

# The art of science communication:

Sarah Schreiner, PhD STROBE Associate Director of Outreach and Broadening Participation

## About me – Graduate school @ Yale in Cell Biology

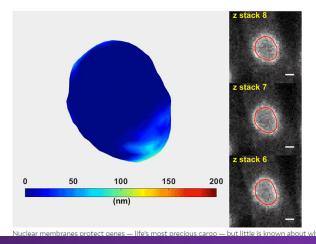
Yale



### YaleNews EXPLORE TOPICS .

## Research in the news: putting the squeeze on a cell's nucleus

By Bill Hathaway JUNE 15, 2015





## About me – Science communication experience



Learn science communication from editors, writers, policy makers, industry communicators, & scientists at our intensive professional development workshop.





Professor (Adjunct) of Molecular, Cellular, and Developmental Biology **robert.bazell@yale.edu** 

Robert Bazell is adjunct professor in the Department of Molecular Cellular and Developmental Biology. Before his arrival at Yale in 2013 he served for 38 years as chief science and health correspondent for NBC News. In that capacity he earned many awards including five Emmys, the Peabody Award and the DuPont Columbia . He has also written extensively for many peer reviewed and general interest publications and websites. He authored a best selling book called "Her-2: the making of of a revolutionary treatment for breast cancer" which was adapted as a TV film At Yale in the CTL and the CST before it, he has set up a series of

The New York Times



ALAN ALDA CENTER FOR COMMUNICATING SCIENCE

## Science Out Loud

#### SCIENCE

SEARCH



Matter

Matter. It's the stuff of everything — large and small.

# Why is communicating effectively important for scientists?

- Engaging the public
- Collaborating across disciplines
- Interacting with news and media
- Talking with legislators
- Gaining support from funding agencies and donors
- Career advancement (academia and industry)

# What are challenges scientists face when communicating their work?

### Game time!

Clustered regularly interspaced short palindromic repeats (CRISPR)/CRISPR-associated (Cas) systems provide bacteria and archaea with adaptive immunity against viruses and plasmids by using CRISPR RNAs (crRNAs) to guide the silencing of invading nucleic acids. We show here that in a subset of these systems, the mature crRNA that is base-paired to trans-activating crRNA (tracrRNA) forms a two-RNA structure that directs the CRISPR-associated protein Cas9 to introduce double-stranded (ds) breaks in target DNA. At sites complementary to the crRNA-guide sequence, the Cas9 HNH nuclease domain cleaves the complementary strand, whereas the Cas9 RuvC-like domain cleaves the noncomplementary strand. The dual-tracrRNA:crRNA, when engineered as a single RNA chimera, also directs sequence-specific Cas9 dsDNA cleavage. Our study reveals a family of endonucleases that use dual-RNAs for site-specific DNA cleavage and highlights the potential to exploit the system for RNA-programmable genome editing.



"Pinker, a cognitive scientist, says it boils down to "brain training": the years of deep study required of academics to become specialists in their chosen fields actually work against them being able to unpack their complicated ideas in a coherent, concrete manner suitable for average folks.

Translation: Experts find it really hard to be simple and straightforward when writing about their expertise.

[Pinker] calls this the "curse of knowledge" and says academics aren't aware they're doing it or properly trained to identify their blindspots—when they know too much and struggle to ascertain what others don't know.

In other words, sometimes it's simply <u>more intellectually challenging</u> to write clearly."

# Personal example of poor science communication



## • Background:

- What are GMOs?
- How are GMOs made?
- What GMOs currently exist?
- Are GMOs safe?



Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize

Gilles-Eric Séralini<sup>a,\*</sup>, Emilie Clair<sup>a</sup>, Robin Mesnage<sup>a</sup>, Steeve Gress<sup>a</sup>, Nicolas De rge Manuela Malatesta<sup>b</sup>, Didier Hennequin<sup>c</sup>, Joël Spiroux de Vendômois<sup>a</sup>

\* University of Caen, Institute of Biology, CRIIGEN and Risk Pole, MRSH-CNRS, EA 2608, Esplanade de la Paix, Caen Cedes 32. Fran <sup>b</sup> University of Verona, Department of Neurological, Neuropsychological, Morphological and Motor Sciences, Verona University of Caen, UR ABTE, EA 4651, Bd Maréchal Juin, Caen Cedex 14032, France

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#### ARTICLE INFO

### ABSTRACT

Article history: Received 11 April 2012 Accepted 2 August 2012 Available online 19 September 2012

Keywords GMO Roundun NK603 Glyphosate-based herbicides

Endocrine disrupting effects

#### 1. Introduction

There is an ongoing ernatio debate as to the necessary dies in relation to the consumplength of mammalian tox including regular metation of genetically (I) plant Currently, no regulatory bolic analyses ac animal feeding studies to authority reg sts mar atory ch. be performe and formulated pesticides. However, several s consisting of 90 day rat feeding trials have the biotech industry. These investigations been conducted mostly concern GM s and maize that are rendered either herbi-

Abbreviations: GM, genetically modified; R, Roundup; MRL, maximal residual levels; GMO, genetically modified organism; OECD, Organization for Economic Cooperation and Development; GT, glutamyl-transferase; PCA, principal component analysis; PLS, partial least-squares; OPLS, orthogonal partial least-squares; NIPALS, Nonlinear Iterative Partial Least Squares; OPLS-DA, Orthogonal Partial Least Squares Discriminant Analysis; G. glycogen; L. lipid droplet; N. nucleus; R. rough endoplasmic reticulum (on microscopy pictures only); U, urinary; UEx, excreted in urine during 24 h; APPT, Activated Partial Thromboplastin Time; MCV, Mean Corpuscular Volume; PT, Prothrombine Time; RBC, Red Blood Cells; ALT, alanine aminotrans ferase: MCHC Mean Corpuscular Hemoglobin Concentration: A/G Albumin/Glo

The health effects of a Roundup-t genetically dified maize (from 11% in the diet), cultivated undup alone (from 0. opb in water), were studied 2 years in rats. In with or without Roundup, and females, all treated groups die -3 times more than controls, and more rapidly. This difference was visible in 3 male groups fed GMC All results we hormone and sex dependent, and the pathological proeveloped lar files were comparable. Female mammary tumors almost always more often than and before controls, the nituitary wa ost disabled organ; the sex hormonal balance was mode secon ified by GMO and created males, liver congestions and necrosis were 2.5-5.5 treatm s confirmed by optic and transmission electron microscopy. Marked times higher. This and severe kidney r also generally 1.3-2.3 greater. Males presented 4 times more large op than is which occurred up to 600 days earlier. Biochemistry data confirmed very deficiencies; for all treatments and both sexes, 76% of the altered parameters / chre results can be explained by the non linear endocrine-disrupting effects of rexpression of the transgene in the GMO and its metabolic consequences. © 2012 Elsevier Ltd. Open access under CC BY-NC-ND license

> cide tolerant (to Roundup (R) in 80% of cases), or engineered to produce a modified Bt toxin insecticide, or both. As a result these GM crops contain new pesticide residues for which new maximal

> residual levels (MRL) have been established in some countries. If the petitioners conclude in general that there is no major change in genetically modified organism (GMO) subchronic toxicity studies (Domingo and Giné Bordonaba, 2011; Hammond et al., 2004, 2006a,b), significant disturbances have been found and may be interpreted differently (Séralini et al., 2009; Spiroux de Vendômois et al., 2010). Detailed analyses have revealed alterations in kidney and liver functions that may be the signs of early chronic diet intoxication, possibly explained at least in part by pesticide residues in the GM feed (Séralini et al., 2007; Spiroux de Vendômois et al., 2009). Indeed, it has been demonstrated that R concentrations in the range of 10<sup>3</sup> times below the MRL induced endocrine disturbances in human cells (Gasnier et al., 2009) and toxic effects thereafter (Benachour and Seralini, 2009), including in vivo (Romano et al., 2012). After several months of consumption of an R-tolerant soy, the liver and pancreas of mice were affected, as highlighted by disturbances in sub-nuclear structure (Malatesta

# Where is there a disconnect between scientists and the public?

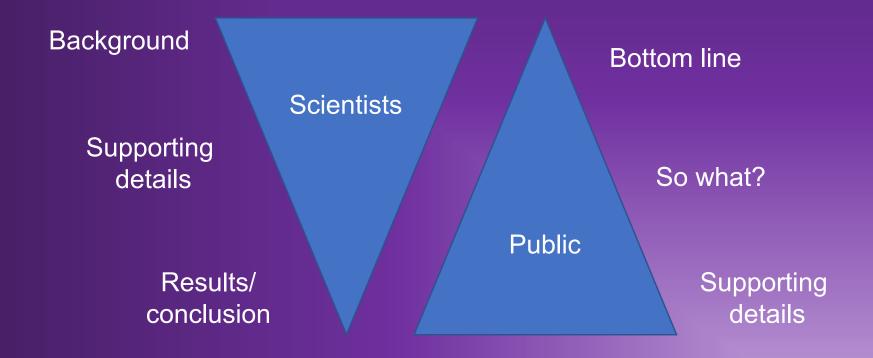


Deficit model - People's opinions differ from scientific consensus because they lack scientific knowledge

Backfire effect - Presenting facts that conflict with an individual's worldview can cause people to dig in further.

"Respondents who knew more about science generally, regardless of political leaning, were better able to identify the scientific consensus ... Yet, when the same people were asked for their own opinions about climate change, [their opinion did not match scientific consensus]. It showed that even when people understand the scientific consensus, they may not accept it."

# Where is there a disconnect between scientists and the public?



# How to determine the Bottom Line and the "So What?"

• Know your audience!



# How do you communicate effectively?

- Know your audience!
- Engage your audience within the first minute
  - Start with the big picture then go into details
- Find the "so what" or the why of your research
  - Tie this into the first minute of your talk

Bottom line

So what?

Public

Supporting details

## How to communicate effectively?

## Define your audience

- Define one take away message
- Think of a useful analogy for the work (if appropriate)
- Think of a lead in sentence that draws your audience in

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# Practice, practice, practice