



*the Foundation for Peripheral Neuropathy*

# Welcome!

## **Biomedical Research 101**

Wednesday, November 3, 2021

*We will begin our presentation shortly.*



# *the* Foundation for Peripheral Neuropathy

*Moderator:*



**Lindsay Colbert**

*Executive Director*

*the* Foundation for Peripheral Neuropathy



# *the* Foundation *for* Peripheral Neuropathy

## Before We Begin



This presentation is being recorded. The recording link will be emailed to you so you can view it again later.



Submit your questions anytime via the Questions Box. We will try to answer them during this webinar.



If you are having trouble with the audio using your computer, you can dial in by phone (check your email for dial-in instructions).



# *the* Foundation for Peripheral Neuropathy

*Guest Speaker:*



**Kristy Townsend, PhD**

FPN Board Member

*Associate Professor*

Department of Neurological Surgery, Wexner Medical Center

Davis Heart and Lung Research Institute (DHLRI)

Diabetes & Metabolism Research Center (DMRC)

The Ohio State University

*the* Foundation for Peripheral Neuropathy

[www.foundationforpn.org](http://www.foundationforpn.org)

# Research 101

*From Bench to Bedside: How to Find and Interpret Current Research in Neuropathy*

Kristy Townsend, Ph.D.

Associate Professor

PI: Neurobiology & Energy Balance Laboratory

Dept Neurological Surgery

Wexner Medical Center, The Ohio State University

Board Member, Foundation for Peripheral Neuropathy



THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER



the FOUNDATION for  
PERIPHERAL NEUROPATHY®

DEDICATED to REVERSING the IRREVERSIBLE

# Outline for Today:

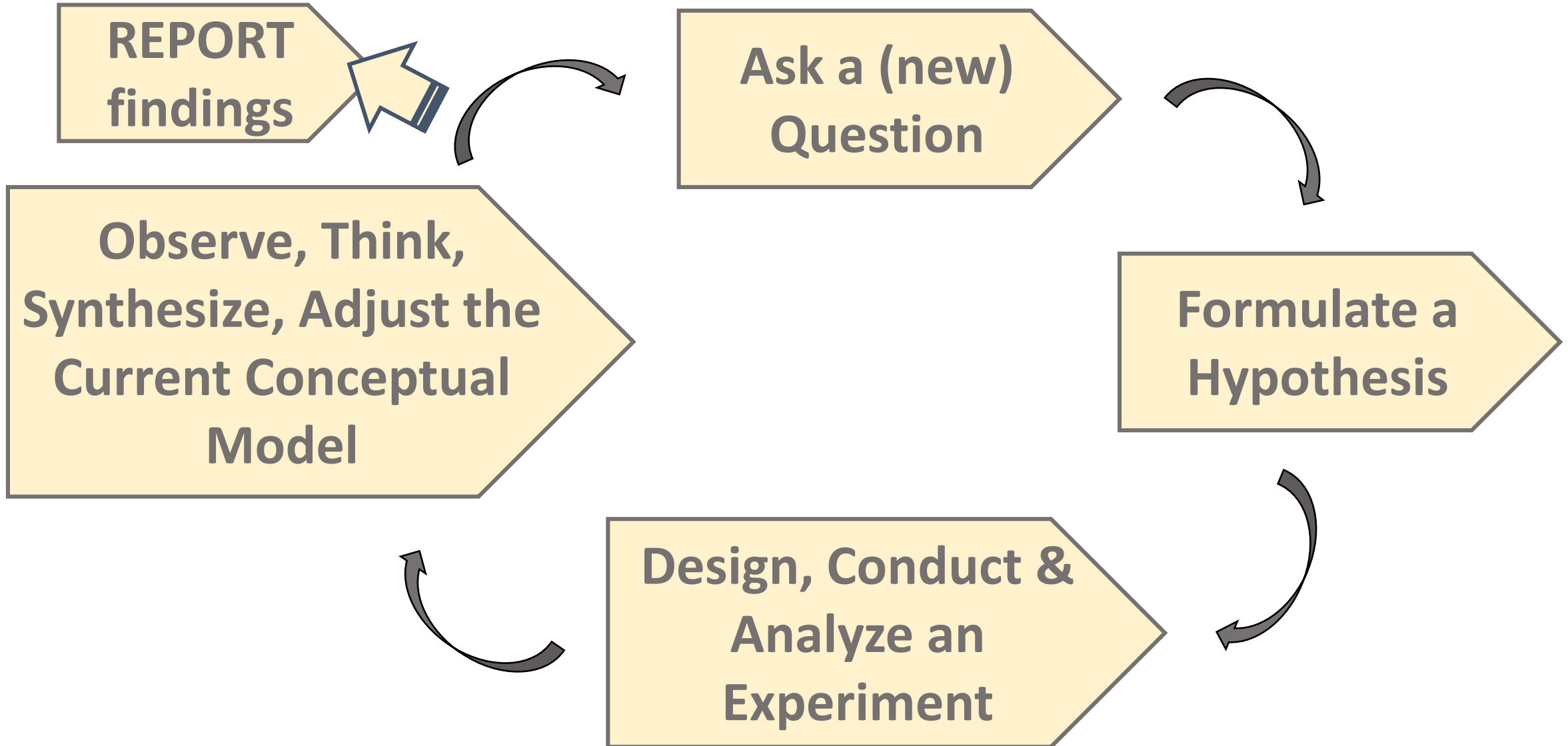
1. **The scientific process** – biomedical research from Basic to Clinical
2. The gold standard of research: **publication** in peer reviewed journals
3. **Funding** for research
4. Research **rigor and ethical** safeguards
5. **Finding** current research studies; **Vetting** research news
6. **Specific examples** of recent Neuropathy research (Basic to Clinical)

# Audience Poll #1

How comfortable do you feel with understanding the processes involved in conducting biomedical research?

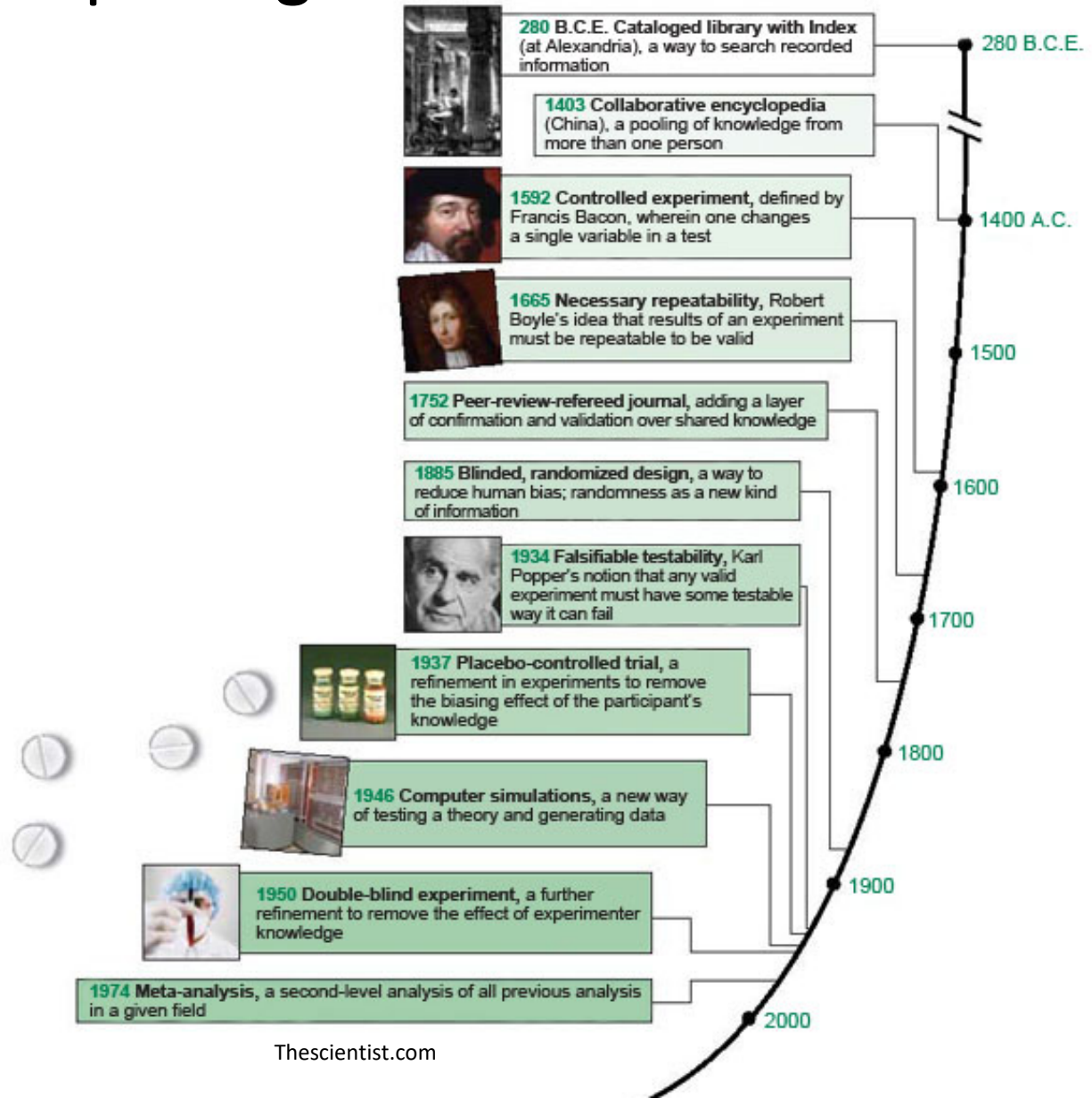
- A. Very comfortable
- B. Somewhat comfortable
- C. A little comfortable
- D. Not at all comfortable

*The Scientific Method* – A successful approach, unchanged in the 21<sup>st</sup> Century





# The Scientific Method – A successful approach, unchanged in the 21<sup>st</sup> Century -- & constantly improving



# The National Institutes of Health (NIH): FOLLOW THE SCIENCE

## HOW RESEARCH WORKS UNDERSTANDING THE PROCESS OF SCIENCE

Scientists ask questions about how the world works. Each research advance builds on past discoveries, often in unexpected ways. This process isn't always a straight path. But here's a general overview:

### DIFFERENT ANGLES DIFFERENT TECHNIQUES

Scientists with diverse skills and training can look at a question from different angles. They review past research and design new experiments to test their ideas.

An illustration of scientists in white coats working in a lab. One scientist is holding a large screen displaying a colorful pie chart. Another is holding a clipboard. In the background, there are various lab equipment like test tubes and a DNA helix icon.

### EVIDENCE ACCUMULATES

Scientists collect data from their experiments and evaluate what their findings might mean. That may lead to new ideas to test—or new ways to test older ideas.

An illustration showing scientists in white coats standing around a large, dark blue puzzle board. They are placing various pieces into the puzzle. The puzzle pieces feature different scientific icons like a DNA helix, a virus, a bar chart, and a test tube.

### THE BIG PICTURE

Each finding is often a small piece of a larger puzzle. It may take data from many different researchers to start piecing the full puzzle together. Science is constantly evolving, and our understanding changes.

An illustration of scientists in white coats standing in front of a large wall covered with various scientific data visualizations, including bar charts, pie charts, DNA helices, and virus icons. They appear to be discussing and analyzing the data.

### FORMING CONCLUSIONS

Over time, enough evidence accumulates to point toward an explanation of all the different findings on a topic.

An illustration of a group of scientists in white coats standing in a circle, engaged in a discussion. They are holding papers and pointing towards each other. The background is light blue with some faint scientific icons.

### SHARING DATA

To tell other scientists what they've found, researchers give presentations at meetings and publish papers in scientific journals.

An illustration of a group of scientists in white coats standing in a circle, engaged in a discussion. They are holding papers and pointing towards each other. The background is light blue with some faint scientific icons.

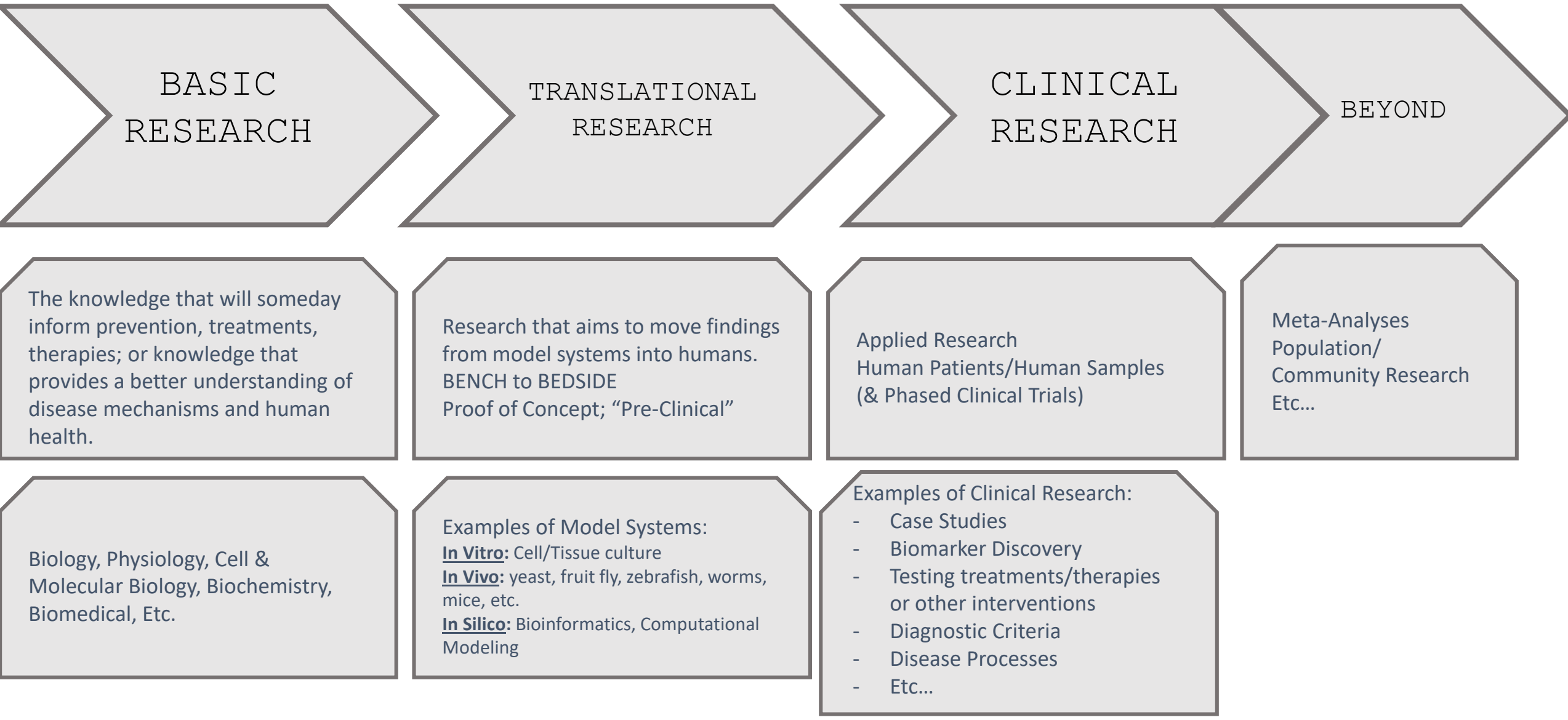
Research results sometimes seem to contradict each other. This can happen when scientists use different methods or timeframes. Reality is often more complex than the findings of a single study. That's why it's important to consider how all research results fit together.

An illustration showing scientists in white coats looking at a large, glowing blue question mark. One scientist is holding a paper, and another is pointing towards the question mark. The background is dark blue with some faint scientific icons.

### MORE QUESTIONS

Some research might not answer the scientists' original questions. But the knowledge gained may help answer other questions. And new findings raise new questions.

# The Scientific Process: Biomedical Research





# Translational Research

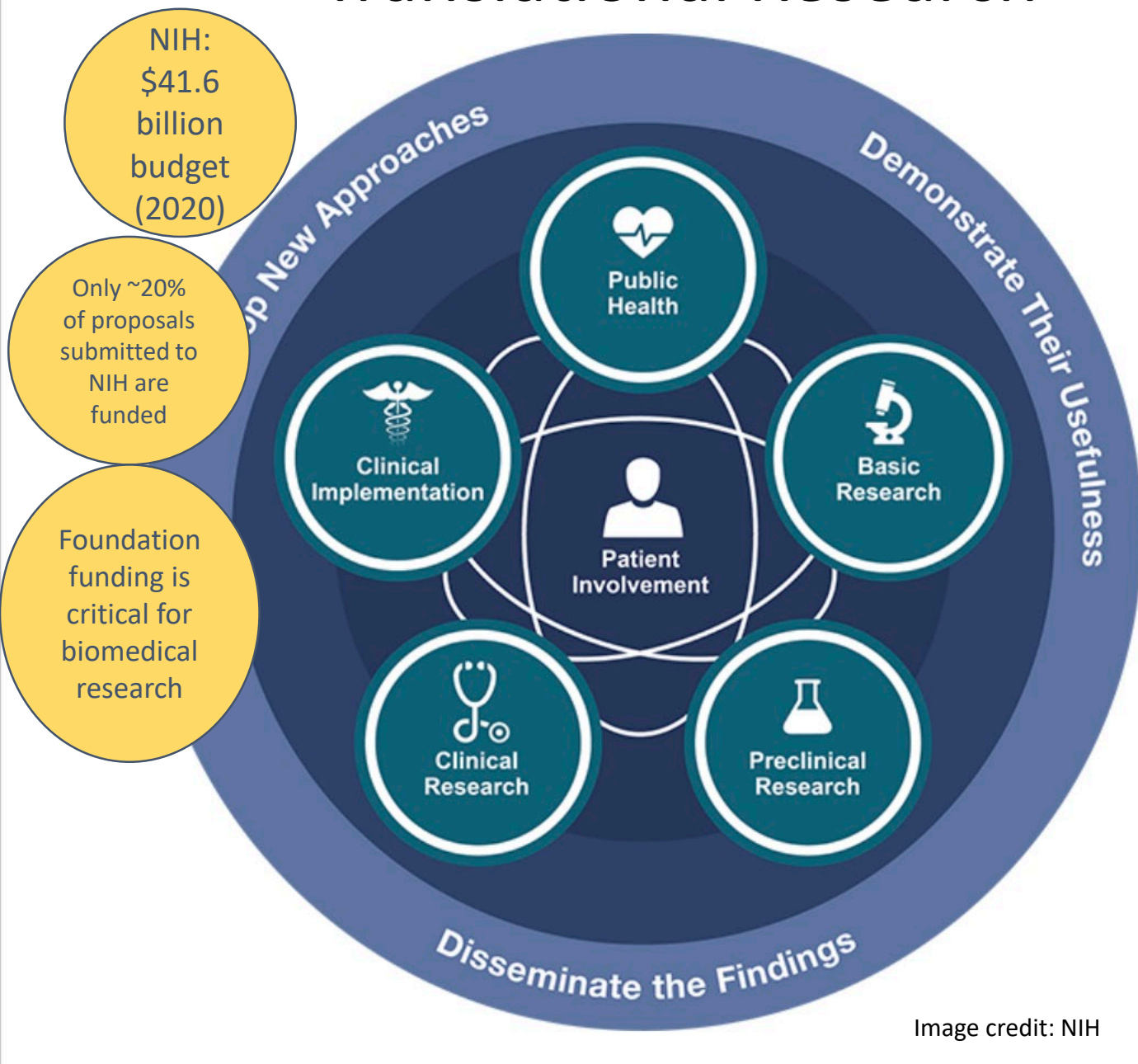
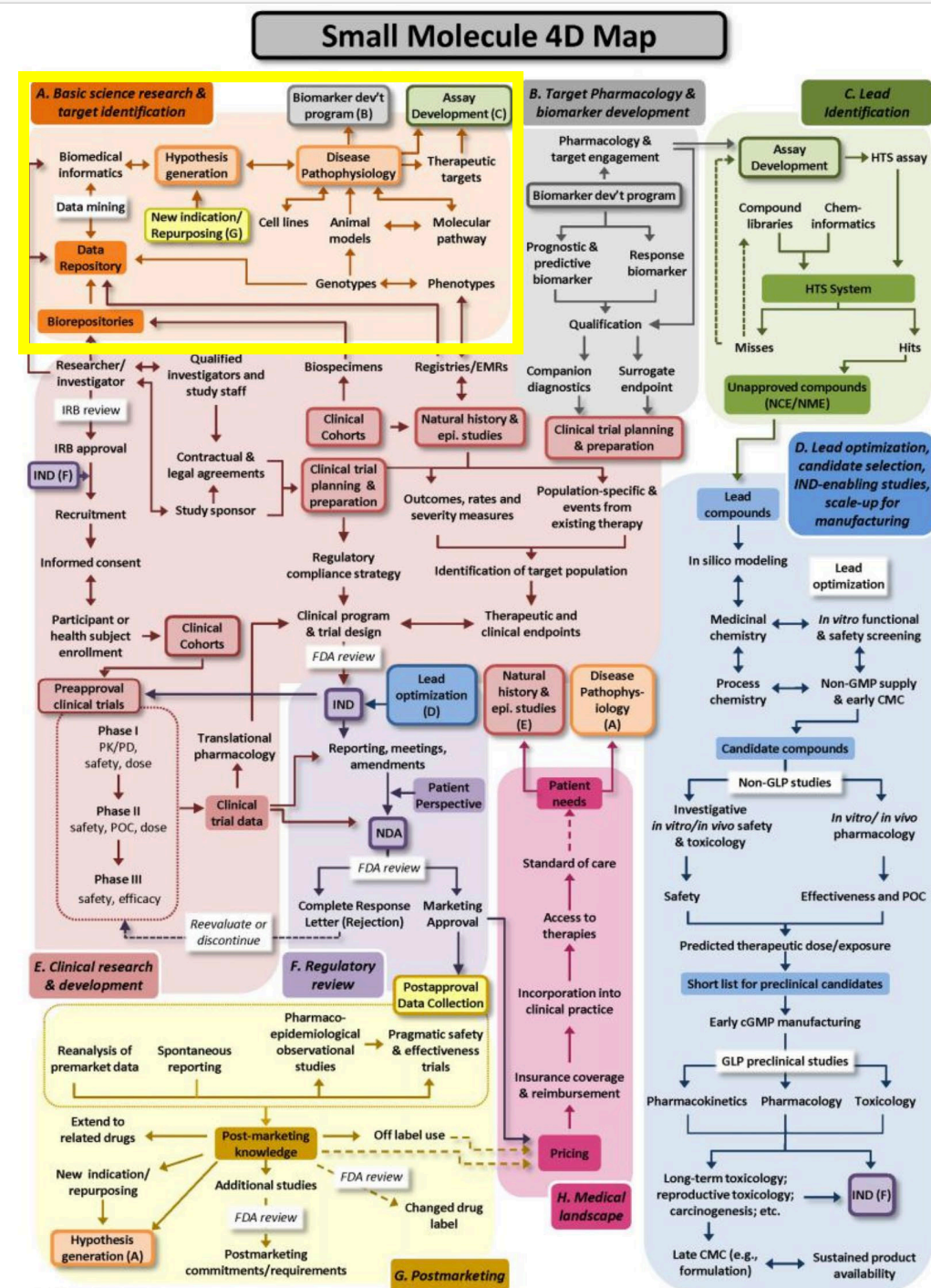
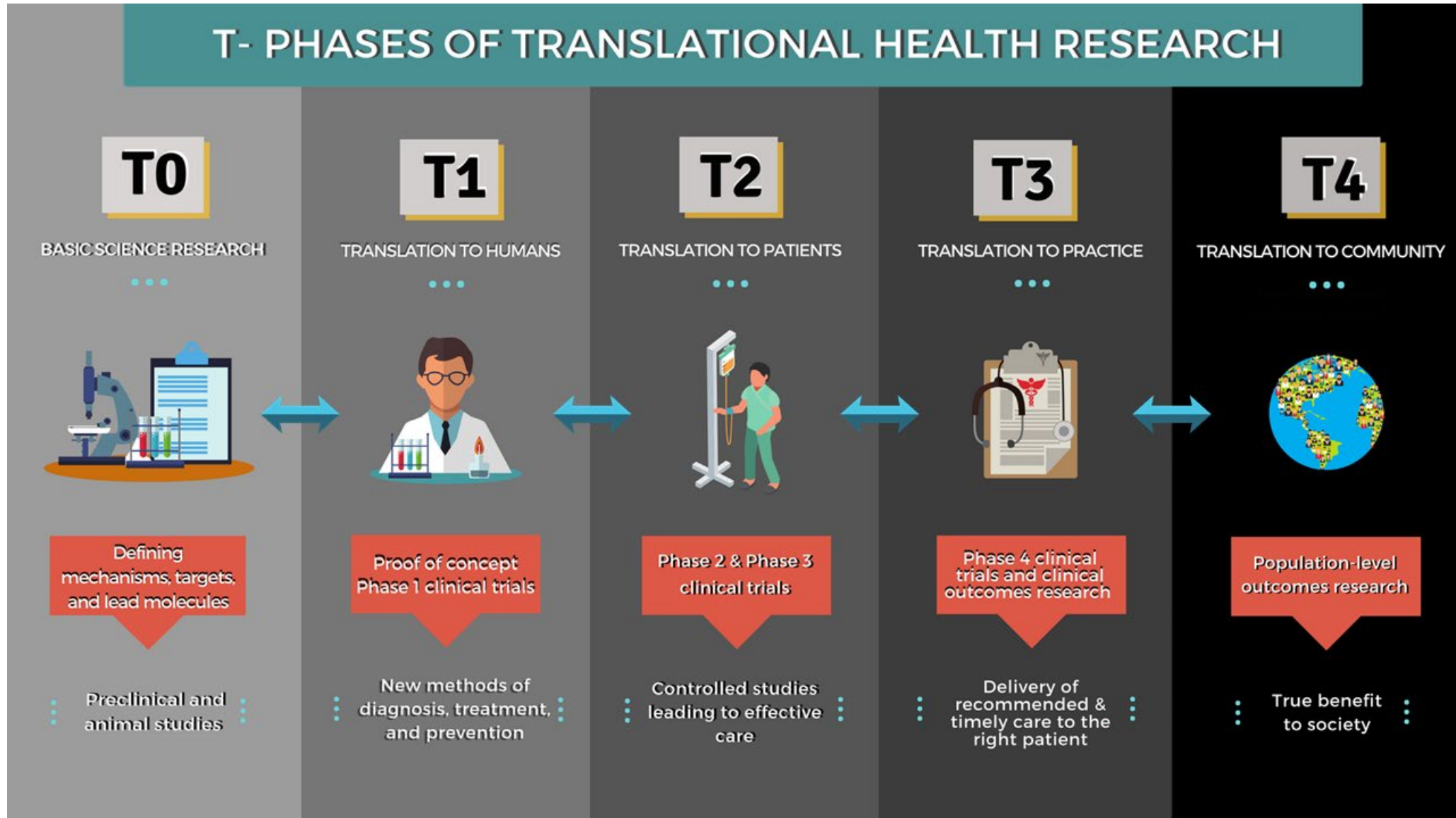


Image credit: NIH



# Translational Research and Beyond



# Phases of Clinical Trials

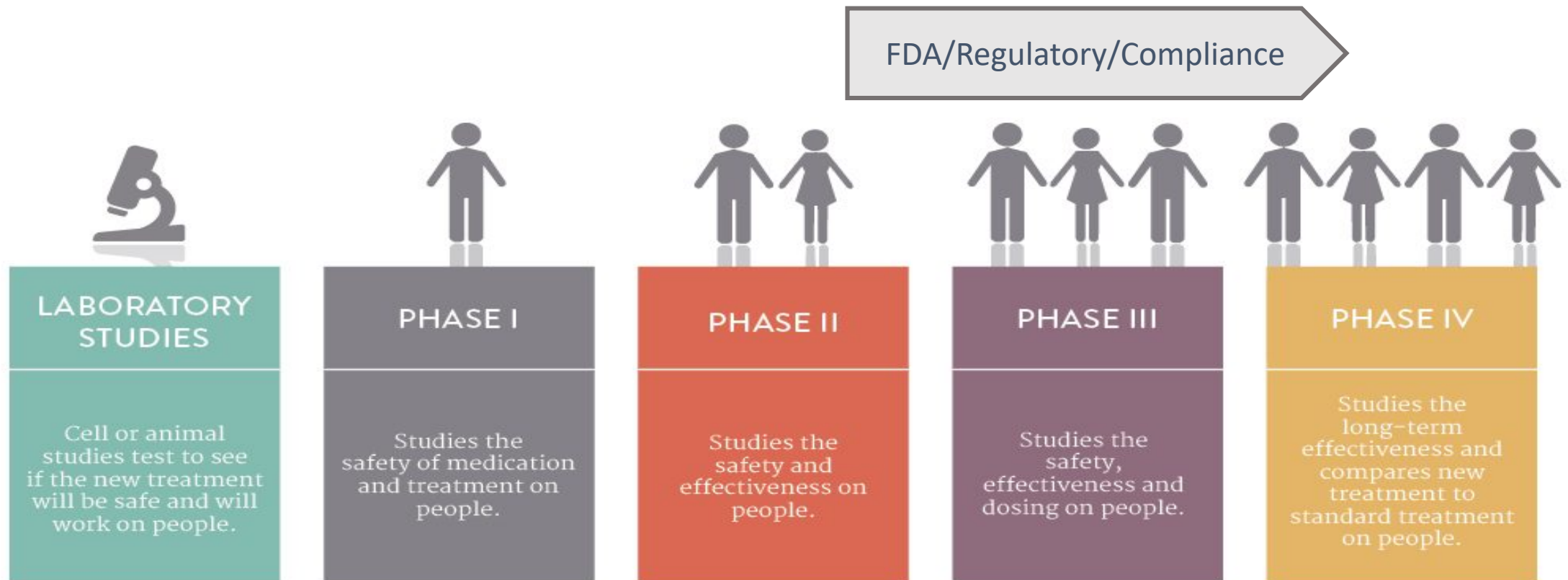


Image credit:  
brainsforthecure.org



# Key Concepts in Biomedical Research:

- Collaborative Research
- Interdisciplinary Research
- Research Teams:
  - Principal Investigator: MDs, Ph.D.s, MD/Ph.D.s, etc.
  - Team Members: Research Staff, Lab Managers, Clinical Trial Offices/Managers, Biobank specialists, etc...
  - Trainees: Residents/Fellows (Med Centers); postdoctoral fellows, graduate students, undergraduate students, post-bacc trainees, etc.
- Correlational, Descriptive, Experimental studies
- “Failure” → troubleshooting/optimization/validation → EUREKA!
- Experimental Controls, Research Reproducibility

# Audience Poll #2

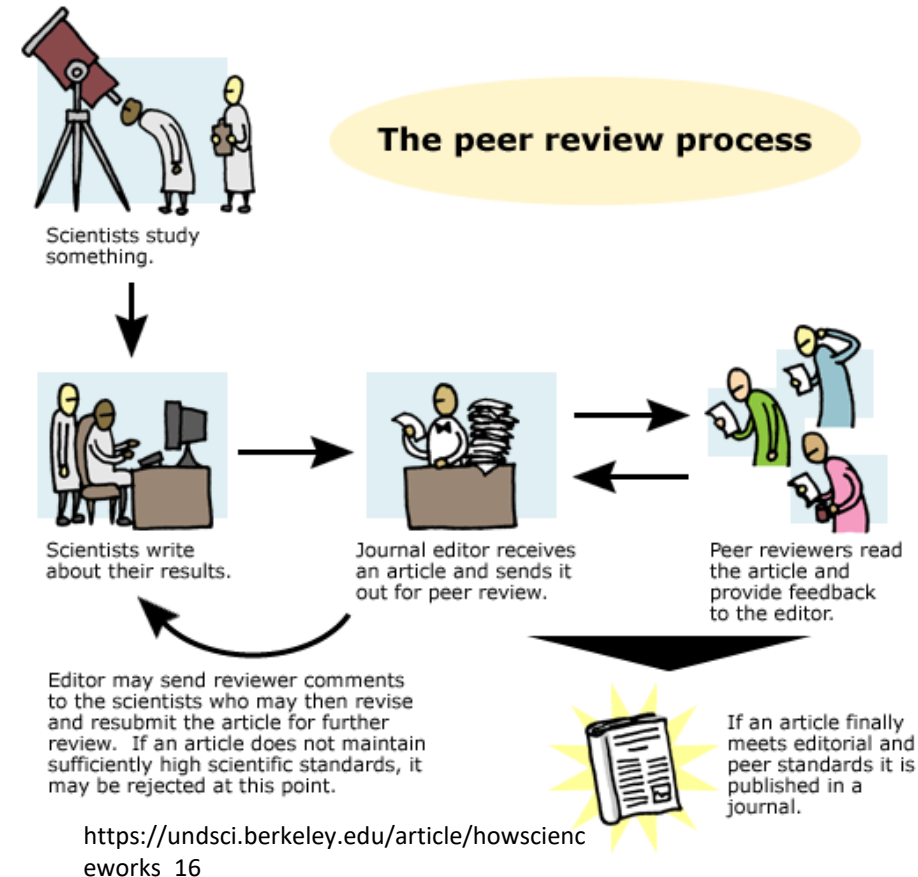
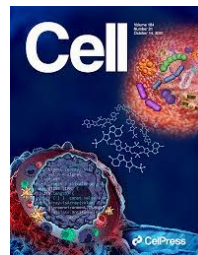
Do you know how to locate the full text of a peer-reviewed research article that has been published by a scientific journal?

- A. Yes and I have done this before
- B. I am familiar, and I think I would be able to figure this out if needed
- C. I would know where to look or who to ask
- D. I have no idea where to start



# Publication and Peer Review

- Types of Articles and Research Studies:
  - Case report → → → → Meta-analysis (increasing N-value = sample size, statistical rigor)
  - Journal Impact Factor (citations, reputation)
  - Replicability/Variability in findings; different populations/environments for subjects
- Peer Review Process:



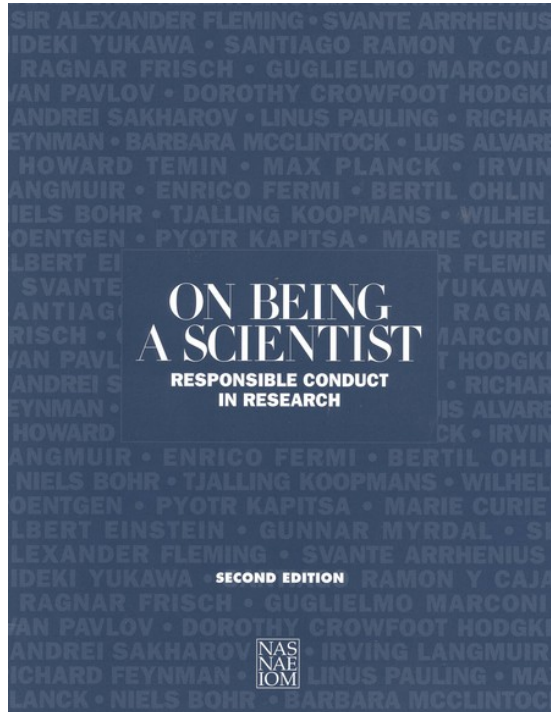
# Funding Cycles:



- Federal Agencies (NSF, NIH, DOD)
- Foundations and non-profits
- Donors (to universities, research institutes)
- Funding requires writing and submitting a Grant Proposal that gets reviewed and scored. Funding paylines are highly competitive.
- Funders hold standards for data management, rigor, ethics, personnel management, reporting, etc.
- Smaller grants (seed grants, pilot grants) can be essential to get a project off the ground and show feasibility for larger awards
- Grants can fund 1 year of research or more, depending on the scope

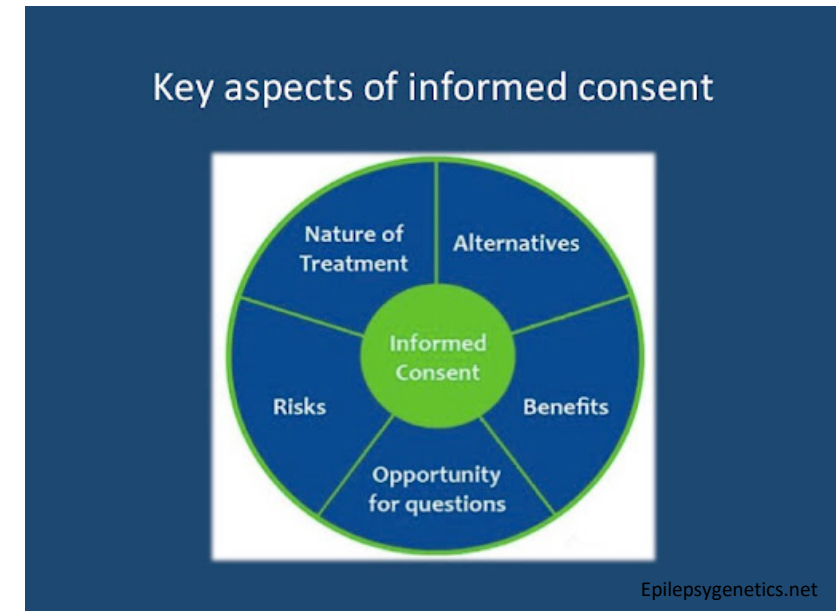
# Research Rigor and Ethical Safeguards

- Research Integrity; Research Rigor
- Responsible Conduct of Research (ethical standards) – training, university offices, professional society codes of conduct



<https://www.aber.ac.uk/en/rbi/staff-students/ethics/>

Medical Ethics & Informed Consent:



# Audience Poll #3

How comfortable do you feel vetting scientific information and determining if it is reputable or not?

- A. Very comfortable
- B. Somewhat comfortable
- C. A little comfortable
- D. Not at all comfortable

# Know Your Source: Caveat Emptor (Buyer Beware)

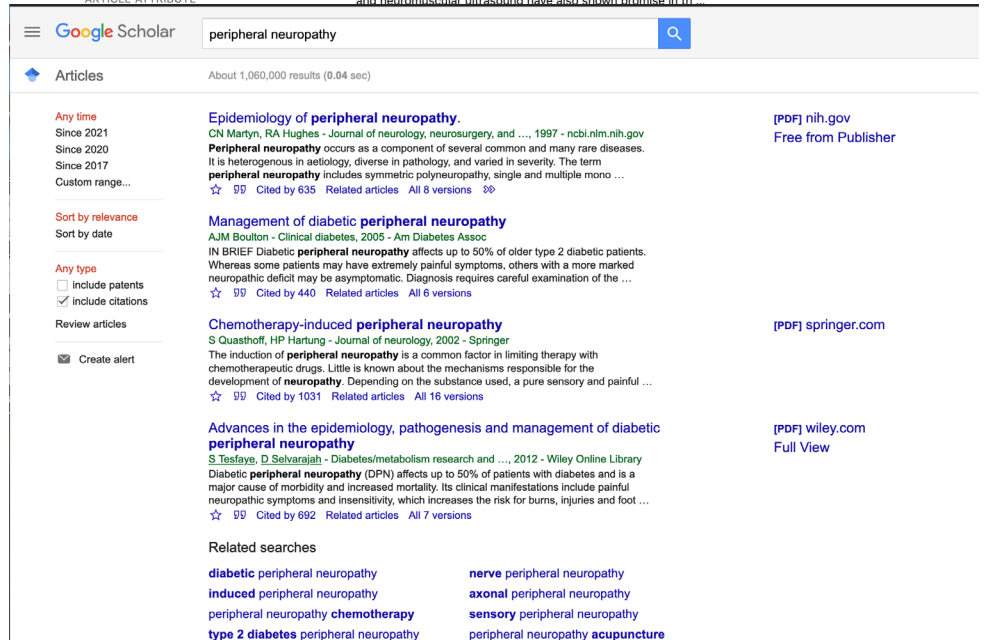
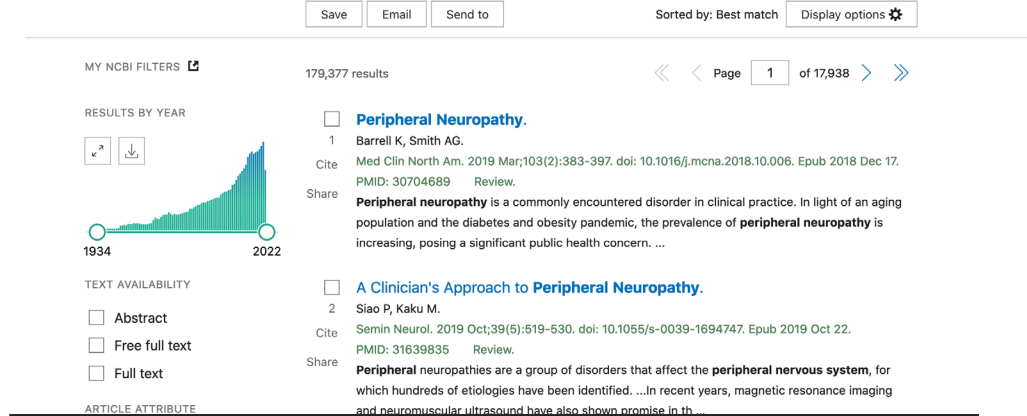
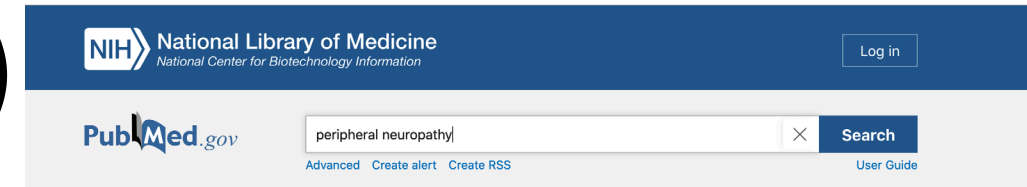
<https://pubmed.ncbi.nlm.nih.gov/>

**Scientific  
Organizations**  
(ie: AAAS, NIH)

**Scientific  
Publications**  
(research articles,  
science news outlets,  
etc.)

**Respected  
Professional Bodies**  
(major research hospitals,  
scientific societies, research  
universities)

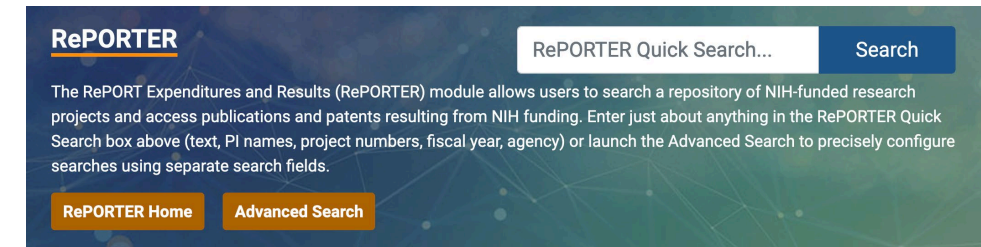
**Trained and  
Practicing  
Experts**





# Caveat Emptor – How to Find and Vet Research

- Look at the source and the intent behind sharing the information – is a product being sold, or is the goal to disseminate reputable & current evidence-based information?
  - Even on PubMed, not all journals are peer-reviewed and/or reputable (“predatory journals”)
  - Even in peer-reviewed and reputable journals, not all studies are well-designed and well-executed (& not all peer reviewers are created equal!)
  - Not all studies are reproduced and hold up with time and further study
  - Caveats: low sample size, model system doesn’t apply to humans, etc.
- Reliable sources:
  - Twitter – follow the researchers and clinicians themselves!
  - Science communicators/journalists
  - University press, hospital newsletters
- Finding what is current/ongoing:
  - Scientific/Medical Conferences – often online news coverage, posted talks
  - Funded Grants
  - Clinical Trials



[Home](#) > Search Results

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[Start Over](#)



2556 Studies found for: **Neuropathy**

Map

Search Details

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Show/Hide Columns

Showing: 1-10 of 2,556 studies 10 ▾ studies per page

Row	Saved	Status	Study Title	Conditions	Interventions	Locations
1	<input type="checkbox"/>	Completed	<a href="#">Pain Diabetic Peripheral <b>Neuropathy</b> (DPN) in China</a>	<ul style="list-style-type: none"> <li>Diabetic <b>Neuropathies</b></li> </ul>	<ul style="list-style-type: none"> <li>Other: Pain diabetic peripheral neuropathy</li> </ul>	<ul style="list-style-type: none"> <li>Peking University Third Hospital Beijing, China</li> </ul>
2	<input type="checkbox"/>	Not yet recruiting	<a href="#">Efficacy of Moxibustion in Diabetes Peripheral <b>Neuropathy</b></a>	<ul style="list-style-type: none"> <li>Peripheral <b>Neuropathy</b></li> <li>Diabetic <b>Neuropathies</b></li> </ul>	<ul style="list-style-type: none"> <li>Device: Moxibustion</li> </ul>	
3	<input type="checkbox"/>	Recruiting	<a href="#">Role of Synchronized Lifestyle Modification Program in Insulin Dependent Diabetic Peripheral <b>Neuropathy</b> Patients</a>	<ul style="list-style-type: none"> <li>Diabetic <b>Neuropathies</b></li> </ul>	<ul style="list-style-type: none"> <li>Other: Synchronized Lifestyle Modification Program</li> <li>Other: Synchronized Lifestyle Modification Program and Physiotherapy</li> <li>Other: Physiotherapy</li> </ul>	<ul style="list-style-type: none"> <li>Pakistan Railway Hospital, Islamabad Islamabad, Federal, Pakistan</li> </ul>
4	<input type="checkbox"/>	Completed	<a href="#">A Nutritional Intervention for Diabetic <b>Neuropathy</b> (WCCR-DN2)</a>	<ul style="list-style-type: none"> <li>Diabetic <b>Neuropathy</b></li> </ul>	<ul style="list-style-type: none"> <li>Other: Vegan diet and vitamin B12 supplement</li> <li>Dietary Supplement: Vitamin B12 supplement</li> </ul>	<ul style="list-style-type: none"> <li>Physicians Committee for Responsible Medicine Washington, District of Columbia, United States</li> </ul>
5	<input type="checkbox"/>	Recruiting	<a href="#">Role of Synchronized Lifestyle Modification Program on Diabetic <b>Neuropathy</b> Taking Oral Hypoglycemics</a>	<ul style="list-style-type: none"> <li>Diabetic <b>Neuropathies</b></li> </ul>	<ul style="list-style-type: none"> <li>Other: SLP</li> <li>Other: SLP along with Physiotherapy</li> <li>Other: Physiotherapy</li> </ul>	<ul style="list-style-type: none"> <li>Pakistan Railway Hospital Islamabad, Federal, Pakistan</li> </ul>

## How to Determine if Science News is Real or Pseudoscience

K. Townsend, UMaine 2017

1. Where is the story posted? Is the site a reputable scientific journal or website? Does the site have an agenda or are they selling a product? Who wrote the article – are they qualified, are they biased? Typically, the following are reputable:
  - a. .edu academic websites, laboratory websites
  - b. .org – such as Mayo Clinic, Cleveland Clinic, professional societies (Endocrine Society, American Diabetes Society)
  - c. library websites
  - d. science news sites or research journals
2. Are there proper reference citations, and are peer-reviewed scientific studies cited? Does the article use scientific terms appropriately and professional language?
3. Does the article mention a conspiracy, proprietary or secret information, or do they consult with respected experts? Outrageous title/headline or claims in the lede?
4. Caveat Emptor – buyer beware. A healthy dose of skepticism (like a true scientist) is needed for reading any coverage, even the primary research literature! Use your knowledge of biology, your understanding of how science works, and your ability to track down and critically analyze primary sources to guide you.

Resources to Learn More:

<http://www.forbes.com/sites/emilywillingham/2012/11/08/10-questions-to-distinguish-real-from-fake-science/#6d2c60a5533b>

<http://www.npr.org/sections/thetwo-way/2016/11/23/503129818/study-finds-students-have-dismaying-inability-to-tell-fake-news-from-real>

<http://www.snopes.com/2016/01/21/6-quick-ways-spot-fake-news/>



# Reputable Neuropathy Research News (late 2021)

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**Science News** from research organizations

**Burning and tingling in your feet? You may have small fiber neuropathy**

Date: October 27, 2021

Source: American Academy of Neurology

Summary: The number of people experiencing numbness, tingling and pain in their feet with no known cause has been increasing over the last two decades, according at a new study. Called small fiber neuropathy, the condition has different symptoms than large fiber neuropathy, which can cause weakness and balance issues. But in many cases people have both types of neuropathy.

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**RELATED TOPICS**

**Health & Medicine**

- > Neuropathy
- > Restless Leg Syndrome
- > Diabetes
- > Obesity

**Mind & Brain**

- > Behavior
- > Racial Issues
- > Depression

**FULL STORY**

The number of people experiencing numbness, tingling and pain in their feet with no known cause has been increasing over the last two decades, according at a new study published in the October 27, 2021, online issue of *Neurology®*, the medical journal of the American Academy of Neurology. Called small fiber neuropathy, the condition has different symptoms than large fiber neuropathy, which can cause weakness and balance issues. But in many cases people have both types of neuropathy.

**EurekAlert!** | **AAAS**

HOME NEWS RELEASES MULTIMEDIA MEETINGS

NEWS RELEASE 12-AUG-2021

**New 5-Year, \$1.25 million NIH grant opens door for scientists at Lewis Katz School of Medicine at Temple University to advance understanding of neurodegenerative disease**

**Grant and Award Announcement**

TEMPLE UNIVERSITY HEALTH SYSTEM

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(Philadelphia, PA) – Like wear and tear that causes electrical system in the human nervous system are susceptible to degenerative process of information. In the human body, faulty transmission between nerve consequences, leading to conditions known as neuropathies, which tingling, and weakness in affected areas.

Neurons degenerate for a variety of reasons, including genetic factors, alcoholism, and exposure to chemicals, toxins, or infectious viruses. Some 20 million people suffer from neural degeneration that culminate in these individuals are patients with severe diabetes and patients with cancer.

**AANEM** American Association of Neuromuscular & Electrodiagnostic Medicine  
Improving the Lives of Patients with Neuromuscular Diseases

ABOUT EDUCATION MEETINGS MEMBERSHIP ADVOCACY PRACTICE CAREERS PATIENTS

**AANEM News Express**

**Science News: Comorbidities, Anthropometric, Demographic, and Lifestyle Risk Factors for Ulnar Neuropathy at the Elbow: A Case Control Study**

7/26/2021

 Submitted by: Pritikanta Paul, MD  
Edited by: Francisco Gomez, MD

**Mondelli M, Mattioli S, Vinciguerra C, et al. Comorbidities, anthropometric, demographic, and lifestyle risk factors for ulnar neuropathy at the elbow: A case control study. J Peripher Nerv Syst. 2020;25(4):401-412. doi:10.1111/jns.12420**

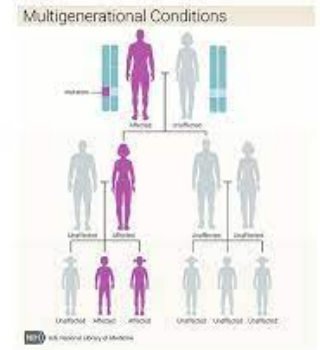
**Summary:** Ulnar Neuropathy at the Elbow is second only to Carpal Tunnel Syndrome as the most frequently encountered focal neuropathy. The clinical presentation of UNE can vary from intermittent fourth and fifth digit paresthesias to anesthesia as well as weakness and atrophy of the ulnar muscles.

The authors conducted prospective multi center case-control study in which they enrolled 220 cases and 460 controls (61.8% males, mean age 51.7 years), cases were confirmed via electromyography and nerve conduction studies. Criteria for inclusion in the study comprised electrodiagnostic abnormalities attributable to injury at the elbow.



# Specific Example 1: Basic Neuropathy Research – Genetics and Immunity

- With diabetes, obesity, aging – peripheral neuropathy impacts metabolically important tissues like adipose (fat) tissue and muscle.
- This may represent a vicious cycle whereby loss of tissue innervation further exacerbates loss of metabolic regulation, worsening risk for metabolic complications.
- How do specialized immune cells (neuroimmune cells) in our tissues support nerve health; can they be used to promote re-innervation of tissues?



Genetically identical –  
inbred C57BL6/J mice  
*(diet-induced diabetic neuropathy; testing new diagnostic device, Blaszkiewicz et al. In Prep)*



Neuropathy-prone BTBR ob/ob  
mouse  
*(Blaszkiewicz et al. 2019 – diabetic neuropathy extends from skin to adipose (fat) tissue and muscle)*



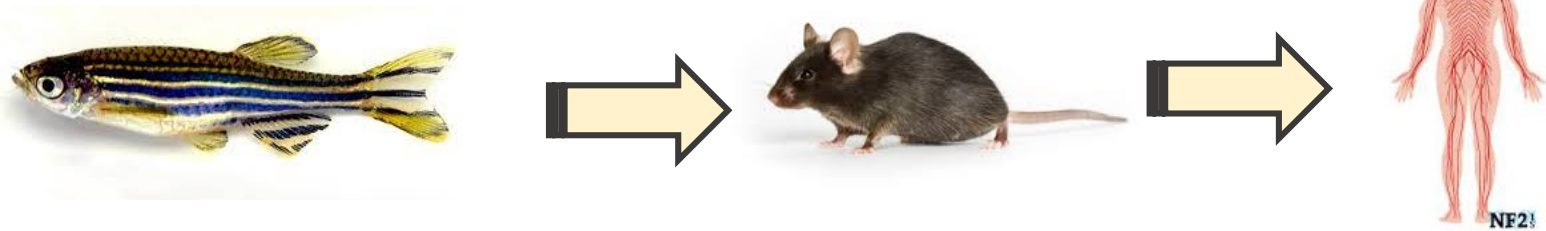
HET3 – genetically  
heterogeneous model of  
aging-related neuropathy  
*(Willows et al. In Prep)*



# Specific Example 2: Translational Neuropathy Research & Moving a New Therapy to Commercial Availability



- Sandra Rieger, Ph.D.
- Chemotherapy-induced neuropathy: new therapies for paclitaxel-induced PN
- MMP13 inhibitor as a drug target



Article | [Open Access](#) | Published: 04 March 2020

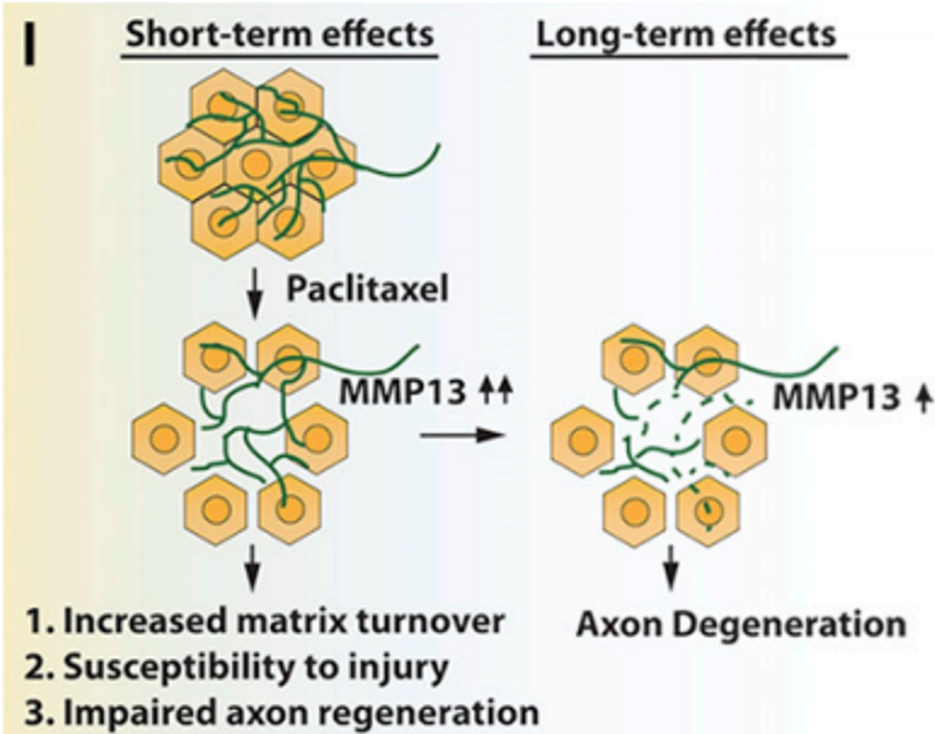
**Paclitaxel-induced peripheral neuropathy is caused by epidermal ROS and mitochondrial damage through conserved MMP-13 activation**

Anthony M. Cirrincione, Adriana D. Pellegrini, Jessica R. Dominy, Marisa E. Benjamin, Irina Utkina-Sosunova, Francesco Lotti, Stanislava Jergova, Jacqueline Sagen & Sandra Rieger

*Scientific Reports* 10, Article number: 3970 (2020) | [Cite this article](#)

4134 Accesses | 5 Citations | 2 Altmetric | [Metrics](#)

Our mission is to cure chemotherapy-induced peripheral neuropathy (CIPN).  
Our revolutionary invention directly targets the root cause of CIPN.



Model of paclitaxel-induced peripheral neuropathy. Paclitaxel damages epithelial keratinocytes by up-regulating MMP-13, leading to skin damage due to increased matrix turnover and neurotoxicity. PNAS, 2016



# Specific Example 3: Clinical Neuropathy Research

**Eva Feldman, MD, Ph.D.** – University of Michigan  
Research from Basic to Clinical, including Neuropathy  
FPN – Scientific Advisory Board Member



<https://medicine.umich.edu/dept/mneuronet>

> Ann Clin Transl Neurol. 2021 Jun;8(6):1292-1307. doi: 10.1002/acn3.51367. Epub 2021 May 6.

## Plasma lipid metabolites associate with diabetic polyneuropathy in a cohort with type 2 diabetes

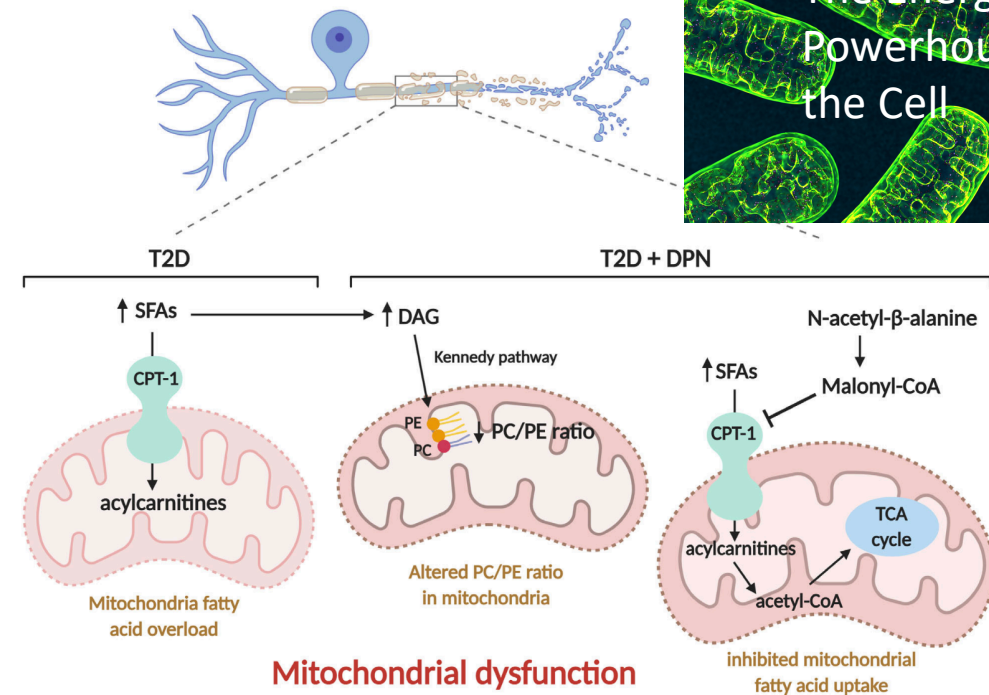
Amy E Rumora<sup>1 2</sup>, Kai Guo<sup>2 3</sup>, Fadhl M Alakwaa<sup>1 2</sup>, Signe T Andersen<sup>4</sup>, Evan L Reynolds<sup>1 2</sup>, Marit E Jørgensen<sup>5 6</sup>, Daniel R Witte<sup>4 7</sup>, Hatice Tankisi<sup>8</sup>, Morten Charles<sup>4</sup>, Masha G Savelieff<sup>2</sup>, Brian C Callaghan<sup>1 2</sup>, Troels S Jensen<sup>9</sup>, Eva L Feldman<sup>1 2</sup>

Affiliations + expand

PMID: 33955722 PMCID: [PMC8164865](#) DOI: [10.1002/acn3.51367](#)

[Free PMC article](#)

Lipids Associated With Diabetic Neuropathy



**Figure 7.** Proposed mechanism for the effect of plasma metabolites on mitochondrial function within the nerve. The metabolites and lipids altered in T2D DPN versus T2D participants may induce mitochondrial dysfunction through three pathways. First, the shift from very long-chain and medium-chain fatty acids to LCSFAs in T2D participant plasma likely leads to mitochondrial bioenergetics overload. Second, elevated N-acetyl-β-alanine levels may induce higher malonyl-CoA production and block CPT-1, which would reduce acylcarnitine levels and mitochondrial ATP production, triggering mitochondrial dysfunction. Reductions in acylcarnitine and citrate levels may also impair the TCA cycle, reducing mitochondrial ATP production. Third, elevated DAG levels stimulate de novo PE and PC synthesis. Alterations in the PC:PE ratio in the de novo mitochondrial membrane may also lead to mitochondrial dysfunction. CPT-1, carnitine palmitoyltransferase-1; DAGs, diacylglycerols; LCSFAs, long-chain saturated fatty acids; PCs, phosphatidylcholines; PEs, phosphatidylethanolamines; TCA, the citric acid cycle. <https://www.discovermagnazine.com/health/scientists-devised-a-method-to-edit-mitochondrial-dna-heres-how-it-works-and>



*the* Foundation *for* Peripheral Neuropathy

# Questions?



# *the Foundation for Peripheral Neuropathy*

## **Thank You for Watching!**

**Did you like this webinar?** Please take our survey at the end of this webinar. A recording will be uploaded on our website at [www.foundationforpn.org](http://www.foundationforpn.org) shortly. Stay tuned.

**Do you like us?** Please consider supporting us so that we can continue to fulfill our mission of improving the lives of people living with Peripheral Neuropathy. You can give securely online, via mail or via phone. Every dollar matters!

**Can we help with anything else?** Call 847-883-9942 or email [info@tffpn.org](mailto:info@tffpn.org). You may also mail inquiries and donations to *the Foundation for Peripheral Neuropathy* at 485 E. Half Day Road, Suite 350, Buffalo Grove, Illinois 60089.