remember, science communication is not only our responsibility, it is also a fun and rewarding activity. What better way to improve public understanding of science and help create more informed citizens than by bridging our creative and analytical cerebral hemispheres

and giving science communication a whole new dimension? So grab your pen, and let's start the whiteboard revolution!

Supplemental Information

Supplemental information associated with this article can be found, in the online version, at doi:10.1016/j.it.2016.02.004.

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<http://dx.doi.org/10.1016/j.it.2016.02.004>

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Special Issue: Communicating Science

Scientific Life

What Can Vampires Teach Us about Immunology?

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Speculative fiction examines the leading edge of science and can be used to introduce ideas into the classroom. For example, most students are already familiar with the fictional infectious diseases

responsible for vampire and zombie outbreaks. The disease dynamics of these imaginary ailments follow the same rules we see for real diseases and can be used to remind students that they already understand the basic rules of disease ecology and immunology. By engaging writers of this sort of fiction in an effort to solve problems in immunology we may be able to perform a directed evolution experiment where we follow the evolution of plots rather than genetic traits.

When I first started teaching, my Department had no courses that needed leadership, so I invented my own class; I led a freshman seminar where we studied the pathogenesis of infectious disease using horror movies (Table 1). I had this great pool of brilliant students with diverse interests and my hope was to introduce some of them to this exciting science and for them to help me think about pathogenesis in different ways. I remember one project that developed the sort of cross-disciplinary thinking I was trying to foster where the student aimed to develop a vaccine for gossip. She planned to test her vaccine by intentionally spreading rumors about another member of the class and gave an entertaining presentation of her plan in which she horrified us by suggesting she had actually begun the experiment.

Although I have not taught this course for years, I kept up with the literature. Now, having consumed a great stack of horror movies, novels, and comics, I think I see a practical application. As a field, we often argue that pathogens are the keenest students of immunology because their lives and fitness depend upon their ability to overcome the immune response of a host. Over evolutionary time, pathogens have explored immune space and have evolved methods of avoiding, tolerating, and resisting host responses. As scientists, we can mine this resource to learn

Table 1. Twenty-Five Infection Driven Stories.

Story	Synopsis	Discussion Categories ^a	Refs
28 Days Later	Emerging pathogen induces transmission behavior in hosts.	1	Boyle, D. (2003) <i>28 Days Later</i> , 20th Century Fox (Movie)
Alien and Aliens	Parasitoid wasp-like alien infects human hosts in space.	1, 3, 9	Scott, R. (1979) <i>Alien</i> , 20th Century Fox (Movie) Cameron, J. (1986) <i>Aliens</i> , 20th Century Fox (Movie)
Blade	Gene therapy used to block symptoms of vampirism.	1, 2	Norrington, S. (1998) <i>Blade</i> , New Line Cinema (Movie)
Buffy the Vampire Slayer	Multiple examples of infectious monsters useful for gathering statistical data.	1, 4, 6, 7	Whedon, J. (1997) <i>Buffy the Vampire Slayer</i> , WB Television Network and United Paramount Network (Movie)
Contagion	Best-case scenario of response to a deadly emerging pathogen.	1, 2, 7	Soderbergh, S. (2011) <i>Contagion</i> , Warner Bros (Movie)
Dead Alive	Over the top zombies featuring imaginative cures and transmission cycles.	1, 2, 3, 9	Jackson, P. (1992) <i>Dead Alive</i> , Trimark Pictures (Movie)
Hostess (short story)	Early example of the microbiota as a source of pathobionts.	1, 3, 4, 5, 8, 10	Asimov, I. (1951) <i>Hostess</i> , Amazon (Radio Play)
Invasion of the Body Snatchers	Early example of a missing-self response and pathogen mimicry.	6, 9, 10	Siegel, D. (1956) <i>Invasion of the Body Snatchers</i> , Allied Artists Pictures (Movie)
It Follows	Challenging transmission cycle involving sexual transmission of a deadly infection.	1, 8, 9	Mitchell, D.R. (2014) <i>It Follows</i> , RADIUS-TWC (Movie)
iZombie	Some zombies lead happy lives and are tolerant of the infection.	4, 7, 10	Ruggiero, D. and Thomas, R. (2015) <i>iZombie</i> , Amazon (Streaming Series)
Lexicon (novel)	Fighting language as a pathogen.	1, 8, 10	Barry, M. (2014) <i>Lexicon: A Novel</i> , Penguin Books
Mimic	What could go wrong following the introduction of genetically altered vectors?	1, 2	Del Toro, G. (1979) <i>Mimic</i> , Dimension Films (Movie)
Outbreak	A pathogen with interesting transmission kinetics but a disappointing cure.	1, 2, 7, 9	Peterson, W. (1995) <i>Outbreak</i> , Warner Bros (Movie)
Parasite, Symbiont and Chimera (novel)	Mechanism driven plot concerning a marketed mutualist gone rogue.	1, 3, 5, 6, 7, 10	Grant, M. (2014) <i>Parasitology Trilogy</i> , Orbit
Raising Stony Mayhall (novel)	A sympathetic view of the infected, highlighting the concept of disease tolerance.	4, 6, 7	Gregory, D. (2011) <i>Raising Stony Mayhall</i> , Del Rey
Snowcrash (novel)	Transmission of a computer virus to humans through language.	1, 8, 10	Stephenson, N. (1992) <i>Snow Crash</i> , Spectra
I Am Legend (novella)	Will resistance or tolerance evolve during a zompires outbreak?	1	Matheson, R. (2008) <i>I Am Legend</i> , Orb Books
The Puppet Masters	Parasite manipulation of host behavior to favor parasite transmission.	1, 3, 6, 10	Orme, S. (1994) <i>The Puppet Masters</i> , Buena Vista Pictures (Movie)
The Ring, Loop and Spiral (novels)	A multiscale view of an infection.	1	Suzuki, K. (2004) <i>The Ring Series</i> , Vertical
The Stand	Host heterogeneity in the response to a massive epidemic.	4	King, S. and Garris, M. (1994) <i>The Stand</i> , American Broadcasting Company (Television Series)
The Stuff	A parasite whose transmission depends on its marketable deliciousness.	9	Cohen, L. (1985) <i>The Stuff</i> , New World Pictures (Movie)
The Tinger	A commensal that survives on fear that succumbs to a bizarre antiparasitic treatment.	3, 5, 8	Castle, W. (1959) <i>The Tinger</i> , Columbia Pictures (Movie)
Twelve Monkeys	An epidemiological whodunnit.	1	Gilliam, T. (1995) <i>Twelve Monkeys</i> , Universal Studios (Movie)
Warm Bodies	Resilience and tolerance to infections.	4, 7	Levine, J. (2013) <i>Warm Bodies</i> , Summit Entertainment (Movie)
World War Z	Zombie pandemic that is halted with an interesting transmission blocking treatment.	1, 2, 4, 6	Forster, M. (2013) <i>World War Z</i> , Paramount Pictures (Movie)

^aSome of these are intended for 'mature audiences' and instructors should be sure to preview movies and books before presenting them to their class. The movies are categorized with regard to lessons they can be used to teach, covering the categories of: 1, Outbreak epidemiology/dynamics; 2, Imaginative cures; 3, Pathogen life cycles; 4, Host heterogeneity and disease tolerance; 5, Native microbiota; 6, Pathogen social behavior; 7, Lives of the infected; 8, Unusual pathogens; 9, Mode of transmission; 10, Manipulation of the host.

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