

# Differentiating Technical Scientific Writing and Popular Science Writing

**Deeksha Gupta, PhD**

**Associate Director-India**

*Editorial, Society Programs & Services*

*AWSAR Workshop @IIT Delhi*

*July 2019*

# Overview

- Technical vs. Non-technical communication/writing
- Examples research paper to popular science article
- Tips and Tricks for both the styles
- Q&A

# Types of Communication (writing or speaking)

## Technical Communication

- Research Article or Review
- Abstract
- Poster
- Conference Presentation
- Thesis
- Grant Proposal
- Job Interview

## Non-Technical Communication

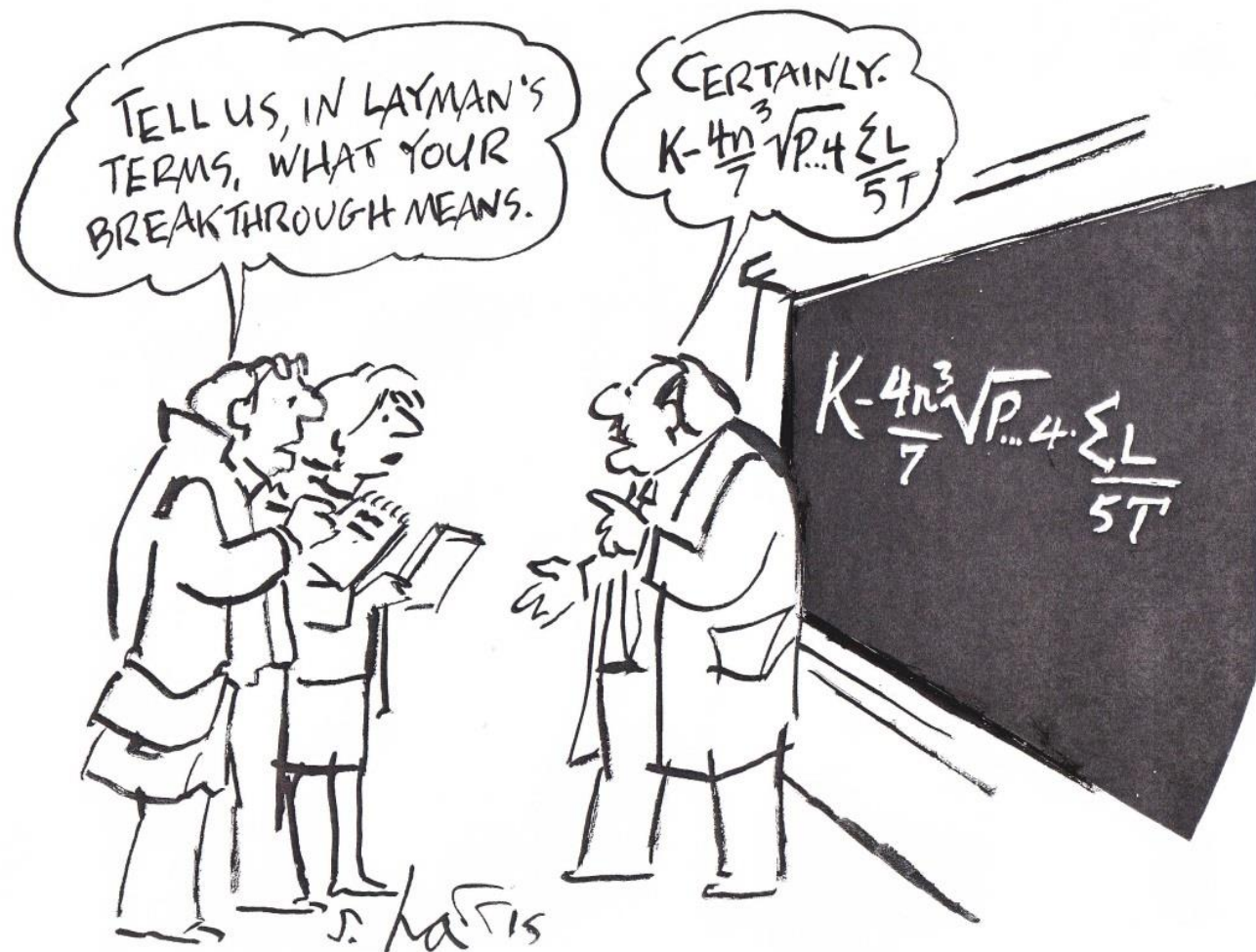
- News Article
- News & Views or Highlight
- Infographic
- Press Release
- Government Brief
- Social Media/Blog Post
- Interview (with a news outlet)

# A Time and a Place for Each



ACS  
Chemistry for Life®

Technical Communication	Non-Technical Communication
<ul style="list-style-type: none"><li>• Disclose Your Findings to Relevant Research Communities</li><li>• Secure Funding Through Grants</li><li>• Support Career Advancement</li></ul>	<ul style="list-style-type: none"><li>• Inform the General Public of the Purpose and Importance of Your Work</li><li>• Promote the Value of Science to Governments to Ensure Global Funding</li><li>• Engage Students</li></ul>



ACS  
Chemistry for Life®

# Few Examples



# Label-Free Optical Detection of Multiple Biomarkers in Sweat, Plasma, Urine, and Saliva

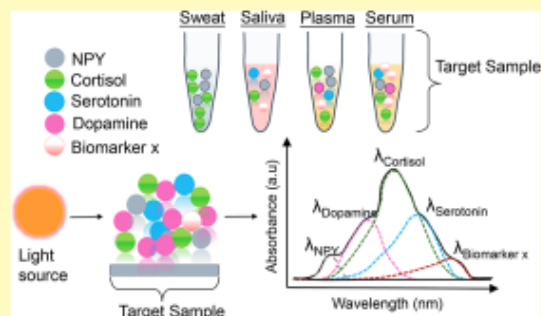
Prajakta Ray<sup>✉</sup> and Andrew J. Steckl<sup>\*✉</sup>

Nanoelectronics Laboratory, University of Cincinnati, Cincinnati, Ohio 45221-0030, United States of America

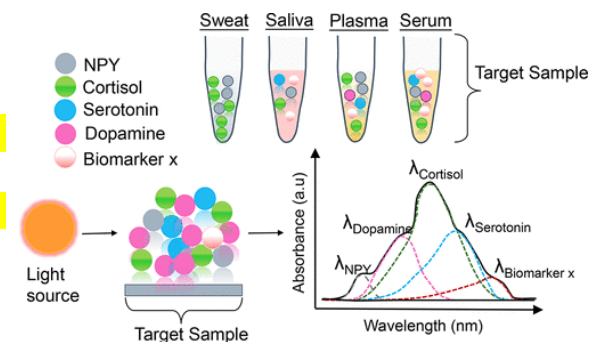
## S Supporting Information

**ABSTRACT:** We report a novel label-free quantitative detection of human performance “stress” biomarkers in different body fluids based on optical absorbance of the biomarkers in the ultraviolet (UV) region. Stress biomarker (hormones and neurotransmitters) concentrations in bodily fluids (blood, sweat, urine, saliva) predict the physical and mental state of the individual. The stress biomarkers primarily focused on in this manuscript are cortisol, serotonin, dopamine, norepinephrine, and neuropeptide Y. UV spectroscopy of stress biomarkers performed in the 190–400 nm range has revealed primary and secondary absorption peaks at near-UV wavelengths depending on their molecular structure. UV characterization of individual and multiple biomarkers is reported in various biofluids. A microfluidic/optoelectronic platform for biomarker detection is reported, with a prime focus toward cortisol evaluation. The current limit of detection of cortisol in sweat is ~200 ng/mL (~0.5  $\mu$ M), which is in the normal (healthy) range. Plasma samples containing both serotonin and cortisol resulted in readily detectable absorption peaks at 203 (serotonin) and 247 (cortisol) nm, confirming feasibility of simultaneous detection of multiple biomarkers in biofluid samples. UV spectroscopy performed on various stress biomarkers shows a similar increasing absorption trend with concentration. The detection mechanism is label free, applicable to a variety of biomarker types, and able to detect multiple biomarkers simultaneously in various biofluids. A microfluidic flow cell has been fabricated on a polymer substrate to enable point-of-use/care UV measurement of target biomarkers. The overall sensor combines sample dispensing and fluid transport to the detection location with optical absorption measurements with a UV light emitting diode (LED) and photodiode. The biomarker concentration is indicated as a function of photocurrent generated at the target wavelength.

**KEYWORDS:** biomarkers, UV spectroscopy, optical sensor, point-of-care, stress detection, biofluids, optoelectronics



We report a novel label-free quantitative detection of human performance “stress” biomarkers in different body fluids based on optical absorbance of the biomarkers in the ultraviolet (UV) region. Stress biomarker (hormones and neurotransmitters) concentrations in bodily fluids (blood, sweat, urine, saliva) predict the physical and mental state of the individual. The stress biomarkers primarily focused on in this manuscript are cortisol, serotonin, dopamine, norepinephrine, and neuropeptide Y. UV spectroscopy of stress biomarkers performed in the 190–400 nm range has revealed primary and secondary absorption peaks at near-UV wavelengths depending on their molecular structure. UV characterization of individual and multiple biomarkers is reported in various biofluids. A microfluidic/optoelectronic platform for biomarker detection is reported, with a prime focus toward cortisol evaluation. The current limit of detection of cortisol in sweat is ~200 ng/mL (~0.5  $\mu$ M), which is in the normal (healthy) range. Plasma samples containing both serotonin and cortisol resulted in readily detectable absorption peaks at 203 (serotonin) and 247 (cortisol) nm, confirming feasibility of simultaneous detection of multiple biomarkers in biofluid samples. UV spectroscopy performed on various stress biomarkers shows a similar increasing absorption trend with concentration. The detection mechanism is label free, applicable to a variety of biomarker types, and able to detect multiple biomarkers simultaneously in various biofluids. A microfluidic flow cell has been fabricated on a polymer substrate to enable point-of-use/care UV measurement of target biomarkers. The overall sensor combines sample dispensing and fluid transport to the detection location with optical absorption measurements with a UV light emitting diode (LED) and photodiode. The biomarker concentration is indicated as a function of photocurrent generated at the target wavelength.





# Label-Free Optical Detection of Multiple Biomarkers in Sweat, Plasma, Urine, and Saliva

Prajakta Ray and Andrew J. Steckl\*

Cite This: *ACS Sens.* 2019, 4, 5, 1346-1357

Publication Date: March 22, 2019

<https://doi.org/10.1021/acssensors.9b00301>

Copyright © 2019 American Chemical Society

[RIGHTS & PERMISSIONS](#)



PDF (6 MB)



Support

Article Views

1006

Altmetric

63

Citations

-

Share



Add to



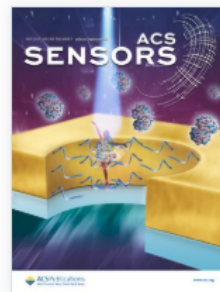
Export



LEARN ABOUT THESE METRICS



News (6)  
Blogs (3)  
Twitter (2)  
Facebook (1)



ACS Sensors



ACS  
Chemistry for Life®



## Votre stress mesuré par un simple test de salive

Futura-Sciences, 29 May 2019

Une bandelette placée sous une lampe UV permet de détecter différentes hormones du stress dans la salive, le sang, l'urine ou...



## Device in the Works for Home-based Stress Monitoring

Technology Networks, 28 May 2019

UC research assistant Shima Dalirirad holds up a sensor in UC professor Andrew Steckl's Nanoelectronics Laboratory.



## Simple Test Can Tell If You're Stressed Out

Lab Manager, 28 May 2019

research assistant Shima Dalirirad holds up a test strip that can measure stress biomarkers in UC's Nanoelectronics Laboratory...



## New Home-Testing Kit Measures Stress Levels In Sweat And Blood

Tech Times, 27 May 2019

Researchers at the University of Cincinnati have created a new diagnostic that can measure just how stressed out a person is.



## Simple test can easily measure common stress hormones

The Medical News, 24 May 2019

Stress is often called "the silent killer" because of its stealthy and mysterious effects on everything from heart disease to...



## Engineers create a simple test that can measure stress hormones in sweat, blood, urine or saliva

Phys.org, 24 May 2019

Stress is often called "the silent killer" because of its stealthy and mysterious effects on everything from heart disease to...

# Engineers create a simple test that can measure stress hormones in sweat, blood, urine or saliva

by Michael Miller, [University of Cincinnati](#)



ACS  
Chemistry for Life®

Stress is often called "the silent killer" because of its stealthy and mysterious effects on everything from heart disease to mental health. Now researchers at the University of Cincinnati have developed a **new test** that can easily and simply measure common stress hormones using sweat, blood, urine or saliva. Eventually, they hope to turn their ideas into a simple device that patients can use at home to monitor their health. The results were published this month in the journal *American Chemical Society Sensors*. "I wanted something that's simple and easy to interpret," said Andrew Steckl, an Ohio Eminent Scholar and professor of electrical engineering in UC's College of Engineering and Applied Science. "This may not give you all the information, but it tells you whether you need a professional who can take over," Steckl said.

UC researchers developed a device that uses ultraviolet light to measure stress hormones in a drop of blood, sweat, urine or saliva. These stress biomarkers are found in all of these fluids, albeit in different quantities, Steckl said. "It measures not just one biomarker but multiple biomarkers. And it can be applied to different bodily fluids. That's what's unique," he said.

Personal experience helping his father with a health crisis informed his research and opinion that a home test for various health concerns would be incredibly helpful. "I had to take him quite often to the lab or doctor to have tests done to adjust his medication. I thought it would be great if he could just do the tests himself to see if he was in trouble or just imagining things," Steckl said. "This doesn't replace laboratory tests, but it could tell patients more or less where they are." UC received grant funding for the project from the National Science Foundation and the U.S. Air Force Research Lab. Steckl said the military studies acute stress in its pilots and others who are pushing the edges of human performance. "Pilots are placed under enormous stress during missions. The ground controller would like to know when the pilot is reaching the end of his or her ability to control the mission properly and pull them out before a catastrophic ending," Steckl said. But the UC device has widespread applications, Steckl said. His lab is pursuing the commercial possibilities.



## Molecular Docking-Guided Ungual Drug-Delivery Design for Amelioration of Onychomycosis

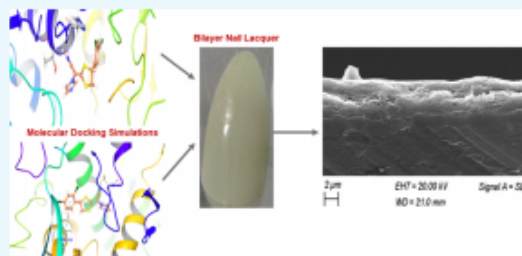
Nazia Hassan,<sup>†</sup> Manvi Singh,<sup>†</sup> Sufiyanu Sulaiman,<sup>†</sup> Pooja Jain,<sup>†</sup> Kalicharan Sharma,<sup>‡</sup> Shyamasree Nandy,<sup>§</sup> Mridu Dudeja,<sup>§</sup> Asgar Ali,<sup>§</sup> and Zeenat Iqbal<sup>\*,†,§</sup>

<sup>†</sup>Department of Pharmaceutics, <sup>‡</sup>Department of Pharmaceutical Chemistry, School of Pharmaceutical Education and Research, and <sup>§</sup>Department of Microbiology, Hamdard Institute of Medical Sciences and Research, Jamia Hamdard, New Delhi 110062, India

A medicated nail enamel to help fight infection developed

[www.thehindubusinessline.com](http://www.thehindubusinessline.com)

**ABSTRACT:** The present work envisaged an adherent luliconazole-loaded bilayer nail lacquer (BNL) with significant transungual activity. The locally applied sustained-release BNL formulation was designed for an improved retention, payload, and final dermatokinetic disposition. A primary step in the fabrication of a BNL included overcoming of physical barriers like  $\alpha$ -keratin (also  $\alpha$ -keratin), a protein present in human nails, and then allowing the drug molecule to permeate at the site of action. Although luliconazole is an established antifungal agent, has limited clinical exploitation for its use in treating onychomycosis. An in silico study elucidating its interaction with lanosterol-14- $\alpha$  demethylase, an enzyme which is the key region of drug action mechanism, was highly supportive of its imminent clinical potential. Optimization of prepared BNL formulations via response surface modeling (Box–Behnken Design-Expert 10.0.6) logically ascertained the effect of selected independent variables and showcased its effect via dependent responses. Surface morphology of the prepared BNL films was well corroborated for the presence of two distinct polymeric layers through scanning electron microscopy imaging. Nail permeation studies revealed a cumulative drug release of  $71.25 \pm 0.11\%$  through bovine hooves up to 24 h. Luliconazole while exposing antifungal activity against clinical isolates of *Trichophyton rubrum* in agar cup-plate method disclosed a 38 mm diameter zone of inhibition. Further, the optimized BNL exhibited a bioadhesive force of  $1.9 \pm 0.11$  N, which assured its retention on the nail surface for prolonged duration of time. In Conclusion, it is deduced that the conventional treatment modalities for onychomycosis require circumvention of certain pharmacotechnical caveats. Therefore, in the present study, a multipronged BNL system was proposed, which negates the need of frequent drug application, improves cosmetic appearance,



PUBLIC RELEASE: 27-FEB-2019

## Detecting cyanide exposure

AMERICAN CHEMICAL SOCIETY



PRINT E-MAIL

Cyanide exposure can happen occupationally or in low levels from inhaling cigarette smoke -- or from being poisoned by someone out to get you. The effects are fast and can be deadly. But because cyanide is metabolized quickly, it can be difficult to detect in time for an antidote to be administered. Now, in an animal study in ACS' *Chemical Research in Toxicology*, researchers report a new precise and accurate biomarker of cyanide exposure.

To treat cyanide poisoning, physicians first have to properly diagnose the condition. But symptoms such as dizziness, headaches and low blood pressure could indicate many different illnesses. And current tests for the condition have disadvantages. Directly measuring cyanide levels in samples is not possible in many cases, since it is rapidly cleared from the body. Some indirect markers of the compound are almost as short-lived, while others are also present in foods, such as broccoli, which can confound the analysis. Cyanide is known to react with thiols, which contain sulfur. In addition, evidence suggests that glutathione, an abundant sulfur-containing molecule in the body, could be a first-line of defense against cyanide poisoning. So, Brian Logue and colleagues wondered if a metabolite of glutathione could be a good indication that someone has been around cyanide.

The researchers reacted glutathione with cyanide and found that 2-aminothiazoline-4-oxoaminoethanolic acid (ATOEA) was produced. They then developed a rapid mass spectrometry method to analyze ATOEA in plasma, and saw that they could accurately detect the compound within minutes of exposure in animals. As the level of cyanide increased, so

Article Metrics

What is this page? Embed badge Share

lite 2-Aminothiazoline-4-

ers find new precise and accurate biomarker of cyanide

ews, 28 Feb 2019

sure can happen occupationally or in low levels from inhaling cigarette  
om being poisoned by someone...

### SUMMARY

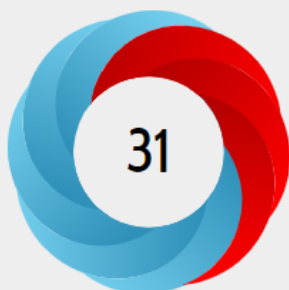
? So far, A

TECHNOLOGY  
NETWORKS

EurekAlert!

## Metabolism of Cyanide by oxoaminoethanoic Acid

Overview of attention for article published in Chemical Research



### About this Attention Score

In the top 5% of all research outputs scored by Altmetric

MORE...

Mentioned by

3 news outlets  
6 tweeters

PUBLIC RELEASE: 27-SEP-2017

# Ancient ink for cancer treatment

AMERICAN CHEMICAL SOCIETY



PRINT E-MAIL

For hundreds of years, Chinese calligraphers have used a plant-based ink to create beautiful messages and art. Now, one group reports in *ACS Omega* that this ink could noninvasively and effectively treat cancer cells that spread, or metastasize, to lymph nodes.

As cancer cells leave a tumor, they frequently make their way to lymph nodes, which are part of the immune system. In this case, the main treatment option is surgery, but this can result in complications. Photothermal therapy (PTT) is an emerging noninvasive treatment option in which nanomaterials are injected and accumulate in cancer cells. A laser heats up the nanomaterials, and this heat kills the cells. Many of these nanomaterials are expensive, difficult-to-make and toxic. However, a traditional Chinese ink called Hu-Kaiwen ink (Hu-ink) has similar properties to the nanomaterials used in PTT. For example, they are the same color, and are both carbon-based and stable in water. So Wuli Yang and colleagues wanted to see if Hu-ink could be a good alternative material for PTT.

ACS  
Chemistry for Life®

## Un inchiostro vegetale potrebbe essere la nuova arma contro il cancro

Diario del Web, 02 Oct 2017

PECHINO - Spesso le cure migliori arrivano da materiali o sostanze improbabili.

## Uralte chinesische Tinte könnte sich für Krebstherapie eignen

Der Standard, 28 Sep 2017

Shanghai - Bei einer sogenannten photothermalen Therapie wird dem Körper eine Flüssigkeit injiziert, in der Nanopartikel...

## Ancient ink for cancer treatment

Phys.org, 27 Sep 2017

Home Nanotechnology Bio



PUBLIC RELEASE: 12-SEP-2018

# Musical sensor shows bad medicine plays false note

*Inspired by a musical instrument, the simple sensor can be constructed from common materials and used to detect adulterated or counterfeit drugs*

UNIVERSITY OF CALIFORNIA - RIVERSIDE



PRINT E-MAIL

RIVERSIDE, Calif. -- What if a single musical note could mean the difference between life and death?

A new sensor based on a 3,000 year old African musical instrument can be used to identify substances, including a poisonous chemical sometimes mistakenly added to medicines. The mbira sensor, which can be constructed from off-the-shelf or discarded materials, could offer pharmacists and consumers in the developing world inexpensive protection from counterfeit and adulterated drugs.

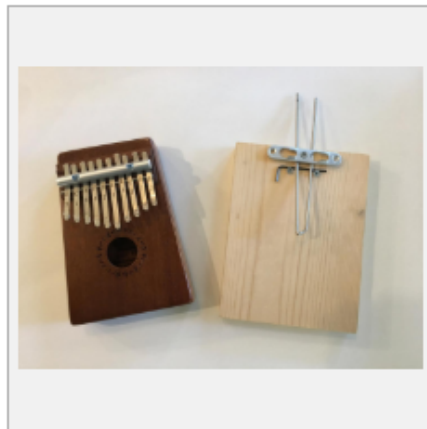


IMAGE: MBIRA INSTRUMENT NEXT TO A DENSITY SENSOR BASED ON IT. [view more >](#)

<http://pubs.acs.org/journal/acsodf>ACS  
Chemistry for Life®**Sensors that are literally 'music to one's ears' (video)**

Long Room, 24 Sep 2018

[embedded content] Researchers have found a new use for a 3,000-year-old African musical instrument: detecting toxic substances...

**Musical instrument goes flat in presence of adulterated medicine**

Antechnica, 17 Sep 2018

Bad medicine sings false Mbira's tone change depends on whether tine is filled with good or bad medicine.

**Musical sensor shows bad medicine plays false note**

Bionity, 17 Sep 2018

William Grover Mbira instrument next to a density sensor based on it. What if a single musical note could mean the difference...

**Sensors that are literally 'music to one's ears'**

Long Room, 12 Sep 2018

[embedded content] Researchers have found a new use for a 3,000-year-old African musical instrument: detecting toxic substances...

**Musical sensor shows bad medicine plays false note**

EurekAlert!, 12 Sep 2018

RIVERSIDE, Calif. -- What if a single musical note could mean the difference between life and death? A new sensor based on a 3,000...

**Musical sensor shows bad medicine plays false note**

Phys.org, 12 Sep 2018

Home Technology Engineering September 12, 2018 September 12, 2018 by Holly Ober, University of California - Riverside What if a...

RETURN TO ISSUE

## Fluorinated Chemicals

Laurel A. Schaidt\*\*  
Margaret E. Dickinson

View Author Information

Cite This: *Environ. Sci. Technol.* 2017, 51, 105-111Publication Date: February 2, 2017  
<https://doi.org/10.1021/acs.est.6b03111>Copyright © 2017 American Chemical Society  
[RIGHTS & PERMISSIONS](#)

PDF (635 KB)

## Abstract

PUBLIC RELEASE: 29-MAR-2017

## Researchers track perfluorinated chemicals in the body

UNIVERSITY OF NOTRE DAME



SHARE

PRINT

E-MAIL

They are the chemicals that made consumers think twice about using nonstick cookware. New research in the journal *Environmental Science & Technology Letters* shows scientists have developed a method to track perfluorinated alkyl substances (PFAS) in the body. PFAS are potentially toxic chemicals found in stain-resistant products, nonstick cookware, fire-fighting foams and -- most recently -- fast food wrappers.

For the first time, scientists radiolabeled PFAS with a fluorine isotope used in nuclear medicine to track the accumulation of these chemicals in the mouse models. Some of these chemicals have already been linked to kidney cancer, testicular cancer, low birth weight, hypertension, decreased fertility and thyroid problems.

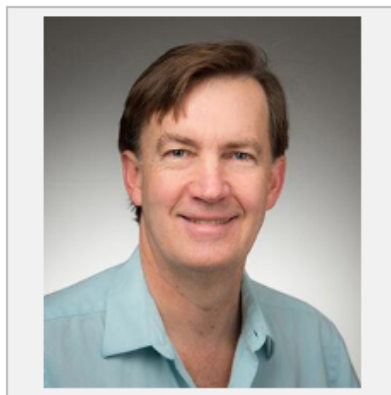


IMAGE: THIS IS GRAHAM PEASLEE, PROFESSOR OF EXPERIMENTAL NUCLEAR PHYSICS IN THE COLLEGE OF SCIENCE AT THE UNIVERSITY OF NOTRE DAME.  
[view more >](#)

CREDIT: UNIVERSITY OF NOTRE DAME

# Technical/Scientific vs. Popular Science writing



## Scientific writing

- Published in peer reviewed journals such as *JACS*, *Science Nature*, *ACS Omega*, *ACS Central Science*...
- For scientific community
- New knowledge
- Technical terms
- Table, Figures, References

## Popular Science writing

- Published in newspapers, magazine, blogs and so on
- For everyone including scientists
- Knowledge review
- Simple terms
- Examples and illustrations

**Different- target groups, organizations, style and layout**



# Goals and Objectives



## Scientific writing

- Registering a presence and credibility among peers/scientific community
- Career progression
- Jobs
- Grants

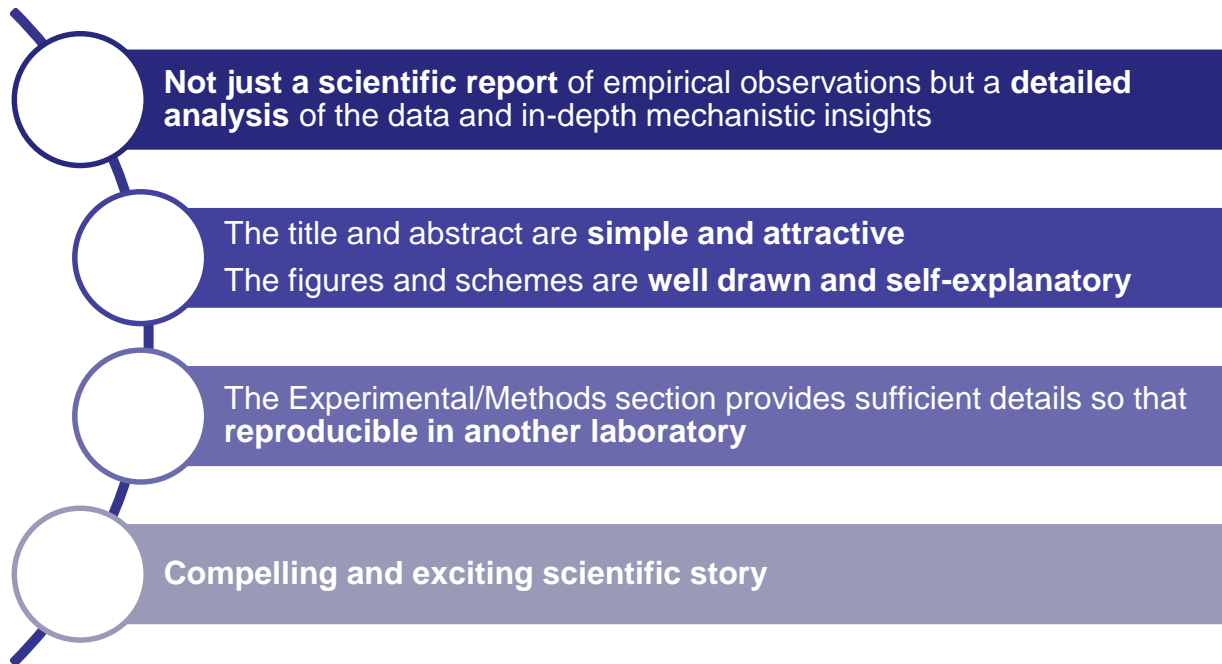
## Popular Science writing

- Increasing awareness in common men (for non-scientists)
- Developing scientific temperament and rational thinking
- Mitigating superstitions
- May help improving the quality of life

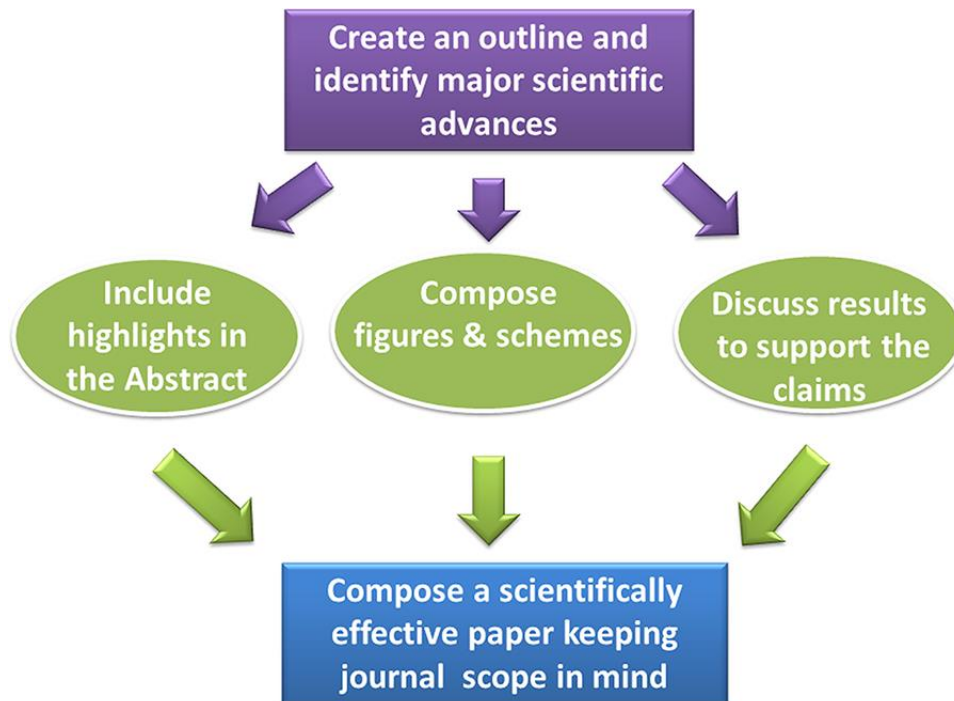
**Both should go hand in hand for broader impact**

# Preparing High Quality Manuscript

# Attributes of a High Quality Research Paper



# Key Steps in Composing a Scientifically Effective Paper



## Create a Useful Outline

- Gather data; determine the major advances that emerged from the study
- Ask questions: WHY? WHAT? HOW?
- Carefully organize the data by importance (not chronology)
- Consider possible figures and where they should appear in the text
- Review your outline with a colleague to see if you missed a key point

**Start outlines early in a project; do not wait until the “end”**

# Tell a Story!

- Make sure the paper has a main theme and punchline
- Avoid “data dumping”
- Provide context to prior literature, and cite the original work in the reference section
- **Explain why the problem is important!**
- Share experimental details that would allow a reasonably educated person in your field to **re-perform** the experiments
- Analyze the data accurately and objectively
- Provide a strong conclusion, describing how your work moves the field forward, but be realistic

# Preparing Abstracts with Style and Substance

# What is an Abstract?

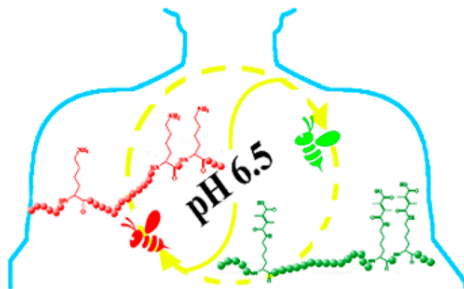
## Title

**Acid-Activated Melittin for Targeted and Safe Antitumor Therapy**

## Body

Melittin (MLT), as a natural active biomolecule, can penetrate the tumor cell membrane to play a role in cancer treatment and will attract more attention in future development of antitumor drugs. The main component of natural bee venom MLT was modified by introducing a pH-sensitive amide bond between the 2,3-dimethyl maleimide (DMMA) and the lysine (Lys) of MLT (MLT-DMMA). MLT and its corresponding modified peptide MLT-DMMA were used for antitumor and biocompatibility validation. The biomaterial characteristics were tested by MALDI-TOF MS,  $^1\text{H}$  NMR, IUPAC and HPLC, cell viability, hemolytic and animal experiment safety evaluation. Compared with the primary melittin, the modified peptide showed decreased surface charge and low cytotoxicity in physiological conditions. Moreover, cell assays confirmed the acid-activated conversion of amide bond resulting in adequate safety during delivery and timely antitumor activity in tumor lesions. Thus, MLT-DMMA provided a feasible platform to improve the targeted and safe antitumor applications.

## Graphic

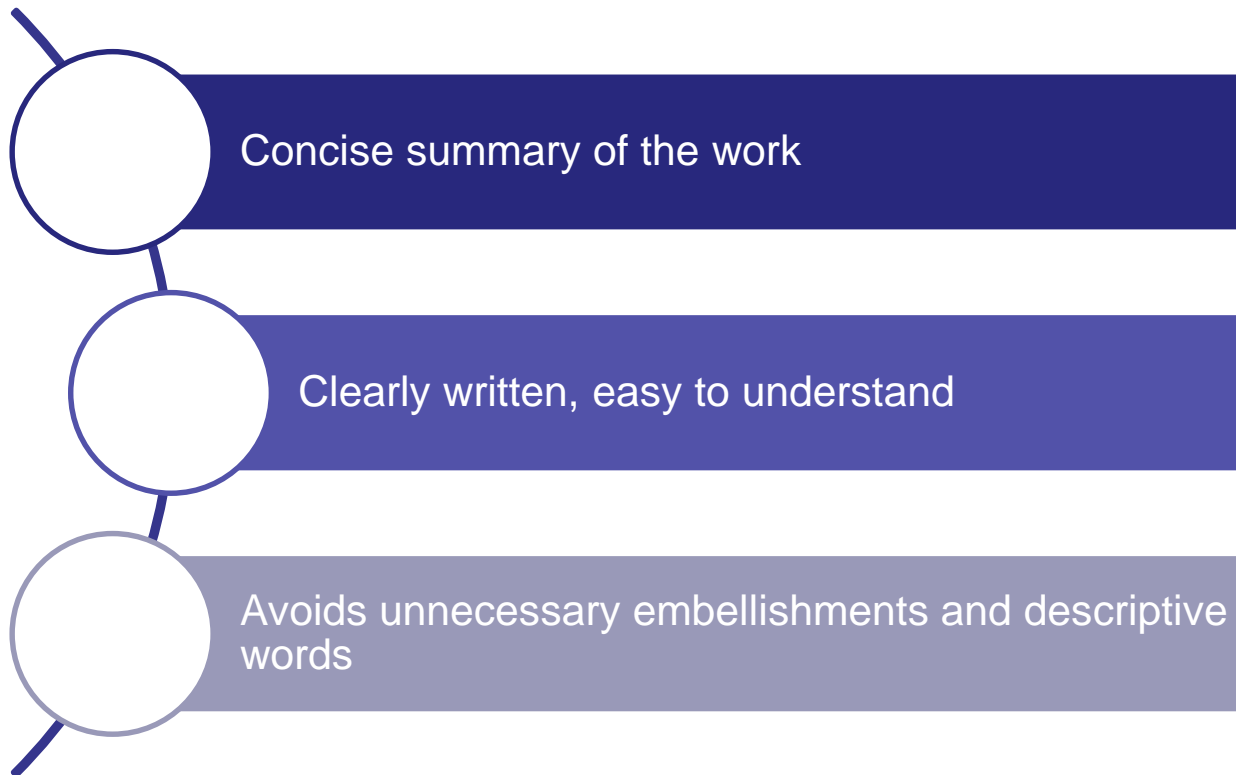


DOI: 10.1021/acs.bioconjchem.8b00352





# What Makes a Good Abstract?



**How do I write a  
compelling abstract?**

# Know the Purpose

- How is your abstract being used?
- How will it be discovered?
- Who is your audience?
- How will you showcase your abstract?
- What is important about your science?
- What professional image do you want to convey?

## How is Your Abstract Being Used?

	Poster	Presentation	Publication
Longevity	Short*	Short**	Forever
Interaction w/ peers	High	Medium	Minimal
Peer Review	Minimal	Minimal	Comprehensive
Work described	Portion	Portion	Complete

\*preprints

\*\*recorded and posted on the internet

# Read the Guidelines

## Inorganic Chemistry

*"The abstract of each manuscript should not exceed 300 words for an article and 150 words for a communication."*

- *The word limit for national meetings is 300 words (2500 characters).*
- *Both tables and images subtract from the abstract word count.*
- *Each row in a table counts for a total of 7 words (56 characters).*
- *An image counts for a total of 70 words (560 characters).*



ACS  
Chemistry for Life®



# The Structure of an Abstract

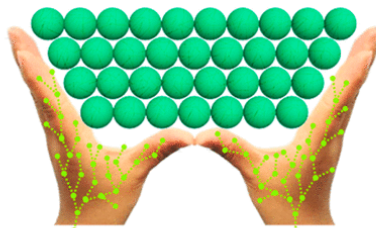
## Title

**Converting Hierarchical to Bulk Structure: A Strategy for Encapsulating Metal Oxides and Noble Metals in Zeolites**

## Body

Multifunctional hyperbranched poly(poly(ethylene glycol) diacrylate) (HB-PEGDA) polymers with well-defined composition, structure, and functionality are proposed in this work as photonic hydrogel scaffolds. By taking advantage of its unique transparency, low intrinsic viscosity, and high amount of vinyl groups, the HB-PEGDA can effectively penetrate inside the colloidal photonic crystal (CPC) substrate and be cross-linked with thiolated hyaluronic acid very quickly. This photonic hydrogel shows not only an unexpected protective effect to the untreated CPC substrate, but also nonswelling characteristics attributed to its relatively compacted network structure, which leads to robust structural integrity and credible, consistent optical performance under complex physiological conditions. Moreover, this photonic hydrogel shows good biocompatibility and can be easily modified to introduce specific functions (e.g., cell attachment), providing novel insights into the photonic hydrogel design toward diverse bio-optical applications.

## Graphic



Hyperbranched PEG supported photonic nanostructures  
for optical hydrogels

# Crafting the Title

**Consider the following when writing:**

Who will read your title?

How will your title be found?

How will your title be used?

What is being presented?

What is of interest to your audience?

What will be clear?

What will catch attention?

What are the key descriptive terms?

# What Makes a Good Title?

- Maximum of 20 words
- Grammatically sound
- Resonates with your TOC image/graphical abstract
- Avoids buzz words and hard-to-justify claims like “first” and “only”
- Avoids listing potential applications
- Avoids acronyms – tend to have little meaning outside of a specific area



Type	Focus
<i>Interrogative</i>	<i>Hypothesis</i>
How Isolated are the Electronic States of the Core in Core/Shell Nanoparticles?	Generate curiosity on what will be answered
<i>Descriptive</i>	<i>Methods</i>
Designed Nanocage Displaying Ligand-Specific Peptide Bunches for High Affinity and Biological Activity	Describe procedure but provide no answers
<i>Declarative</i>	<i>Results</i>
Low Dose of Amino-Modified Nanoparticles Induces Cell Cycle Arrest	Provide the main conclusion from the outset

# Writing the Body Text – Key Components

- Problem/Purpose of the research
- Methodology and key observations
- Major conclusions
- Implication of the study in a broader context  
highlights importance of the work

# High-Quality $(\text{CH}_3\text{NH}_3)_3\text{Bi}_2\text{I}_9$ Film-Based Solar Cells: Pushing Efficiency up to 1.64%

Bismuth-based solar cells have exhibited some advantages over lead perovskite solar cells for nontoxicity and superior stability, which are currently two main concerns in the photovoltaic community. As for the perovskite-related compound  $(\text{CH}_3\text{NH}_3)_3\text{Bi}_2\text{I}_9$  applied for solar cells, the conversion efficiency is severely restricted by the unsatisfactory photoactive film quality. ■

Herein we report a novel two-step approach—high-vacuum  $\text{BiI}_3$  deposition and low-vacuum homogeneous transformation of  $\text{BiI}_3$  to  $(\text{CH}_3\text{NH}_3)_3\text{Bi}_2\text{I}_9$ —for highly compact, pinhole-free, large-grained films, which are characterized with absorption coefficient, trap density of states, and charge diffusion length comparable to those of some lead perovskite analogues. Accordingly... ■

**Briefly state the problem/purpose of the research**

**A couple of sentences indicating the methodology and key observations (scope of the study)**

# High-Quality $(\text{CH}_3\text{NH}_3)_3\text{Bi}_2\text{I}_9$ Film-Based Solar Cells: Pushing Efficiency up to 1.64%

...the solar cells have realized a record power conversion of efficiency of 1.64% and also a high external quantum efficiency approaching 60%. ■ Our work demonstrates the potential of  $(\text{CH}_3\text{NH}_3)_3\text{Bi}_2\text{I}_9$  for highly efficient and long-term stable solar cells ■ \*

Point out major conclusions

End with a sentence summarizing the implication of the study in a broader context (e.g., possible applications) that highlights importance of the work

# Common Mistakes to Avoid

- Going too far
- Too long, too much detail
- Doing too little
- Incomplete or misrepresentation
- Limited keywords
- Being inconsistent



# When Writing the Abstract Remember...

- Take time (start early)
- Know the purpose/audience
- Review guidelines
- Get input
- Distill key points and words
- Balance the specifics
- Get feedback



# **Preparing Popular Science Article with Style and Substance**

Popular science pieces must be written in a clear and direct style, so that any hard work by the reader comes from understanding the concepts, not fighting their way through the sentences.

Popular writing uses colorful and idiomatic language to create interest, and often adopts a semi-conversational style. For scientific writing that is not necessary or desirable.



# Opening Paragraph: Setting the Hook

- Open with a quote. As in novels, dialogue is inherently interesting.
- Set the scene. Use descriptive details to make readers feel they are in the action.
- Begin with an anecdote. Stories draw readers in.
- Start with a surprising fact or statistic that makes the reader say “wow.”
- Draw on popular culture or common experience.

Try thinking about a friend or parent while writing, and **begin with the information that would be most interesting to that person.**



# Body: Maintaining Interest

- It is a good idea to **balance heavy data with lighter, more engaging content**.
- Draft an outline before writing the body, to ensure frequent alternation between data, description, examples, anecdotes, and/or quotations from experts in the field.
- Popular science articles can be structured in many ways, and creativity is welcome.
- It is important, however, to be sure that the **transitions between ideas are smooth and logical**, to avoid confusing the reader.



# Conclusion: Summarizing and Satisfying

- A conclusion should make the reader feel that the time he or she spent reading the article was, in fact, time well spent. In other words, **the reader should feel satisfied by the experience.**
- A truly successful conclusion will also inspire the reader to seek out additional information about the topic.

**“If you can’t explain it simply, you don’t understand it well enough.”**

*Einstein*



# Questions?