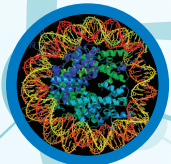
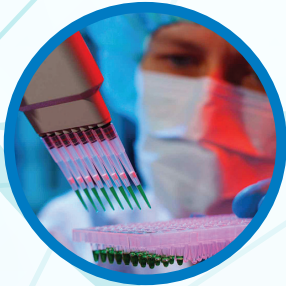


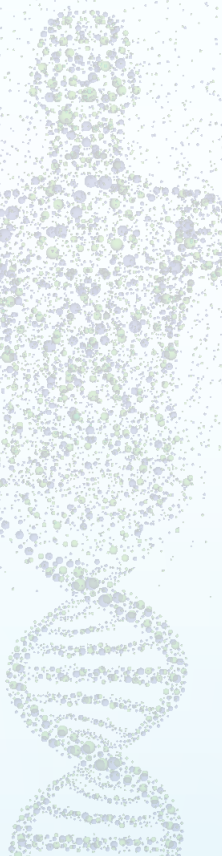
# Genetic Literacy Project

SCIENCE NOT IDEOLOGY



## ANNUAL REPORT 2019

FACT-BASED SCIENCE TO  
SERVE THE PUBLIC INTEREST





“

Science is not just about facts and new discoveries; it's a reflection of how we as humans see ourselves. The GLP is distinguishable from other science news outlets in that it regularly engages the meta-issues that define science: What does it mean to be human? What are the appropriate limits of technology? How do we balance prudence and precaution with our quest for innovation? How do embrace innovation while respecting diversity, particularly of deep-held religious beliefs that are often shunted aside. Those issues are front and center on the GLP site. It's truly a unique resource.



*Art Caplan, professor of bioethics at New York University Langone Medical Center and founding director of the Division of Medical Ethics*

“

GLP offers more bricks on a wall of scientific and technological records, developments, innovations, inventions and discoveries, as they happen. Plus, it exposes people who confuse science with ideology. It makes a great difference to the global information space!

From my world in Kampala, Uganda and throughout Africa, I tell policy-makers, students, farmers, journalists, cultural leaders and scientists that if the people of the 17th, 18th, 19th and 20th centuries were as picky and superstitious as many activists are today, such inventions as electricity, cars, trains, vaccines, radio, atomic energy, space-crafts, oil, gas and guns, let alone space and undersea exploration, wouldn't have seen the light of day!

GLP is a very important source of meticulously and comprehensively documented information from around the biology and overall science world. Thank you.



*Peter Wamboga-Mugirya, GLP Africa correspondent and director for communication and partnerships at the Science Foundation for Livelihoods and Development (SCIFODE), Uganda*

# MESSAGE FROM JON ENTINE

**Executive Director, Genetic Literacy Project**

What are we to make of the 'disruptive' biotechnology revolution fermenting around us?

This is a breathtakingly exciting moment in history, with implications beyond science.

We are witnessing almost daily innovations in CRISPR gene editing and the development of tools designed to manipulate the genes of crops, animals and humans, all in an effort to improve our health and environment.

But with this surge of change, there are concerns, legitimate and otherwise. Biotechnology involves a new view of what it means to be human in an ecologically challenged world, and that begs for ethical and religious reflection. The era of plant, animal and human eugenics presents prickly issues. And we also face a disturbing and growing movement to stifle innovation for ideological reasons.

In 1975, 140 biologists, physicians and lawyers organized by DNA pioneer and future Nobel Prize winner Paul Berg gathered at Asilomar State Beach, California to draw up principles for how the emerging tools of DNA manipulation might be safely used, and to ensure public acceptance. Asilomar is often cited as a great success, and it was in many ways as it established principles that paved the way for an explosion in the safe use of biotech innovation. There has been a burst in the development of lifesaving, biotechnology developed pharmaceuticals and medical procedures. And after more than 40 years, no evidence has been found that crops grown from genetically engineered seeds are any less healthy than conventional or organic foods, and there is considerable evidence of their sustainability advantages.

But through the lens of history, public opinion appears not to have kept up with science. As futurist Jamie Metz has written, Asilomar can be viewed as a "significant failure. Because the general public was not educated, engaged, and empowered at the early stages of the GMO era, many people felt GMOs were being forced on them." By the 2000s, coalitions spearheaded by Greenpeace, ETC Group, Center for Food Safety, Friends of the Earth and other "environmental" groups tilting towards extremism were attacking human and agricultural biotechnology. Many people, particularly in Europe, began seeing transgenics as dangerous.



Where are we now? In response to two decades of relentless campaigning by NGOs often engaging in scare tactics, 130 Nobel Prize winners signed a petition supporting GMOs as an effective tool in fighting malnutrition and climate change, with most future benefits likely to flow to the developing world. The petition had no impact on public opinion.

Europe remains firmly opposed to the introduction of new nutrition-enhancing, chemical-reducing, climate change-adaptive biotechnology crops. Uganda, Nigeria and other African countries have pulled back from commercializing biotech crops after protectionist threats from Europe (hypocrisy alert: 'GMO-free Europe' blocks biotech crops over nonexistent health fears while importing tens of millions of tons of genetically engineered crops for animal consumption with no safety incidents). European activists go door-to-door in Africa, claiming GMOs cause sterility and autism.

The US situation is modestly better. As a consequence of inefficient regulations, and opposition from American 'environmental' groups, it takes over \$120 million and 7 years to get a new crop approved; animal biotech innovations, such as hornless cows or fast-growing, sustainable fish, are in regulatory purgatory.

What has gone wrong? The collective failure of those who support science is not in the research but in communications. Views have hardened as some advocacy groups try to obscure the fact that GMOs have cut pesticide use, boosted yields and lowered the costs of food, particularly in the developing world. Going forward, we will require streamlined regulations that navigate the risks but also promote the benefits of 'disruptive' change.

CRISPR, synthetic biology and other advances in genetics could reset public opinion on biotechnology and challenge the dystopian, science-starved narrative. The GLP team is dedicated to ensuring that biotechnology rejectionism does not scuttle the most transformative technology in global history. The future is bright if we work together.

Please join us in helping to protect our fragile planet and promote a better quality of life for all people.

A handwritten signature in blue ink that reads "Jon Entine".





## OUR COMMITMENT TO YOU

Genetic engineering is reshaping food and medicine and providing new insights into our understanding of human history. GLP is committed to aiding the public, media and policymakers in understanding the societal implications of this burgeoning revolution and promoting science literacy.

Our goal, through our website and outreach efforts, including the dissemination of educational materials, organizing public and private conferences and initiating briefings with regulators and government officials, is to prevent legislative overreach and encourage cooperation

among academic and industry researchers to promote the public interest.

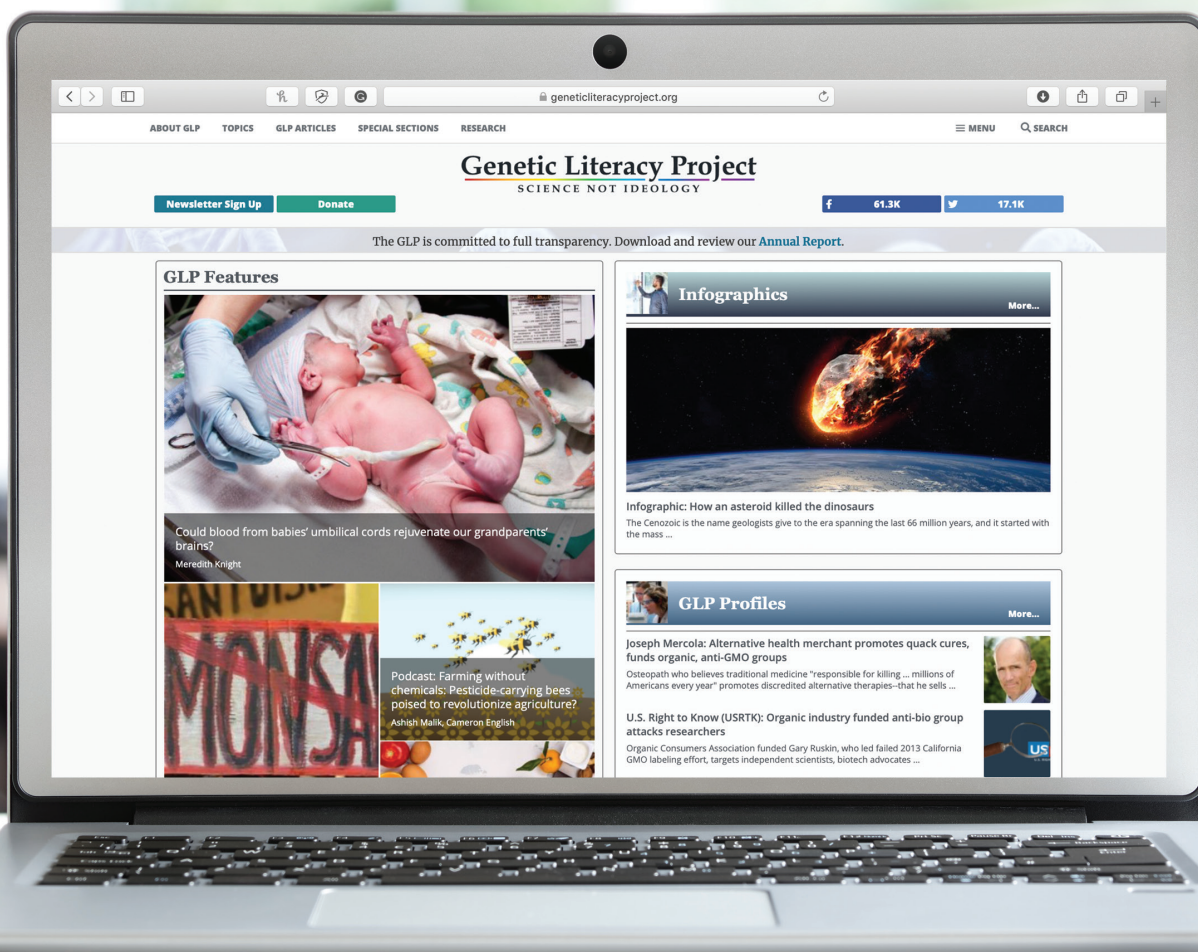
Some advocacy groups are critical of 'biotechnological' innovation. Dramatic change, when misapplied, can lead to unintended health and environmental consequences and present ethical and religious challenges. While we respect the uncertainties inherent in science, the GLP is grounded in the conviction that uncertainty is built into change and biotechnology is a critical engine of innovation. We examine these often-profound issues on a daily basis.



*"In researching my book on the making of the first genetically modified plants, along with many scientists, GLP was my best source for reliable, concise answers — and for pointing where to look for more information. Working in a field littered with misinformation from interested parties, I found GLP, with its respect for facts and its accessible presentation, to be a godsend."*

**JUDITH M. HEIMANN**

*Author of 'Using Nature's Shuttle: The Making of the First Genetically Modified Plants and the People Who Did It'*







# GLP RESOURCES

When the GLP launched in 2011, we had 26 visitors on the first day; almost all of those were likely our staff of two checking if we were still online. Eight years later, we average more than 55,000 daily unique visitors. Our Archives and easily searchable library contain more than 25,000 full and excerpted articles that we've collected over the years.

The screenshot shows the GLP Library homepage. At the top is a header with the text "GLP Library" over a background of binary code. Below this is a search bar containing the text "25,000+ articles on food and farming and human and medical biotechnology" and a "SEARCH" button. Under the search bar are three filter buttons: "EVERYTHING" (selected), "ONLY INFOGRAPHICS", and "ONLY VIDEOS", along with a "RESET SEARCH" button. Below the filters is a large orange banner with the text "Bees & Pollinators" and a small image of bees. Under the banner are two article previews. The first article is titled "How NPR, Washington Post, Bloomberg and other media botched reporting on EPA's 'ban' of 12 'bee-killing' neonicotinoid insecticides" by Cameron English, Jon Entine | Genetic Literacy Project, with a small image of a protest sign that says "save the bees". The second article is titled "Neonics ban tied to corrupted bee research by scientists at EU's ethically-challenged IUCN?" by David Zaruk | Genetic Literacy Project, with a small image of a beehive.

## GLP on GMOs

Our companion website, GMO FAQ, has emerged as the go-to educational resource for schools, universities, the media and the public exploring the debate over GMOs. It answers dozens of pressing questions about GMOS, the regulation of gene editing, concerns about the use of chemicals in farming, the sustainability differences between organic and conventional farming, and the labeling of genetically engineered foods.

The screenshot shows the Genetic Literacy Project GMO FAQ website. At the top right is the logo "Genetic Literacy Project" with the tagline "SCIENCE NOT IDEOLOGY". On the left is the title "GMO FAQs" in large green letters, with the subtitle "Agricultural biotechnology frequently asked questions" below it. The main content area is divided into three columns. The first column is titled "Fundamentals" and features a background image of colorful alphabet blocks. It contains a list of questions: "What are GMOs?", "Which genetically engineered crops and animals are approved in the US?", "Where are GMO crops and animals approved and banned?", "How does genetic engineering differ from conventional breeding?", "What are CRISPR and other New Breeding Techniques (NBTs)?", and "Why is there controversy over GMO foods but not GMO drugs?". The second column is titled "Farming & Food" and features a background image of a hand holding a pile of yellow corn kernels. It contains a list of questions: "Are GMOs necessary to feed the world?", "Can genetic engineering improve crop yields?", "What are 'superweeds'?", "Do GMOS cause 'superweeds'?", "Are GMOS to blame for the mass suicides of Indian farmers?", and "What is nutritionally enhanced Golden Rice and why is it controversial?". The third column is titled "Health & Safety" and features a background image of a human torso with a blue overlay. It contains a list of questions: "Are GMOs safe?", "Are organic foods healthier than conventional foods?", "Is glyphosate (Roundup) dangerous?", "Why are there no long-term GMO safety studies or studies on humans?", "Are most GMO safety studies funded by industry?", and "What are we to make of the 'Seralini studies' claiming GMOs and glyphosate are dangerous?".



# GLP EMERGES AS THE WORLD'S MOST VISITED ONLINE BIOTECHNOLOGY RESOURCE

Combined they are now the most visited online resources in the world for the media and the public interested in agricultural and human genetics and biotechnology. Together they have logged more than **11,895,000 unique visitors in the first six months of 2019 alone.**



## GeneticLiteracyProject.org Metrics

### Total Visitors

**10,494,472**

January 1, 2019-June 30, 2019

Source: Cloudflare

### Daily Visitors

**2019** 57,662

**2018** 14,000+

### Best Day

**2019** 102,077

**2018** 119,695

### Best Week

**2019** 686,864

**2018** 120,284

### Best Month

**2019** 2,551,692

**2018** 459,242

### Total Unique Visitors by Month



### Alexa Traffic Ranks



Alexa  
Global 59,875 U.S. 15,424

## GMO FAQs

Agricultural biotechnology frequently asked questions

### Total Visitors

**736,572**

January 1, 2019-June 30, 2019

### Best Month

**170,223**

Source: Cloudflare

### Daily Visitors

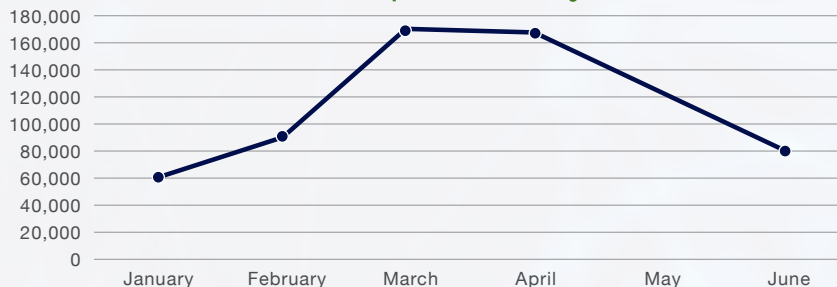
**3,818**

### Best Week

**45,561**

## GMO.GeneticLiteracyProject.org Metrics

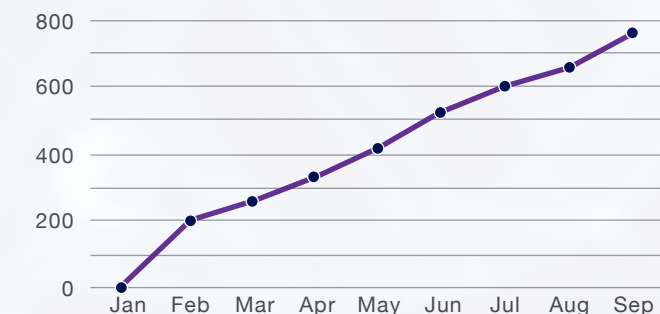
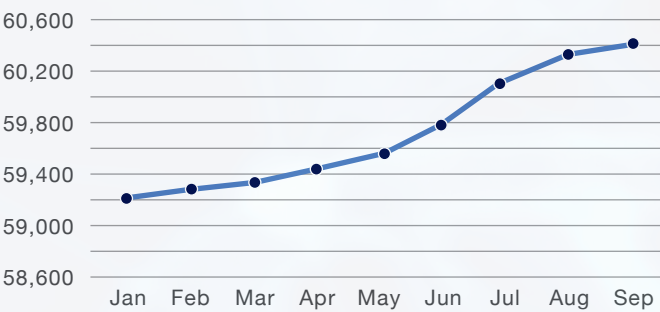
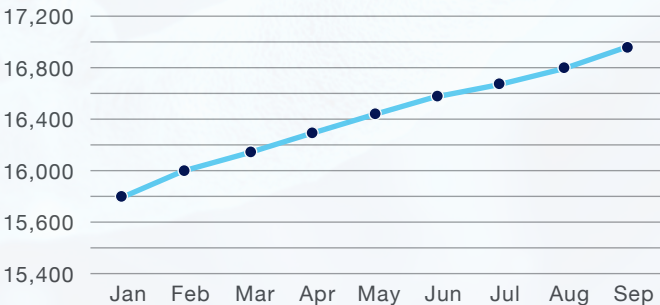
### Total Unique Visitors by Month



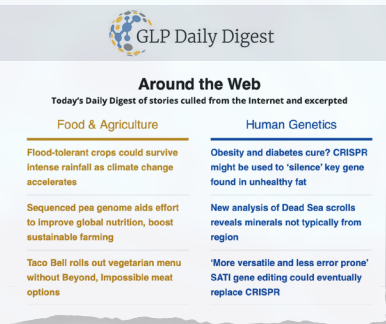


## Social Media Metrics

The GLP strategically engages social media to circulate stories, podcasts and videos and to alert readers of our expanding resources. Our social media outreach — Twitter likes and followers on Facebook and Instagram — has shown steady growth.



## Newsletters: Daily Digest, Weekly and Top 6



The GLP distributes 6 newsletters a week: 4 Daily Digests that present daily GLP features and short excerpts of the day's top human and agricultural genetic-related stories; 1 Weekly Digest highlighting the top features for the week; and a GLP Top 6 Roundup on Sundays calling out our most interesting stories of the week. Interest in our newsletters has increased dramatically over the past year.

**5,075 growth in one year (+39%)**







## MEDIA IMPACT AND CREDIBILITY

As the GLP's national and global audience has grown, it has emerged as a reliable and respected resource for scientists, policymakers and journalists. Media Bias Fact Check rates the GLP as "pro-science" and its "factual reporting" as high. Under the supervision of our managing editor Tim Barker, the GLP has dramatically increased its posting of resources and articles and has a growing list of media partners—journalism sites that partner with us, allowing us to run their articles in full and sometimes repost our original reports.



McGill Office  
for Science  
and Society  
Separating sense from nonsense



Truth, Beauty, Science.



# NATIONAL AND INTERNATIONAL MEDIA, SCIENCE, INDUSTRY AND ACADEMIC SITES QUOTE AND LINK TO THE GLP AND OUR RESOURCES

## The Washington Post

Outlook • Perspective

### Five myths about gene editing

The Genetic Literacy Project, a group dedicated to increasing the public's understanding of gene research, [wrote this year that](#) "parents worried about passing on genetic disorders to their children have hope: Gene editing." Likewise, an [Australian newspaper](#) greeted this month's CRISPR news with an ebullient headline: "Hope for parents as science deletes mutant killer gene."

## The New York Times

### Pesticide Industry Ramps Up Lobbying in Bid to Pare EPA Rules

"In the first two years of the Obama administration, you had a lot of saber rattling by political appointees" who appeared to favor the European approach to broader regulation, said Jon Entine, editor of the book "Crop Chemophobia: Will Precaution Kill the Green Revolution?" That, he said, "seemed to signal to chemical industry, agricultural and otherwise, that they were going to push for more precautionary oversight of chemicals."



U.S. National Library of Medicine



Genetics  
Home  
Reference

Your Guide to Understanding  
Genetic Conditions

The Genetic Literacy Project provides the editorial "That 'Precision Medicine' initiative? A Reality Check" outlining some of the possible challenges and limitations of the Precision Medicine Initiative.

## SLATE

### Do Neonics Hurt Bees? Researchers and the Media Say Yes. The Data Do Not.

A new, landmark study provides plenty of useful information. If only we could interpret it accurately.

By JON ENTINE



### Gene Editing of Embryos Gives Insight Into Basic Human Biology

In classic genetic studies, researchers routinely disable genes to figure out how they function, [reports Ricki Lewis for the Genetic Literacy Project](#). But CRISPR allows them to do the same with greater precision and accuracy.

The new research used fertilized cells donated after people had undergone *in vitro* fertilization treatments. "When it comes to illuminating early human development, there's nothing that measures up to using the real thing: human cells and tissues," writes Lewis.

## DAILY BEAST

INDIGESTION

### We're Paranoid About GMO Foods Because of Pseudo-Science

Chipotle says it will eliminate GMO ingredients from its menus. But many scientists believe the feverish antipathy toward GMOs is misplaced.

"They're positioning themselves as the good guys, but they're actually exploiting people's lack of sophistication about these issues and perpetuating pseudoscience," says Jon Entine, founder of the Genetic Literacy Project and senior fellow at the University California-Davis's World Food Center.

## FINANCIAL TIMES

"In most of the US, the genomic revolution is occurring out of public sight and mind, unless somebody takes the initiative to go online and read about what is happening on websites such as the Genetic Literacy Project."

## WALL STREET JOURNAL

### Food Goes 'GMO Free' With Same Ingredients

Supporters of biotechnology object to putting the non-GMO stamp on fresh produce with no commercially available GMO variants. It spreads misinformation and casts unfounded doubts on the scientific process and the safety of the food supply, said Jon Entine, executive director of the Genetic Literacy Project, which generally supports biotechnology. The fact that the Non-GMO Project classifies nearly all foods as either at "high risk" or "low risk" of genetic modification is disingenuous because it implies they can cause injury, he said.





# GLP CHALLENGES MISINFORMATION AND ANTI-SCIENCE ACTIVISM

The GLP stands for empirical evidence. We challenge poor science reporting every day, which keeps us busy. And we contest bad science on both the left and the right. Our investigations, especially in our GLP Profiles section, review the activities of individuals and groups who oppose technology for ideological and political reasons.



## GLP Profiles

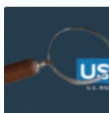
**Joseph Mercola:** Alternative health merchant promotes quack cures, funds organic, anti-GMO groups

Osteopath who believes traditional medicine "responsible for killing ... millions of Americans every year" promotes discredited alternative therapies--that he sells ...



**U.S. Right to Know (USRTK):** Organic industry funded anti-bio group attacks researchers

Organic Consumers Association funded Gary Ruskin, who led failed 2013 California GMO labeling effort, targets independent scientists, biotech advocates ...



For example, on the issue of GMO safety, there is no scientific debate. In a 2016 PEW survey of Association for the Advancement of Science members, 88% viewed GMOs as safe, a higher percentage than said humans drive global warming. But on the Internet, super-charged by 'environmental' advocacy groups or sloppy reporters who put ideology ahead of empirical evidence, the views are almost the opposite.



**Podcast:** Nobel laureates mobilize against Greenpeace to reverse campaign to block vitamin-enhanced Golden Rice

## Viewpoint: Activist myth-making, anti-science lobbying undermine Uganda's path to food security

Robert Wager



## Viewpoint: Guardian (UK) 'Toxic America' series: Anti-chemical activism masquerades as science journalism

Andrew Porterfield, Jon Entine | June 11, 2019

### Toxic America

Is modern life poisoning us?

## How John Oliver was duped by the fringe anti-science advocacy groups USRTK and the Organic Consumers Association

Jon Entine | August 24, 2018

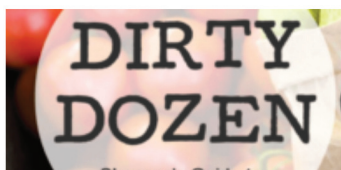




The GLP challenges organizations that exaggerate risk and generate unsubstantiated fears about food, chemicals and drugs — groups such as the Organic Consumers Association, which promotes the belief that GMOs cause cancer and autism; US Right to Know, which attacks mainstream scientists and science journalists; and the Center for Food Safety and Environmental Working Group, which promote chemophobia.



**Worst 10 list: Advocacy groups that put ideology ahead of science on food and farming issues**



**Viewpoint: How the Environmental Working Group and 'Big Organic' manipulate pesticide data to scare people**

We have our share of critics on the fringes of the anti-GMO movement, most notably Dr. Joseph Mercola, who promotes a range of bogus 'natural' cures, and Natural News, known for advancing conspiracy theories, such as dismissing the Sandy Hook school shooting as 'false flag' government operations, fostering a belief in the dangers of chemtrails and scaring readers into not using anti-cancer drugs. Twitter and Facebook banned the site because of its incendiary posts. Its founder Mike Adams has called the GLP's Jon Entine one of the "10 Most 'Evil People in the World'" because of our support for empirically based science. We're in good company and flattered!

### **Mike Adams, Alex Jones and Joe Mercola: How the web turns quacks into science gurus**

Stephanie M. Lee | BuzzFeed | March 10, 2017



M. Alsip/Bad Science Debunked  
http://BadSciDebunked.Wordpress.com

## **Natural News**

The world's top news source on natural health | Part of the NATURAL NEWS NETWORK

## **10 most evil people in the world today who lie about science, pharmaceuticals and GMOs**

### **1. Paul Offit**

Paul Offit made a vaccine in his laboratory using two strains of deadly circovirus to treat rotavirus is called Rotateq. He mixed a deadly pig virus called circovirus in a vaccine meant to help prevent children and babies from getting a rather benign virus that simply causes diarrhea. He works at the Children's Hospital of Philadelphia.

### **2. Farid Fata**

Psycho doctor Farid Fata was a Detroit area oncologist who defrauded Medicare and private insurance companies for more than \$30 million in the biggest healthcare scheme the world has ever known. Fata was poisoning innocent people, including children, with a deadly dose of chemo he called the "European Protocol."

### **3. Dr Richard Pan**

Dr Richard Pan is the clown who authored California's force-vaccination bill that ensures all children in the state are injected with mercury, aluminium and formaldehyde.

### **4. Neil DeGrasse Tyson**

He pushes GMO propaganda films for dirty money.

### **5. Bill Nye**

The "Science Fraud Guy" who once questioned GMOs and global warming now pushes all the propaganda behind them for money.

### **6. Ex-President Barack Obama**

Obama hired a former Monsanto shill to run the FDA and hide GMOs.

### **7. Bill Gates**

Bill Gates pushes cancer-causing GMOs and toxic population-reducing vaccines on the innocent African nation.

### **8. George Soros**

He funds eugenics programs and transgenic seeks via Monsanto.

### **9. Jon Entine**

**He pushes chemicals that cause cancer as "sustainable" and "safe" for human consumption.**

### **10. Kevin Folta**

He pushes Monsanto's GMO propaganda and was recently exposed by the U.S. Right-to-Know group.





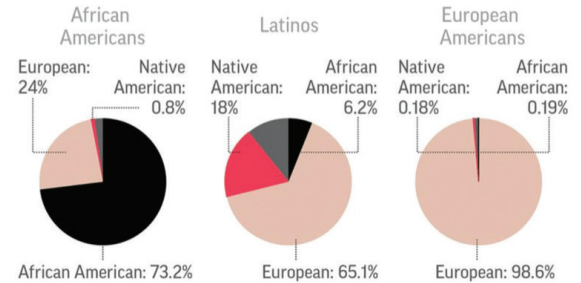
## GLP IMPACTS POLITICS AND POLICY

The GLP is not shy about challenging politicians or policymakers who stand on the wrong side of science, regardless of whether they are Republicans or Democrats. Just ask Elizabeth Warren. We knew she was playing loose with science when she claimed last fall that she had 'significant' Native American ancestry and misleadingly said it was based on a DNA test. Our GLP analysis made clear that she tried to twist science for political gain. Our reporting was cited across the media world, left and right, with particularly high-profile coverage on *Salon*, *FOX News*, *Washington Times*, *The Blaze*, *American Spectator* and most significantly by the *AP*, which disseminated this graphic to more than 1,300 newspapers in 106 countries. Sen. Warren has since backed away from promoting her essentially non-existent Native American ancestry, which had offended many in the American indigenous population.

### Elizabeth Warren's DNA claim inflames some Native Americans

Francois Duckett | Posted: Tuesday, October 16, 2018 6:34 pm

Genetic analysis of the ancestry of 160,000 Americans by Harvard University and 23andMe, the largest such study to date, show averages across three major population groups:



SOURCE: Jon Entine, Genetic Literacy Project

AP

We also challenged government-originated science rejectionism...and highlighted reforms. We featured attempts by the White House to block critical research at the NIH, but also its attempts to reduce innovation-blocking red tape in the regulation of agricultural biotechnology.



NIH blocks research using fetal tissue, prompting calls of 'scientific censorship'



Will Trump Administration reduce 'unnecessary' agricultural biotechnology regulations?

In a continuous series of reports, we called out the Food and Drug Administration's scientifically backward plans, also endorsed by the Trump and Obama Administrations, to regulate gene editing of animals as if they were drugs, using a law passed in 1937 before DNA was even discovered. The FDA has not yet reversed course, but the outcry from the science community has gotten louder.



FDA plan to regulate a gene-edited animal as a 'drug' will 'choke' research, experts say



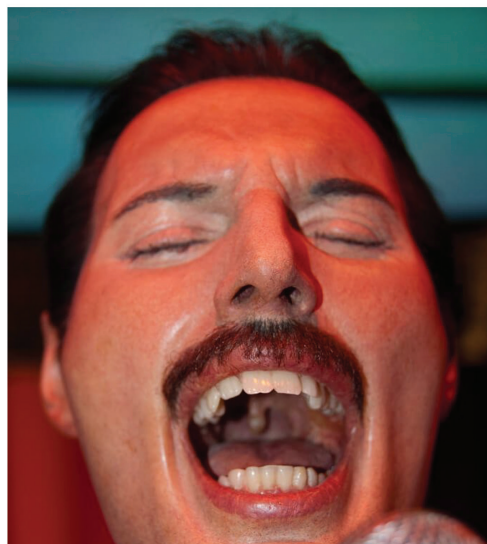


## GLP EDUCATES

One of the GLP's most important mandates is to educate—to make the biotech revolution accessible. Many of our stories have gone viral globally. Contributing writer and geneticist Ricki Lewis, who also writes a blog for the Public Library of Science (PLOS), mused about the mystery that captured the imagination of fans of Freddie Mercury and the rock group Queen: Was his magnificent voice somehow the result, at least in part, of a genetic defect — four extra incisors that pushed his front teeth forward? Lewis' story, timed to the Academy Awards, captured the world's imagination with more than **180,000 views**.

### How Freddie Mercury got his voice: It wasn't his teeth

Ricki Lewis



### Artificial wombs: The coming era of motherless births?

David Warmflash



The most shared article in GLP history — Astropysicist David Warmflash's futuristic take on incubating human babies: "Artificial wombs: The coming era of motherless births?" — has been shared across the web more than **430,000 times** and has received more than **500,000 views**.

GLP has developed a reputation for puncturing myths, particularly those that raise health concerns, such as the unfounded belief that autism is caused by vaccines, chemical exposure or GMOs — as former editor and writer Arvind Suresh explained in "Autism increase mystery solved? No, it's not vaccines, GMOs, glyphosate—or organic foods". It's been picked up by dozens of science sites and viewed more than **360,000 times**.

### Autism increase mystery solved? No, it's not vaccines, GMOs, glyphosate—or organic foods

Arvind Suresh







# TEACHING THROUGH VIDEOS, INFOGRAPHICS AND PODCASTS

## VIDEOS

Many people embrace visual communications, so we've dramatically expanded our posting of videos and infographics, from stories we've found on the web and from our own contributors. We have a growing collection of video pieces on genetics that we've assembled from social media outlets – YouTube, Instagram, Vine, Facebook, Twitter, SnapChat, etc.



Video: Crops engineered with nanoparticles could survive bleak environments—including space

September 13, 2019



Video: Does eating red meat increase cancer risk? Here's what's wrong with a recent study.

August 28, 2019

## INFOGRAPHICS



Infographics are an informative way to illustrate and explain intricate science. Besides posting informative infographics we find on the web, our data visualization specialist, neuroscientist Dr. Kayleen Schreiber, designs them. Two of Kayleen's infographics went viral.

**'How Crops are Genetically Modified'** explains in visual form the range of breeding techniques

from traditional breeding through GMOs and gene editing. What's the safest? Many people were surprised when we separated science from Internet myths.

### How Crops are Genetically Modified

| Traditional Breeding                                                                                             | Mutagenesis                                     | RNA Interference                                 | Transgenics                                            | Gene Editing                                                                      |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------|
| Crossing plants and selecting offspring                                                                          | Exposing seeds to chemicals or radiation        | Switching off selected genes with RNA            | Inserting selected genes using recombinant DNA methods | When used to delete genes using engineered nucleases (CRISPR, TALENs, ZFNs, etc.) |
|                                                                                                                  |                                                 |                                                  |                                                        |                                                                                   |
| Desired gene(s) inserted with other genetic material                                                             | Random changes in genome, usually unpredictable | Targeted gene(s) switched off or 'silenced'      | Only gene(s) inserted at desired locations selected    | Desired gene(s) deleted only at known locations                                   |
| Almost all crops                                                                                                 |                                                 |                                                  |                                                        |                                                                                   |
| Number of genes affected: few genes to whole genomes                                                             | 100s - 1,000s                                   | 1 - dozens                                       | 1 - 8                                                  | 1 or more                                                                         |
| No safety testing required; <b>Unregulated</b>                                                                   | No safety testing required; <b>Unregulated</b>  | Safety testing required; <b>Highly regulated</b> | Safety testing required; <b>Highly regulated</b>       | Safety testing required depending on jurisdiction; <b>Mixed regulations</b>       |
| Undesirable, unintended effects rarely occur in the final product of any crop, regardless which process is used. |                                                 |                                                  |                                                        |                                                                                   |

**'What do global regulatory and research agencies conclude about the health impact of glyphosate'** explains one of the most contentious issues over the past year. There is a sizable gap between what some juries and many environmental activists believe and what scientists have determined about this weedkiller, often sold as Roundup, which is commonly paired with GMO crops. The infographic has become an essential resource for researchers and policymakers.

| What do global regulatory and research agencies conclude about the health impact of GLYPHOSATE? |             |                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Risk Assessment                                                                                 |             |                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                 | USA         | "Human health risk assessment concludes that glyphosate is not likely to be carcinogenic to humans... [and] no other meaningful risks to human health when the product is used according to the pesticide label"                                                                                                                                       |
|                                                                                                 | USA         | "Not strong support for... 'suggestive evidence of carcinogenic potential...' based on the weight of evidence... Even small, non-statistically significant changes... were constructed by studies of equal or higher quality. The strongest support is for 'not likely to be carcinogenic to humans'."                                                 |
|                                                                                                 | USA         | "Little evidence of toxicity, and there was no evidence of glyphosate causing damage to DNA"                                                                                                                                                                                                                                                           |
|                                                                                                 | Canada      | "Products containing glyphosate do not present unacceptable risks to human health or the environment when used according to the revised product label directions... Risks to [occupational] handlers are not of concern for all scenarios"                                                                                                             |
|                                                                                                 | Europe      | "Based on the epidemiological data as well as on data from long-term studies in rats and mice, taking a weight of evidence approach, no hazard classification for carcinogenicity is warranted"                                                                                                                                                        |
|                                                                                                 | Europe      | "Glyphosate is unlikely to be genotoxic or to pose a carcinogenic threat to humans... Neither the epidemiological data nor the evidence from animal studies demonstrated causality between exposure to glyphosate and the development of cancer in humans"                                                                                             |
|                                                                                                 | France      | "Level of evidence of carcinogenicity in animals and humans is considered to be relatively limited and does not allow for a 1A or 1B classification (known or suspected carcinogen for humans)"                                                                                                                                                        |
|                                                                                                 | Germany     | "Available data do not show carcinogenic or mutagenic properties of glyphosate nor that glyphosate is toxic to fertility, reproduction or embryonal/fetal development in laboratory animals"                                                                                                                                                           |
|                                                                                                 | Switzerland | "Residues of glyphosate in the foods investigated do not represent a risk of cancer"                                                                                                                                                                                                                                                                   |
|                                                                                                 | Australia   | "Glyphosate does not pose a carcinogenic risk to humans... Products containing glyphosate are safe to use as per the label instructions"                                                                                                                                                                                                               |
|                                                                                                 | New Zealand | "Unlikely to be carcinogenic to humans or genotoxic (damaging to genetic material or DNA) and should not be classified as a mutagen or carcinogen"                                                                                                                                                                                                     |
|                                                                                                 | Brazil      | "No evidence to indicate that the herbicide glyphosate is carcinogenic"                                                                                                                                                                                                                                                                                |
|                                                                                                 | Japan       | "No neurotoxicity, carcinogenicity, reproductive toxicity, teratogenicity, and genotoxicity"                                                                                                                                                                                                                                                           |
|                                                                                                 | Korea       | "Epidemiological studies on glyphosate... found no cancer link"                                                                                                                                                                                                                                                                                        |
|                                                                                                 | Global      | "Glyphosate is unlikely to be genotoxic at anticipated dietary exposures. Glyphosate is unlikely to pose a carcinogenic risk to humans from exposure through the diet"                                                                                                                                                                                 |
|                                                                                                 | Global      | "Under usual conditions, the presence of glyphosate and AMPA [aminomethylphosphonic acid, glyphosate's primary metabolite] in drinking water does not represent a hazard to human health"                                                                                                                                                              |
|                                                                                                 | Global      | "Available data on occupational exposure for workers applying Roundup indicate exposure levels far below the NOAEL [no observed adverse effect level] from the relevant animal experiments"                                                                                                                                                            |
| Longitudinal Study                                                                              |             |                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                 | USA         | "No association was apparent between glyphosate and any solid tumors or lymphoid malignancies overall, including non-Hodgkin lymphoma and its subtypes... some evidence of increased risk of AM, leucis myeloid leukemia among the highest exposed group that requires confirmation"                                                                   |
| Hazard Assessment                                                                               |             |                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                 | Global      | "Limited evidence in humans for the carcinogenicity of glyphosate... Evidence in humans from studies of exposures, mostly agricultural (e.g., not from dietary exposure)... A positive association has been observed for non-Hodgkin lymphoma... There is 'strong' evidence that exposure to glyphosate or glyphosate-based formulations is genotoxic" |
|                                                                                                 | Global      | IARC placed glyphosate in its hazard category 'Group 2A: probably carcinogenic to humans' along with red meat, hot beverages, and working as a barber. The evidence on carcinogenicity was less robust than for agents such as bacon, salted fish, oral contraceptives and wine."                                                                      |







## PODCASTS


In addition to posting provocative on-point podcasts that we find across the web, the GLP now offers 4 podcasts developed specifically for the GLP or by our content partners. Our flagship Biotech Facts & Fallacies podcast challenges popular myths about biotechnology promoted by ideological advocacy groups, clickbait headlines and social media. It's hosted by GLP's Cameron English, who also serves as editorial director of our podcasts, and Steve Savage, plant pathologist and industry consultant.

|                                                                                      |                                                                                    |                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>BIOTECH</b><br/> <b>Facts &amp; Fallacies</b><br/>         Cameron English</p> |  |  <p>July 25, 2019 <b>AI-powered nutrition devices</b> could cut exploding obesity rates. Will FDA rules keep them off the market?</p> |
| <p><b>BIOTECH</b><br/> <b>Facts &amp; Fallacies</b><br/>         Steve Savage</p>    |  |  <p>Viewpoint: How the Environmental Working Group and 'Big Organic' manipulate pesticide data to scare people</p>                    |

University of Florida horticulturalist Kevin Folta's podcasts have been downloaded more than **1,000,000 times**.

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Podcast: Battle to conquer HIV with biotechnology is on. How much progress have we made?</b></p> <p>Kevin Folta, Pamela Skinner   July 24, 2019</p> <p>  Apple Podcasts            Google Podcasts            RSS         </p> |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|


Dr. Kat Arney, biologist and award-winning science communicator is the newest member of our podcast crew. She hosts Genetics Unzipped in partnership with the UK Genetics Society, covering the history of genetics, genomic medicine, gene editing controversies and crop biotechnology innovation.



August 29, 2019 **Podcast: Overlooked women in science, Huntington's disease and witch trials.** The best of Genetics Unzipped



April 11, 2019 **What would have happened if Darwin and Mendel had been on Twitter?**

|                                 |                                                                                                               |
|---------------------------------|---------------------------------------------------------------------------------------------------------------|
| <p><b>genetics unzipped</b></p> |  <p><b>Kat Arney</b></p> |
|---------------------------------|---------------------------------------------------------------------------------------------------------------|



“

This year at the National Association of Science Writers meeting, I am a speaker on a panel about strategies for getting the word out on science news outside of a press release, and moderating a second panel on seeking diverse sources in science writing. Many of my perspectives on how science is communicated was and continues to be shaped by my time as a writer and editor at GENeS and the Genetic Literacy Project, so I am always grateful when I think back to that experience!



*Arvind Suresh, writer, University of Pittsburgh Medical Center*

“

As a student and researcher, I have been impressed by the level of investigation and detail from the Genetic Literacy Project. Most recently, a background article on glyphosate completely opened my eyes to the flaws in a recent meta-analysis of studies on the herbicide and helped me contextualize the public debate. I've shared it with my fellow master's students as well as friends and family members. The GLP analysis, juxtaposed with public debate, brought to mind the following quote, a favorite of my graduate advisor: "It's easier to fool people than to convince them that they have been fooled." - Mark Twain



*Joshua Erickson, master's student, international agribusiness*





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Executive Director



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Managing Editor



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**ANDREW PORTERFIELD**  
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Former Associate Professor,  
Cell and Molecular Biology

**PHYLLIS A. LUDWIG**  
Advisor to the Board





“

I was never really good at science in college. Unfortunately, this lack of science education left me open to the organic industry propaganda against GMOs and ‘Big Ag’. Thanks to the GLP, I have been able to see through the propaganda, and the “fervor of the converted” burns very strongly in me. I find it shameful how supposedly intelligent people accept the scientific consensus on global warming but not on the safety of GMOs. It is wonderful to find an online community that eagerly defends the accomplishments of science.



*Stuart Massion, retired teacher, Kushiro City, Japan*





## FINANCIAL INFORMATION

|                                  | FYE 2019  | FYE 2018  |
|----------------------------------|-----------|-----------|
| <b>TOTAL REVENUE AND SUPPORT</b> | \$488,853 | \$613,179 |

### EXPENSES

|                            |                  |                  |
|----------------------------|------------------|------------------|
| Labor Expense (core staff) | \$362,956        | \$289,610        |
| Labor Expense (freelance)  | \$48,956         | \$21,065         |
| Benefits                   | \$20,031         | \$19,308         |
| Digital Expenses           | \$50,407         | \$41,436         |
| Development/Promotion      | \$34,041         | \$32,534         |
| General & Administrative   | \$87,171         | \$111,596        |
| <b>TOTAL EXPENSES</b>      | <b>\$603,070</b> | <b>\$515,549</b> |

|                             |                    |                 |
|-----------------------------|--------------------|-----------------|
| <b>CHANGE IN NET ASSETS</b> | <b>(\$114,217)</b> | <b>\$97,631</b> |
|-----------------------------|--------------------|-----------------|

|                                   |                  |                  |
|-----------------------------------|------------------|------------------|
| Cash on hand at beginning of year | <b>\$497,197</b> | <b>\$399,566</b> |
| Cash on hand at end of year       | <b>\$382,980</b> | <b>\$497,197</b> |

FYE concluded on June 30

|                                                        | FYE 2019         | FYE 2018         |
|--------------------------------------------------------|------------------|------------------|
| <b>REVENUE AND SUPPORT</b>                             |                  |                  |
| John Templeton Foundation                              | \$267,685        | \$267,687        |
| Winkler Family Foundation                              | \$120,000        | \$165,000        |
| Charles Koch Foundation, Technology & Innovation Group | \$68,500         | -                |
| The Bader Family Foundation                            | \$10,000         | -                |
| Perry Hackett                                          | \$5,000          | -                |
| The Modzelewski Charitable Fund                        | \$2,500          | -                |
| Peter Treadway                                         | \$2,500          | -                |
| Searle Foundation                                      | -                | \$75,000         |
| Phil Harvey                                            | -                | \$65,000         |
| The Global Farmer                                      | -                | \$25,000         |
| Triad Foundation                                       | -                | \$5,000          |
| Individual Contributions                               | \$10,861         | \$7,723          |
| <b>TOTAL NEW GRANTS/CONTRIBUTIONS</b>                  | <b>\$487,046</b> | <b>\$610,410</b> |
| Investment Income                                      | \$1,807          | \$2,769          |
| <b>TOTAL REVENUE AND SUPPORT</b>                       | <b>\$488,853</b> | <b>\$613,179</b> |





# Genetic Literacy Project

SCIENCE NOT IDEOLOGY

## SCIENCE LITERACY PROJECT/GENETIC LITERACY PROJECT

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