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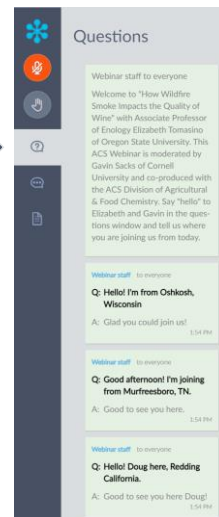
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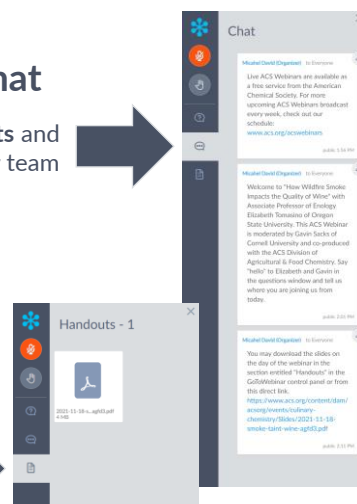
Chat

Announcements and hyperlinks from our team



Handouts

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2

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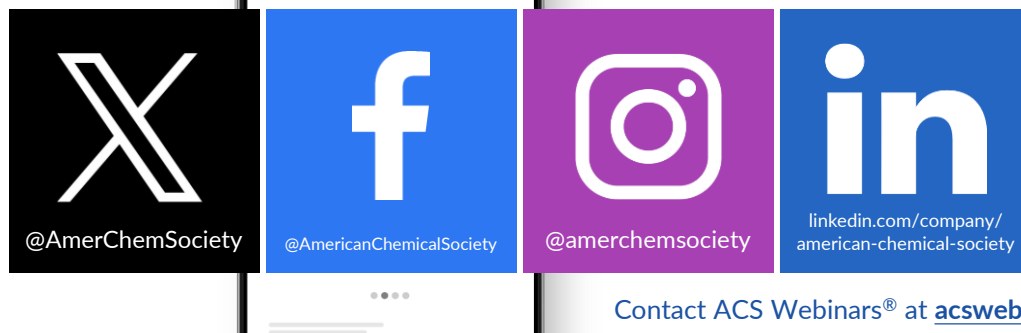


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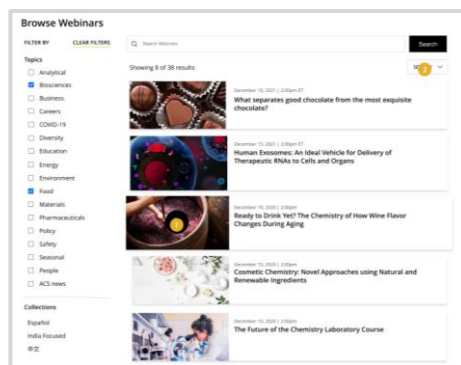
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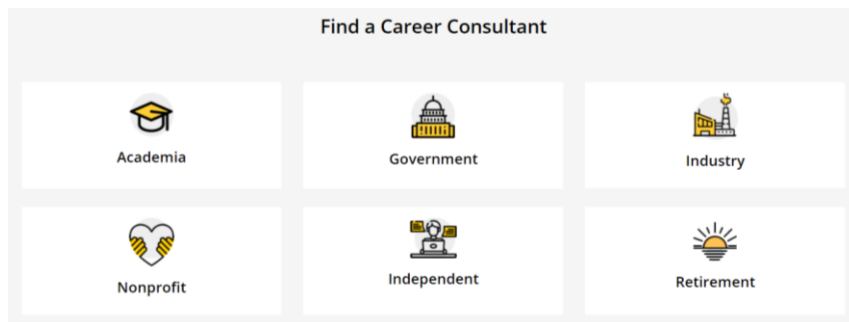


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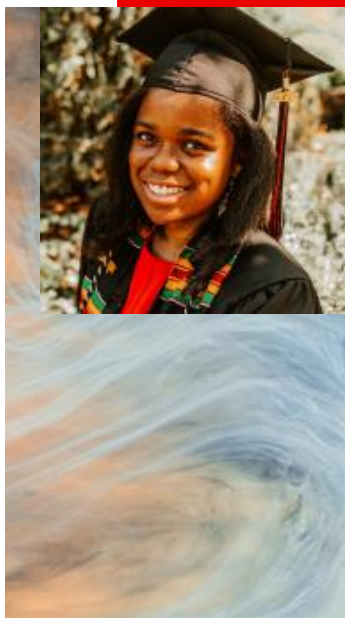
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ACS Scholar Adunoluwa Obisesan

BS, Massachusetts Institute of Technology, June 2021
(Chemical-biological Engineering, Computer Science & Molecular Biology)



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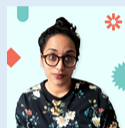
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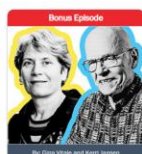
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Bonus Episode
Carolyn Bertozzi and K. Barry Sharpless chat about sharing the 2022 Nobel Prize in Chemistry
December 6, 2022



Bonus Episode
Bioorthogonal, click chemistry clinch the Nobel Prize
October 5, 2022



Episode #46
Lithium mining's water use sparks bitter conflicts and novel chemistry
September 13, 2022



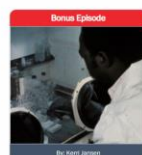
Bonus Episode
Happy 100th birthday, John Goodenough!
For John Goodenough's 100th birthday, Stereo Chemistry revisits a fan-favorite interview with the renowned scientist
July 25, 2022



Bonus Episode
CHEM CONVOS
Jess Wade on Wikipedia and work-life balance
June 21, 2022



Bonus Episode
TINY MATTERS
The sticky science of why we eat so much sugar
May 31, 2022



Bonus Episode
There's more to James Harris's story
April 27, 2022



Bonus Episode
The helium shortage that wasn't supposed to be
March 24, 2022

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Personal Career Consultations

Jim Tung
 Consulting
 Lucamas Laboratories
 B.S., Biochemistry, University of Oregon
 Ph.D., Organic Chemistry, University of Notre Dame

Jim Tung works at Lucamas Laboratories in Portland, OR, currently as a business development manager. He has been with Lucamas for 10 years, working on developing new chemical manufacturing projects. Before that, he was a senior research chemist at Glaber Research in Champaign, IL, performing kilo-scale organic chemistry.

An Oregon native, Jim got his B.S. in biochemistry from the University of Oregon, his Ph.D. in organic chemistry from the University of Notre Dame, with postdoctoral experience at Pfizer's laboratories in La Jolla, CA. He is past chair of the Portland Section of the American Chemical Society and was 2019 general co-chair of NORM 2019. He has interests in process chemistry, labor economics, social media outreach and encouraging career exploration and development for younger chemists.

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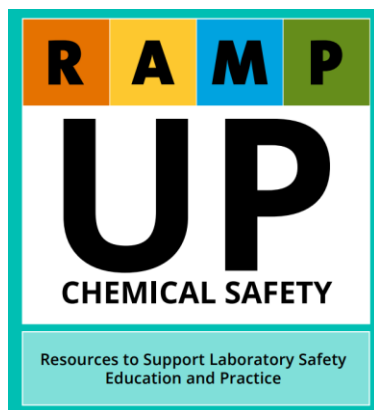
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Letters sent to
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Take Action

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A complete listing of ACS Safety Programs and Resources



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Advancing ACS' Core Value of Diversity, Equity, Inclusion and Respect



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ACS Publications DEIR Hub See what ACS Publications is doing for fostering inclusivity in scholarly publishing →	ACS Volunteer and ACS Meetings Code of Conduct Fostering a positive and welcoming environment for attendees, volunteers and staff. →
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How Nanoscale Materials in Biosensors are Innovating Health from Concept to Care



JEAN-MARC PECOURT, PhD

Chemical Informatics Scientist, CAS, a
division of the American Chemical Society



JUN CHEN, PhD

Assistant Professor, Department of
Bioengineering, the University of
California, Los Angeles



VENK VARADAN, MBA

Co-founder and CEO, Nanowear



**QIONGQIONG
ANGELA ZHOU, PhD**

Manager, Scientific Analysis and Insights, CAS,
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NANOMATERIALS FOR NANOSENSORS

Insights from two decades of research

Jean-Marc Pecourt, Chemical Informatics Scientist, CAS

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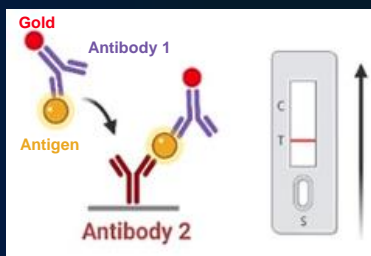


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Nanosensors save lives

COVID: 6M lives and \$14T

- Rapid antigen tests use gold-nanoparticle based nanosensors
- Beyond COVID, impact to cancer diagnosis could be even larger: \$25T & 10M lives



Small Sci., 2: 2200009 (2022)

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Why are nanosensors growing in popularity?

Unique properties, capabilities, and applications

Physical properties

- Different nanostructures with high-surface area/volume ratio

Unique capabilities

- Large range of materials (elements, polymers, small molecules)
- Transduces physical, chemical, or environmental stimuli into measurable signal

Growing applications

- Cancer and pathogen detection/treatment
- Health monitoring
- Environmental, agriculture and food industries

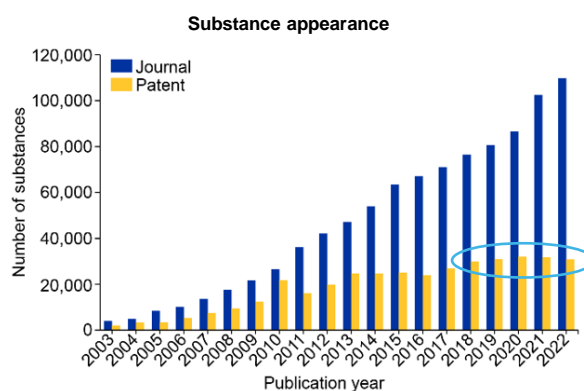
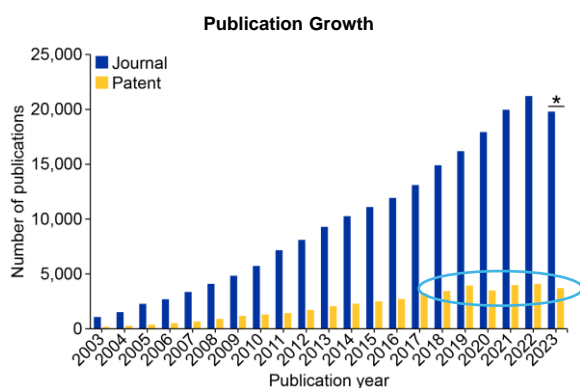
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Patent growth has trailed publications

Challenging gap to bridge between research and commercialization



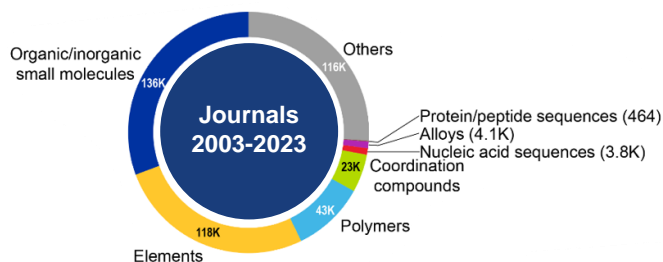
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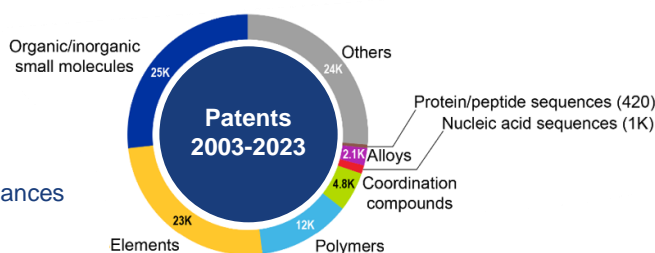
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Very wide variety of substances

But small molecules, elements and polymers dominate



- Small molecules: Silica, ZnO, TiO₂
- Elements: Gold, Carbon, Silver
- Polymers: PEG, Polyaniline, Polystyrene



Patents focused on well-established substances

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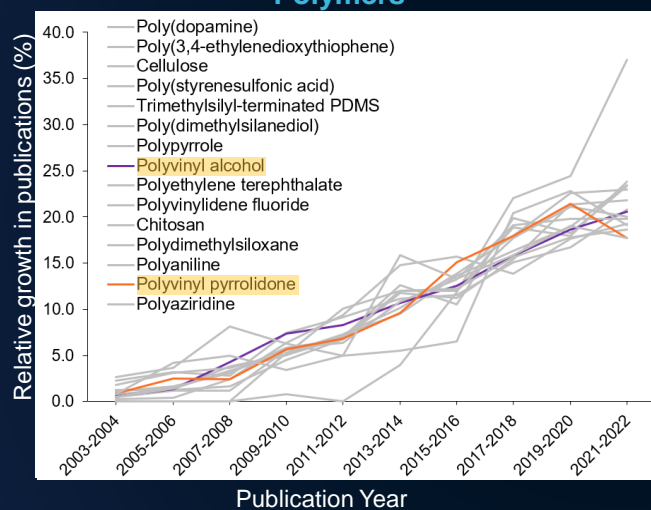


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Emerging materials to watch

High relative rates of growth across publications

Polymers



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Elements

- Ytterbium
- Graphene
- Copper

Small molecules

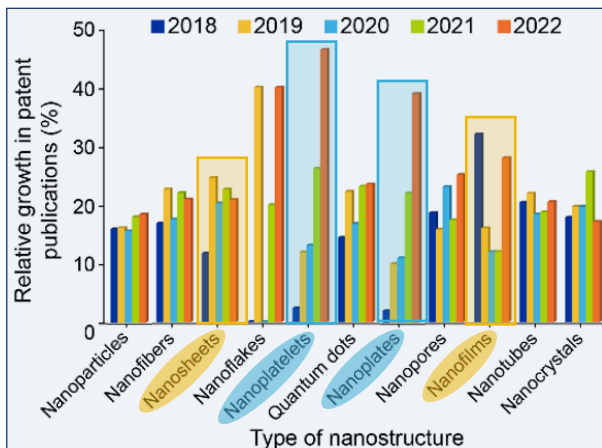
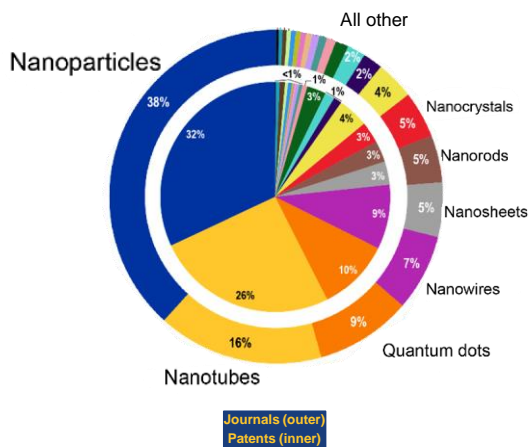
- Glycerol and Thiourea
- MoS₂
- 3,3',5,5'-tetramethylbenzidine
- AgCl
- FeCl₃



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Different nanostructures for different applications

Emerging Trends: For Journals → 8% steady growth across all nanostructures

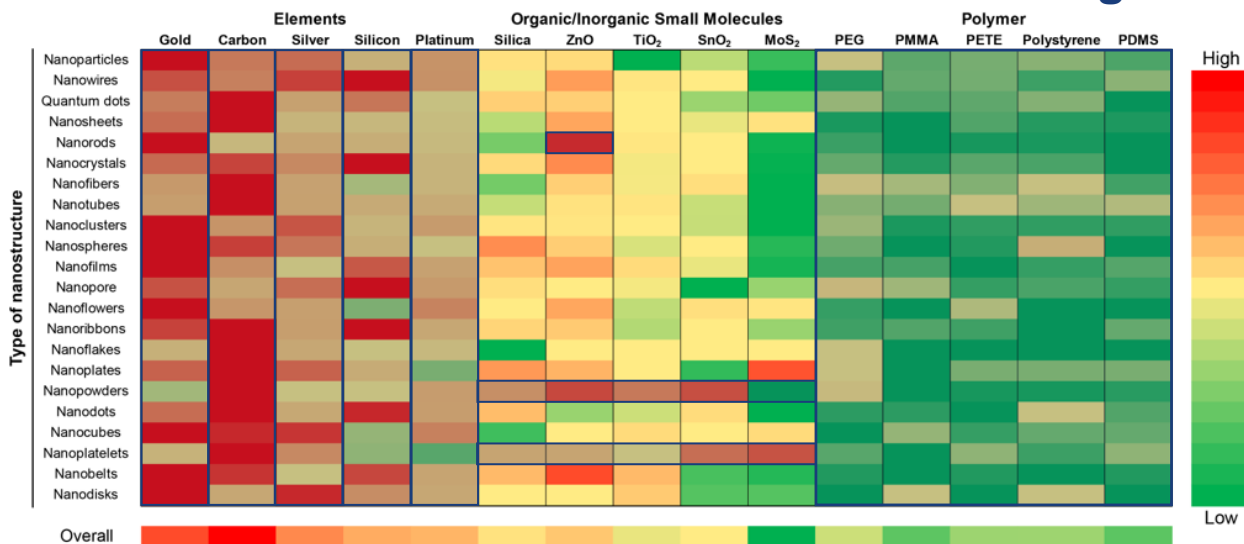


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Dominant nanomaterials and nanostructures at a glance



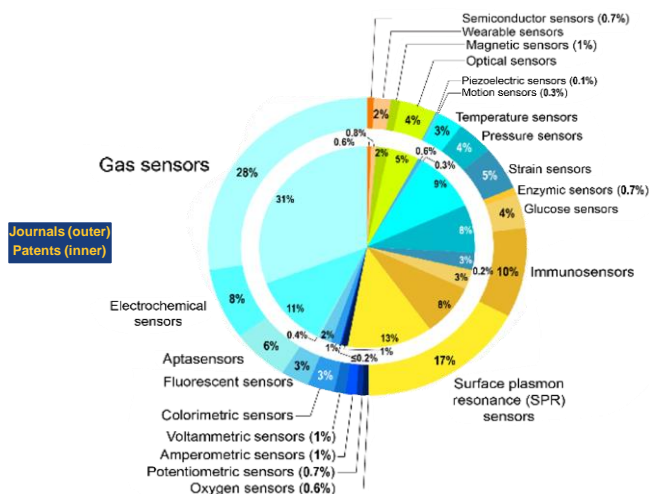
Heat map showing co-occurrences of specific types of nanostructure vs substances in patents

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Distinguishing nanosensors by type of stimuli



- Chemical nanosensors dominate due to ease of detection, esp. gas sensors
- Biological nanosensors see more exploratory research, esp. SPR sensors
- Physical nanosensors show twice as much commercial interest, esp. temperature and pressure sensors
- All other nanosensors including semiconductor, wearable and electromagnetic sensors <10%

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Emerging nanosensors

Similar rates of growth across patents and publications

Chemical

- Aptasensors growth since 2020 (COVID) with aptamers binding to analytes as general platform
- Colorimetric nanosensors growth due to visible output
- Electrochemical nanosensors growth in publications

Biological

- Growth of SPR and Immunosensors in publications but not as much commercial interest

Others

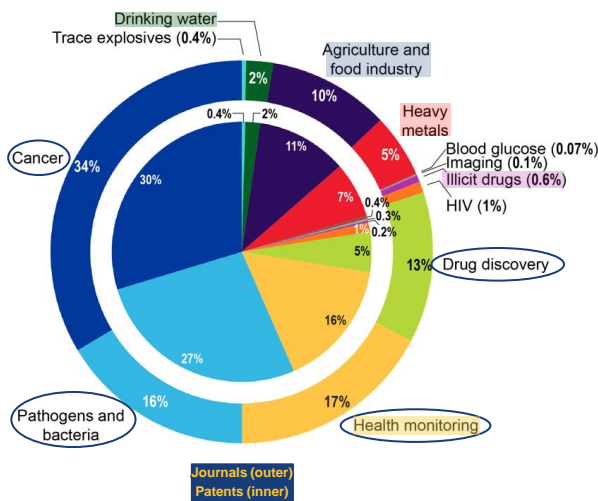
- Semiconductor and wearable nanosensors showed high acceleration of research since 2019
- Strain and pressure sensors research grew faster than other nanosensors

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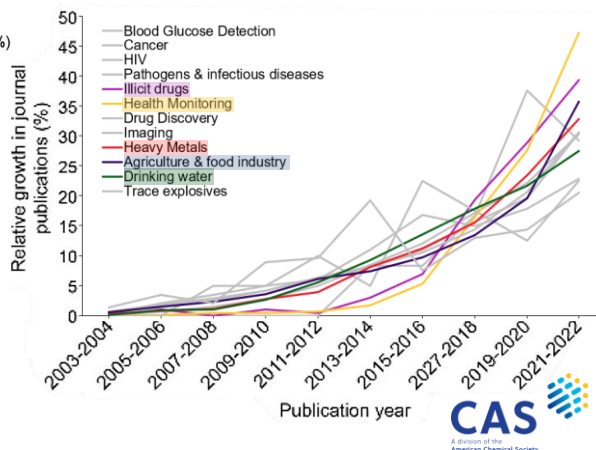


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Nanosensor applications



- 80% of biomedical applications
- Higher commercial research interest in pathogen and infectious disease detection
- Higher exploratory research interest for new drug discovery



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In Summary

Expanding technologies with trends beyond well-known nanomaterials and biomedical applications

- Asymmetric growth in basic research vs. commercial research as evidence for challenges in commercialization
- Variety of substances, often in composites, dominated by elements, small molecules, and polymers w/ industry focus on well-established materials
- Tailored nanostructures depending on ease of manufacture, specific stimuli measured, and nanosensor applications
- Majority of nanosensors transduce chemical or biological stimuli with recent growth in semiconductor and wearable nanosensors
- Nanosensor applications are 80+% biomedical with recent growth in use in environmental, agricultural, and food industry applications

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Acknowledgement

- Krittika Ralhan
- Kavita Iyer
- Kevin Hughes
- Robert Bird
- Qiongqiong Angela Zhou

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Gain insights on emerging nanosensor trends and more



Jean-Marc Pecourt
Chemical Informatics Scientist
jpecourt@cas.org

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Discovering Giant Magnetoelasticity in Soft Matter for Bioelectronics

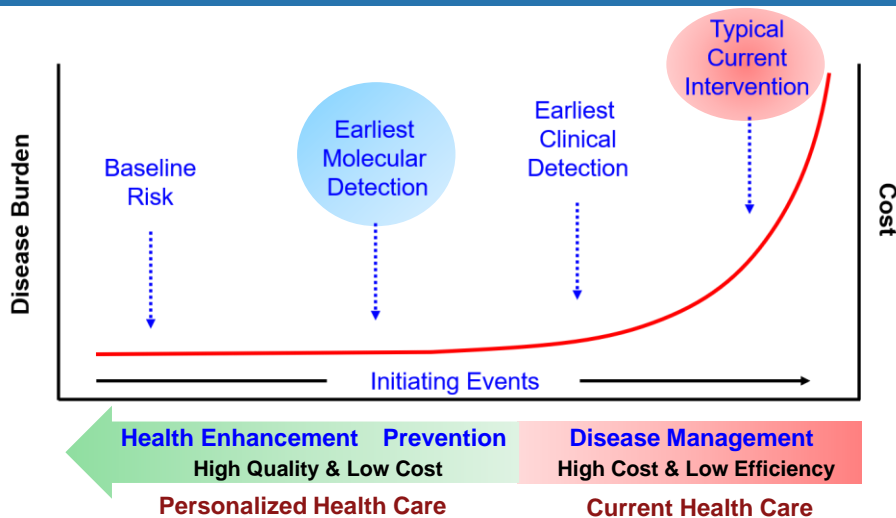
Jun Chen, Ph.D.

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Health Care Transformation



Bioelectronic devices enable the change of [current reactive & disease-centric healthcare system](#) to a personalized model with a focus on [disease prevention & health promotion](#).

R. Snyderman et al. *JAMA* **2016**, 316,1923

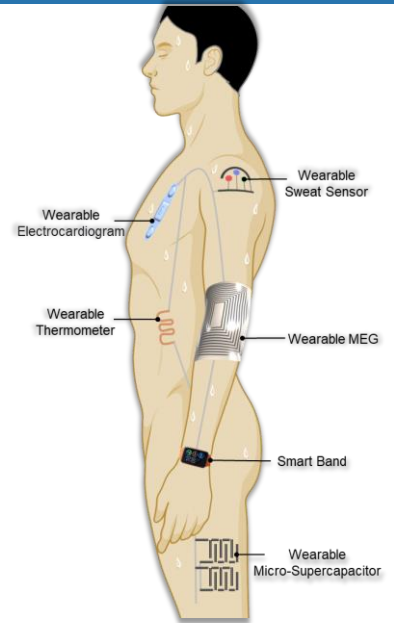
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Body Fluids and Humidity



A person has 2 million to 4 million sweat glands



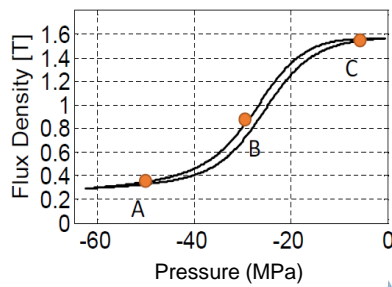
High Humidity on/in Human Body

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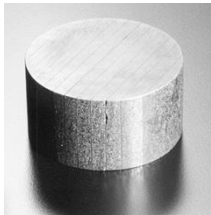
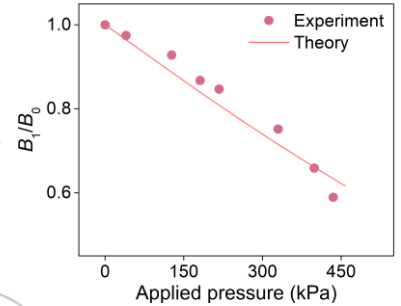
Platform Technology: Magnetoelasticity in Soft Systems



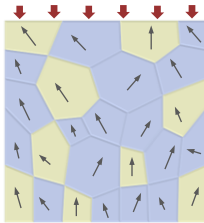
Emilio Villari, 1865
(Magnetoelastic Effect)
Metal and Metal Alloy



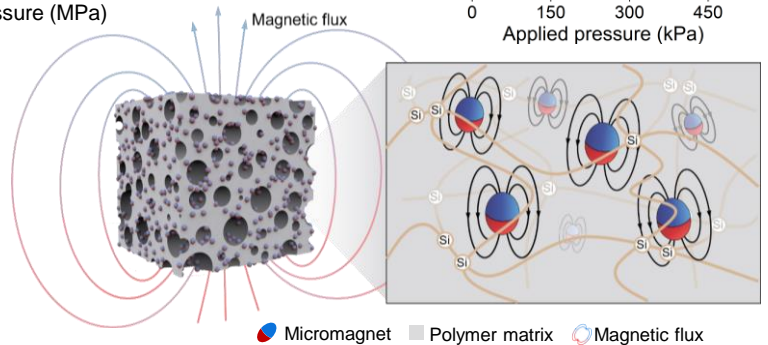
The Pressure
MPa to kPa



Terfenol-D



Compressed



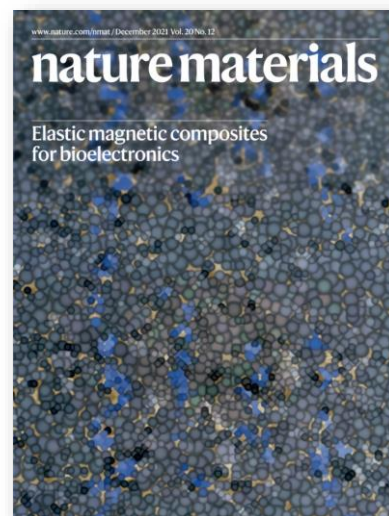
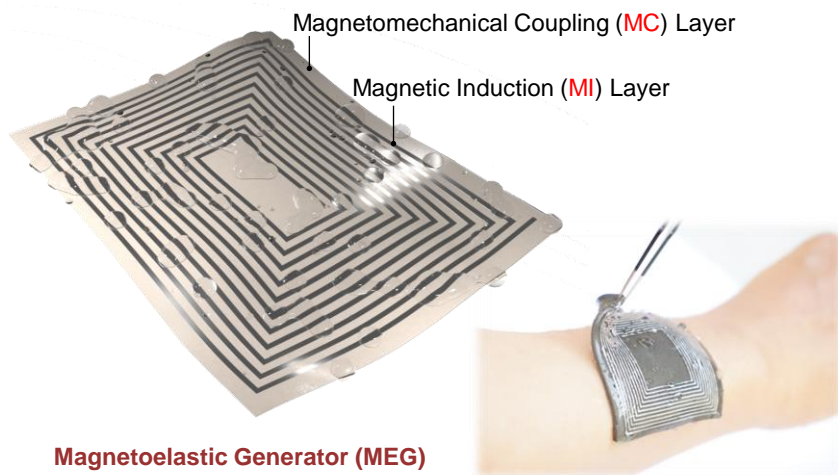
Soft System Composed of Polymer Matrix and Nanomagnets

Change of a material's magnetic property under mechanical deformation

44

Soft Magnetoelastic Generator Since 2021

UCLA



Front Cover

Magnetoelastic Generator (MEG)

The **MC Layer** is for **Mechanical** to Magnetic Conversion

The **MI Layer** is for Magnetic to **Electrical** Conversion

A Magnetic Patch on A Twitchy Arm Makes a Useful Current. *Nature*, **2021**, 598, 239

Y. Zhou, X. Zhao, [...], Y. Song, S. Li, **J. Chen***, *Nature Materials*, **2021**, 20, 1670–1676 (Front Cover)

45

Discovering Magnetoelastic Effect in Soft Systems

UCLA

Y. Zhou, [...], **J. Chen***. *Nature Materials* **2021**, 20, 1670 (Front Cover)

X. Zhao, [...], **J. Chen***. *Nature Materials* **2024**, in press

X. Zhao, [...], **J. Chen***. *Nature Electronics* **2024**, in press

X. Zhao, [...], **J. Chen***. *Nature Communications* **2021**, 12, 6755

Z. Che, [...], **J. Chen***. *Nature Communications* **2024**, in press

Y. Zhou, [...], **J. Chen***. *Science Advances* **2024**, 10, eadj8567

G. Chen, [...], **J. Chen***. *Matter* **2021**, 4, 3725

A. Libanori, [...], **J. Chen***. *Adv. Mater.* **2023**, 35, 06933

X. Zhao, [...], **J. Chen***. *Adv. Mater.* **2022**, 34, 2204238

J. Xu, [...], **J. Chen***. *Appl. Phys. Rev.* **2022**, 9, 031404

X. Zhao, [...], **J. Chen***. *ACS Nano* **2022**, 16, 6013

G. Chen, [...], **J. Chen***. *ACS Nano* **2022**, 15, 20582

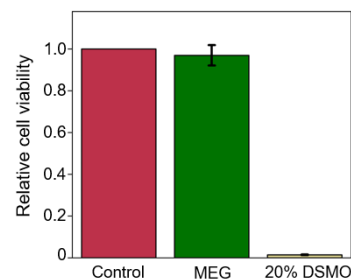
I.W. Ock, [...], **J. Chen***. *ACS Nano* **2022**, 9, 031404

I.W. Ock, [...], **J. Chen***. *Nano Energy* **2023**, 109, 108298

J. Xu, [...], **J. Chen***. *Matter* **2023**, 6, 2235-2247



Waterproof and Stretchable



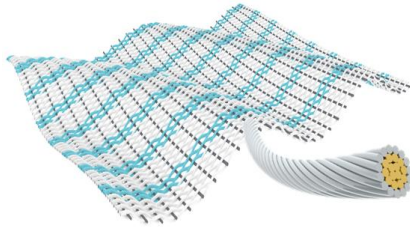
Biocompatible

Pioneering Efforts in Discovering Magnetoelastic Effect in Soft System for Energy and Healthcare

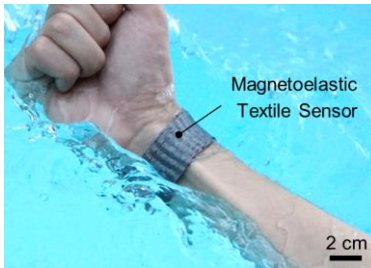
46

Pulse Wave Monitoring

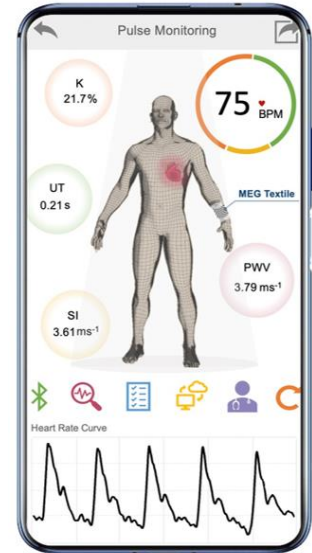
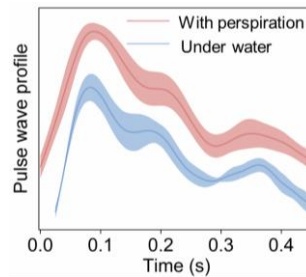
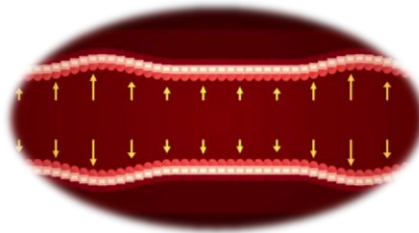
UCLA



■ Nylon ■ Magnetic microfiber ■ Conductive yarn



Magnetoelastic
Textile Sensor

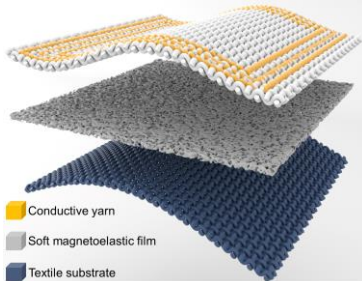


The textile MEG can monitor the human pulse continuously with heavy perspiration
X. Zhao, Y. Zhou, [...], Y. Song, S. Li, **J. Chen***, *Nature Communications*, **2021**, **12**, 6755

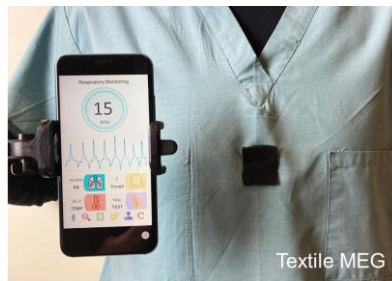
47

Respiration Monitoring with Perspiration

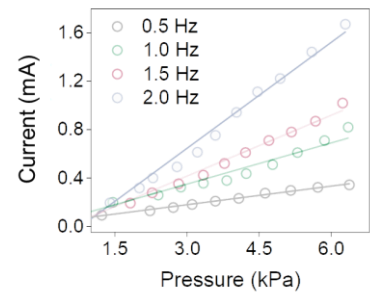
UCLA



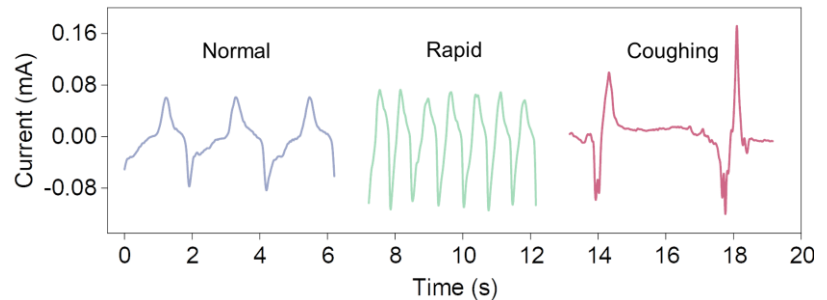
■ Conductive yarn
■ Soft magnetoelastic film
■ Textile substrate



Textile MEG



Perspiration

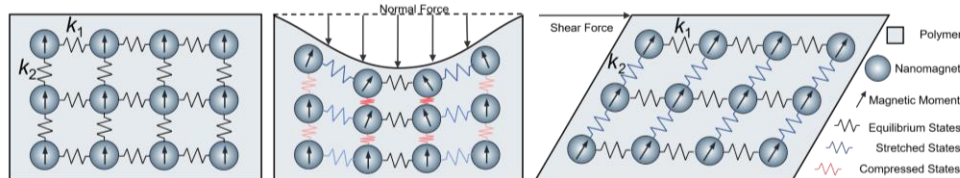
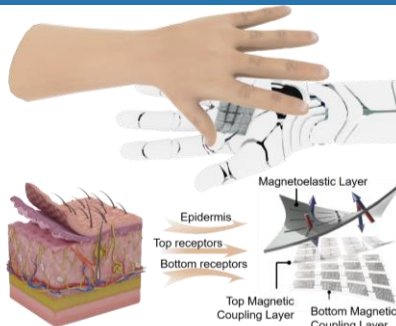
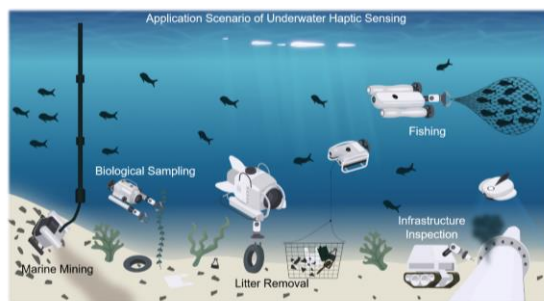


G. Chen, X. Zhao, S Andalib, J. Xu, Y. Zhou, T. Tat, K. Lin, **J. Chen***, *Matter*, **2021**, **4**, 3725

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Underwater Haptic Sensing

UCLA



20	0	0	0	0	0	0	C1
0	19	0	0	0	1	0	C2
0	0	20	0	0	0	0	C3
0	0	0	20	0	0	0	T1
0	0	0	0	20	0	0	T2
0	0	0	0	0	20	0	T3
0	0	0	0	0	1	19	C4
	C	C	C	C	C	C	

Actual Class

Predicted Class

A Multimodal Magnetoelastic Artificial Skin for Underwater Haptic Sensing

Item Recognition

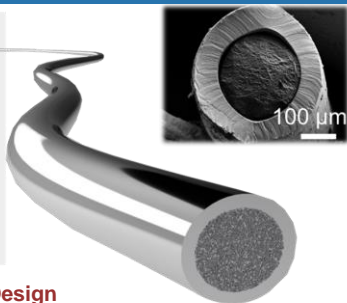
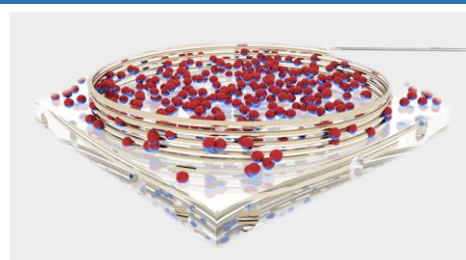
Y. Zhou, X. Zhao, J. Xu, G. Chen, T. Tat, J. Li, and **J. Chen***. *Science Advances*, **2024**, 10, eadj8567

49

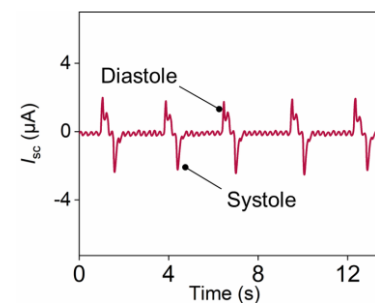
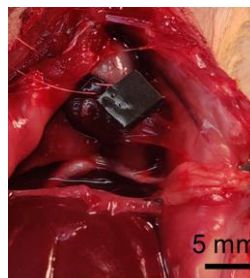
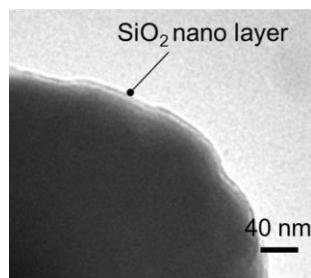
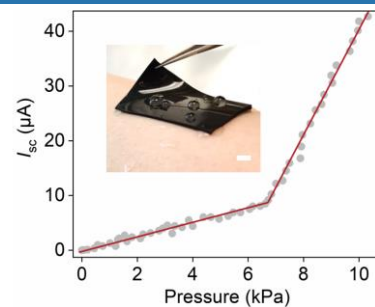
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Implantable Bioelectronics

UCLA



Device Design



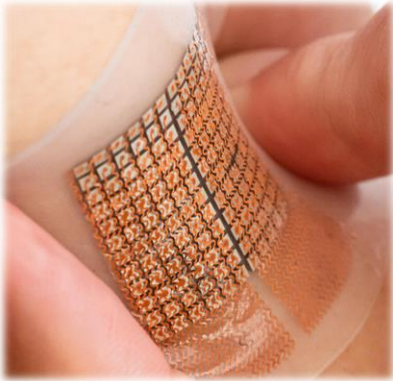
X. Zhao, G. Chen, Y. Zhou, [...], S. Li, **J. Chen***, *ACS Nano*, **2022**, 16, 6013–6022

50

50

Wearable Bioelectronics

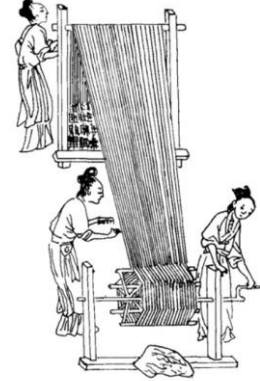
UCLA

**Wearable Biomedical Devices**

- Soft but not breathable
- Wearing discomfort

**Textile (Indispensable)**

- Wearing comfort
- Scalability

**Long History with Human**

- Massive production
- Cost effectiveness

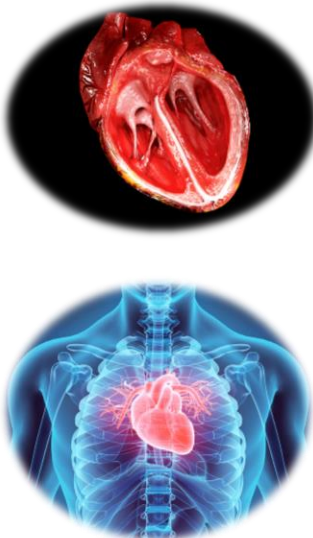
Textiles have been made from a **very wide range** of materials, from **natural materials** (silk, wool, cotton) to **synthetic materials** (peptide, polyamide, polyester). Many of them, are biocompatible, biodegradable, even bioabsorbable.

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Body Biomechanical Motions

UCLA

**Biomechanical Motions****Smart Textiles for Personalized Health Care**

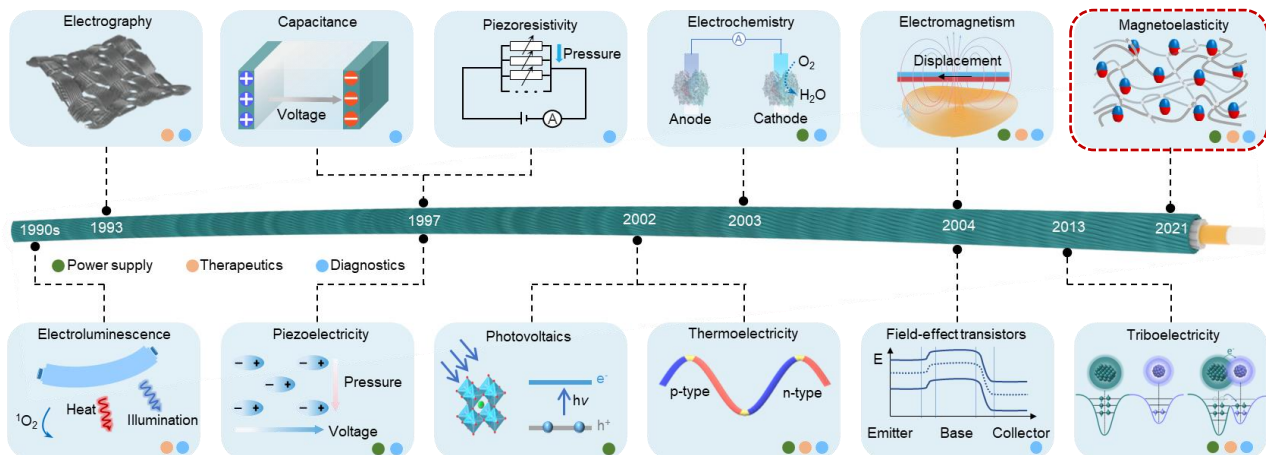
A. Libanori, G. Chen, X. Zhao, Y. Zhou, **J. Chen***, *Nature Electronics*, **2022**, 5, 142–156 (Invited Review)

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Platform Technologies

UCLA



Timeline of Platform Technology Development for Smart Healthcare Textiles

X. Zhao, H. Askari, **J. Chen***. *Joule* **2021**, 5, 1391-1431

K. Meng,[...], **J. Chen***. *Adv. Mater.* **2022**, 34, 2109357

Y. Zhou, [...], and **J. Chen***. *Joule* **2022**, 6, 1381-1389

K. Meng,[...], **J. Chen***. *Adv. Mater.* **2022**, 34, 2202478

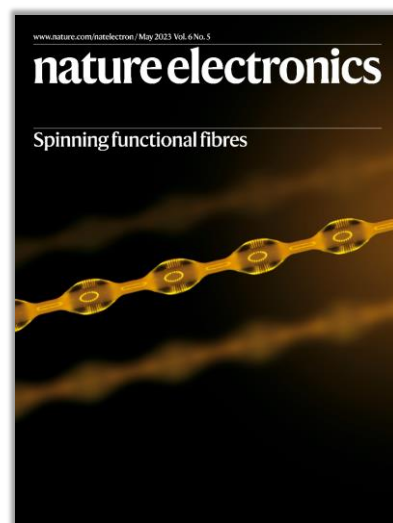
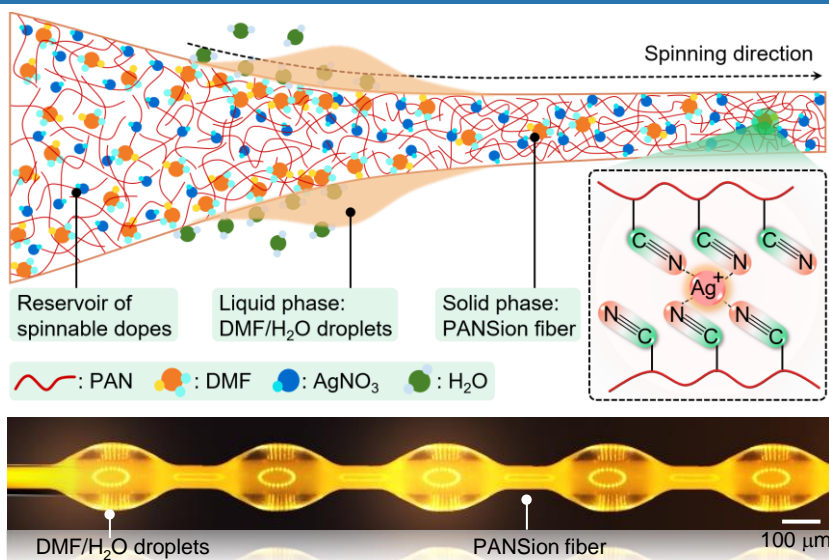
Y. Fang,[...], **J. Chen***, *Chem. Soc. Rev.* **2021**, 50, 9357 (Front Cover)

S. Zhang, [...], **J. Chen***. *Matter* **2021**, 4, 845-887

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Phase Separation-Enabled Ambient Spinning

UCLA



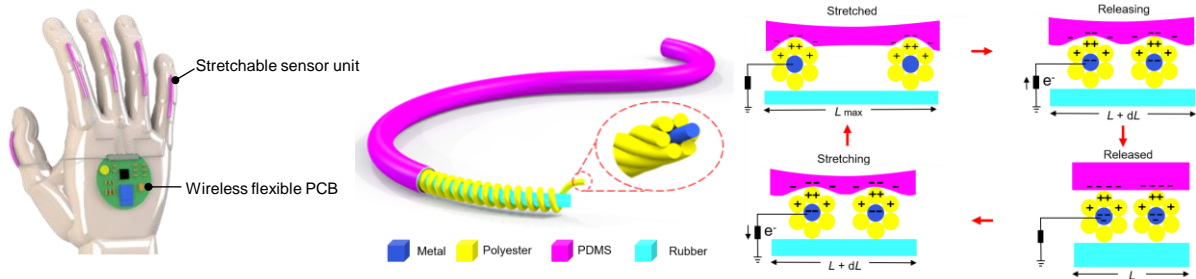
A simple, scalable, cost-effective approach to create soft and conductive fibers at ambient temperature and pressure

S. Zhang, Y. Zhou, A. Libanori, [...], **J. Chen***, *Nature Electronics*, **2023**, 6, 338–348 (Front Cover)

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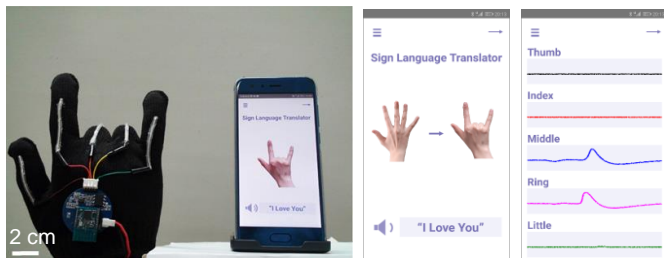
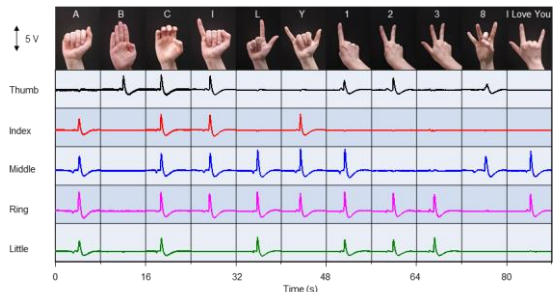
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Wearable Sign-to Speech Translation



Structure Design

Mechanical to Electrical Conversion

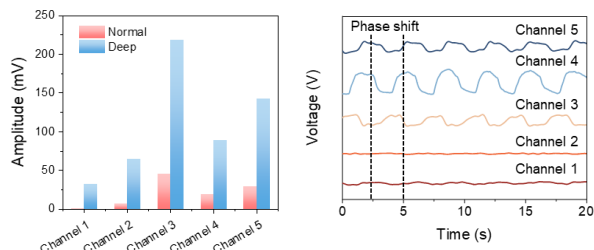
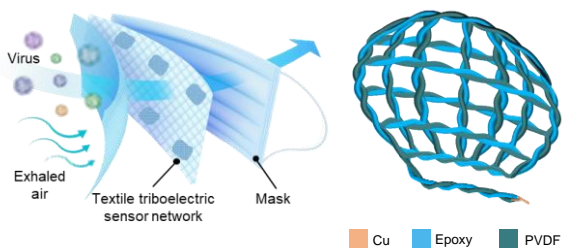


Z. Zhou, [...], J. Yang, **J. Chen***, *Nature Electronics*, 2020, 3, 571–578 (Hot Paper in Web of Science)

55

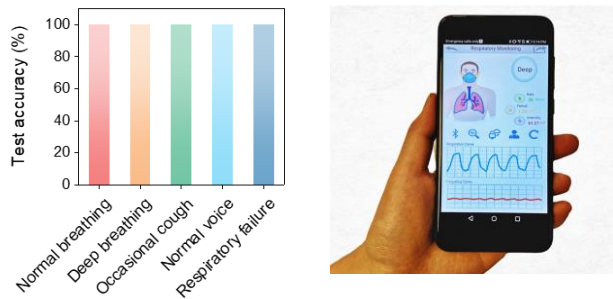
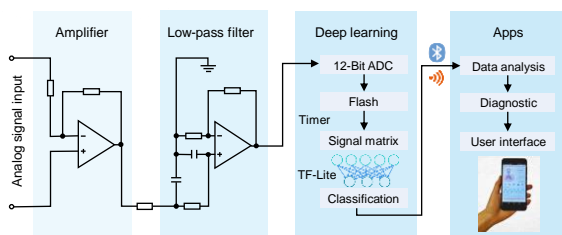
55

Facial Mask for Respiratory Monitoring



On-Mask Sensor Network

Electrical Signals from Network of Five Pressure Sensors

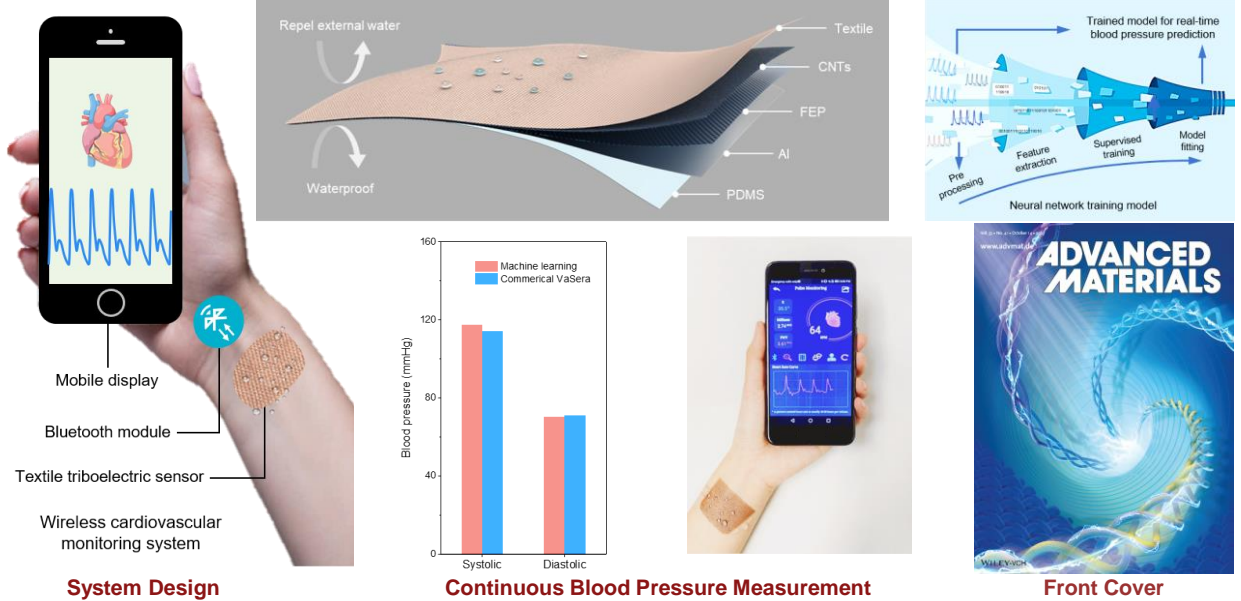


Signal Processing and Transmission

Y. Fang, J. Xu, X. Xiao, Y. Zou, X. Zhao, Y. Zhou, and **J. Chen***. *Adv. Mater.* 2022, 34, 2200252

56

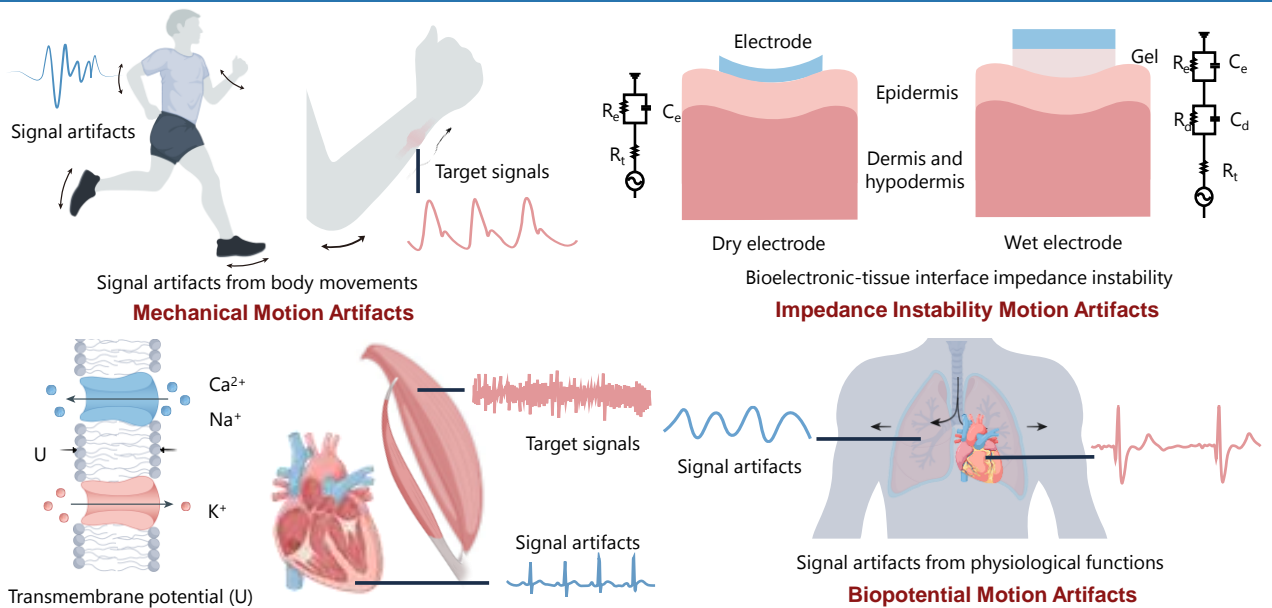
Ambulatory Cardiovascular Monitoring UCLA



Y. Fang, [...], and **J. Chen***. *Adv. Mater.* **2021**, 33, 2104178 (Invited Article for *Adv. Mater. Rising Star Award*)

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Motion Artifact Management UCLA



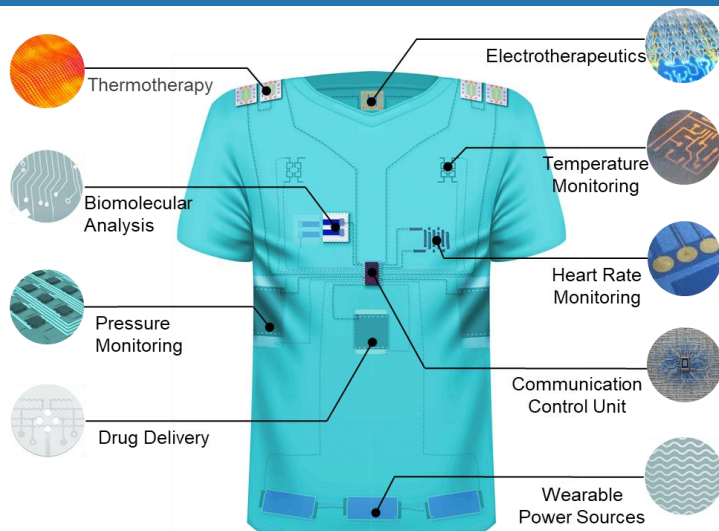
J. Yin, S. Wang, T. Tat, **J. Chen***. *Nature Reviews Bioengineering*, **2024**, Online (Invited Review Article)

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Summary and Outlook

UCLA

**Electronic Textiles for Wearable Point-of-Care Systems****Main Front Cover**

Using polymer science and bioelectronics to develop smart textiles for biomonitoring, therapeutic, and energy

G. Chen, X. Xiao, M. Bick, T. Tat, **J. Chen***, *Chemical Reviews*, **2022**, 122, 3259–3291

59

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Acknowledgement

UCLA

Wearable Bioelectronics Group at UCLA

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Ms. Jing Xu	Mr. John Lama
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Ms. Trinny Tat	Ms. Yaqi Liu
Mr. Guorui Chen	Ms. Sarah O'Donovan
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UCLA



American
Heart
Association.



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Thank you very much for your attention!



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Email: jun.chen@ucla.edu
Group Website: <https://www.junchenlab.com/>

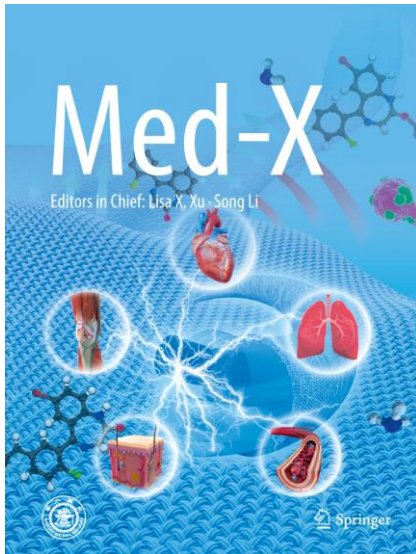


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A New Journal: Med-X from Springer Nature

UCLA



Online ISSN: 2731-8710

Publisher: Springer Nature & Shanghai Jiao Tong University

**An international journal that publishes breakthrough papers
in all areas of Biomedical Engineering**

1. Bioinformatics & Computational Systems Biology
2. Biomedical Imaging & Biosensors
3. Biomechanics & Mechanobiology
4. Biothermal Science & Engineering
5. Drug, Gene & Cell Delivery Systems
6. Gene & Cell Engineering
7. Immune & Vaccine Biotechnology
8. Medical devices & Artificial Intelligence
9. Nanobiotechnology & Nanomedicine
10. Precision Regeneration Medicine
11. Translational Medicine
12. Biomaterials
13. Tissue Engineering
14. Telemedicine & Medical Robotics

SPRINGER NATURE

Journal Website: <https://www.springer.com/journal/44258>

Submission: <https://www.editorialmanager.com/medx/default2.aspx>

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Nanowear

FDA approved Cloth Nanotechnology + Software-as-a-Service + AI/ML

=

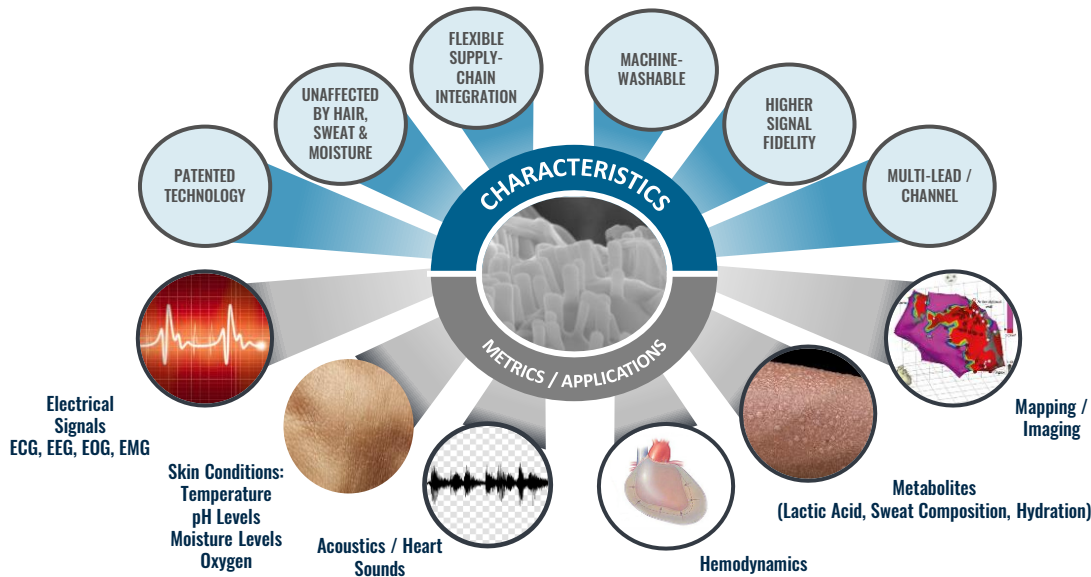
Healthcare-at-home Remote Diagnostics

nanowear
Smarter Care. Anywhere.

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Proprietary, Patented Nanotechnology and Chemical Formulation of cloth-based sensors



65

The Problem: Hypertension → Structural Heart Failure ... America's \$400bn+ problem

...clinical trials and preventative care require recurring in-person, invasive cardio-pulmonary assessments utilizing standard front-line tools which only provide snapshot insights in a point in time...




						
Digital Stethoscope	Electrocardiographs (multi-channel)	Blood Pressure	Hemodynamics / Right Heart Caths (Invasive)	Respiration / Lung volume	Pulse Oxygenation	Actigraphy

66

What if all 7 front-line diagnostic tools were a combined single source digital platform that offers safer, more frequent and continuous home-based cardio-pulmonary assessments?

What if the same platform's time synchronous A.I.-based diagnostics ultimately provided a patient "risk" signature in real-world evidence at home across the entire care continuum?

What if the same platform can reduce \$millions upfront in direct and indirect costs in personnel, efficiency and actuary analysis in clinical trials and preventative care?

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The Solution: Nanowear's FDA-cleared SimpleSense Healthcare-at-home Digital Platform

SimpleSense offers a substitute for routine in-person cardio-pulmonary assessments and pre-op / post-op consults at-home; 45min-1hr wear

Cloth Nanotechnology
+
Mobile App
+
SaaS & HIPAA compliant back-end
+
AI-based SaMD diagnostics

Commercially Launched 2023
in Enterprise partnership

Data Services ARR business model

Demand is higher than we can supply














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B2B large-caps inbounding SimpleSense's Unique and Single source Cardiopulmonary Data Services

SimpleSense **simultaneously** and **time synchronously** assesses the Heart, Lungs, Vascular and Hemodynamic System by replacing:

- i) Digital Stethoscope (\$100-\$400)
 - ii) ECG monitor (\$200-\$700)
 - iii) Hemodynamic monitor (\$1,000-\$5,000)
 - iv) Respiration monitor (\$150-\$1,300)
 - v) Actigraphy (\$25-100)
 - vi) Blood Pressure line (\$300-\$1,500)
 - vii) Pulse Oxygenation* (\$50-\$450)
 - viii) Continuous Glucose* (\$300-\$800)
- * Currently 3rd party integrated

Data Services ARR model per patient per month – hardware is included for free

Clinical Trial Costs are up 300% since the pandemic as new market has been set by flush large-cap Pharma. CROs, Biotech and Medtech companies require innovative, data driven solutions for trials

Data Services Monetization comparables



Today

- 1 Leading Cardiovascular Device, Diagnostics/Therapeutics, and CROs (Phase IIA to post-market companion diagnostic) (~\$55bn TAM)



Peer Review Publications



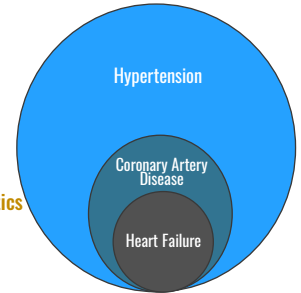
Data Driven Insights (Upstream)

AI/ML-based diagnostics (Downstream)

Tomorrow w/ right Partner(s)

- 2 Preventative at-home cardiopulmonary care and risk assessment (~\$400bn TAM)

100M+ Americans with Cardiovascular Disease



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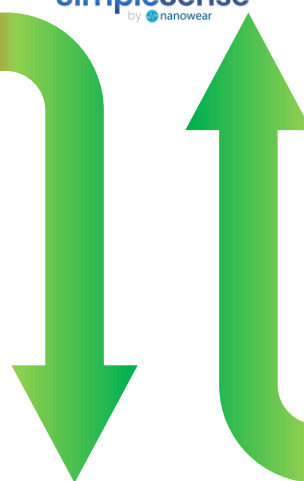
Nanowear's established Enterprise Product-Market-Fit in \$55bn Clinical Research TAM

Monopolistic: SimpleSense data services and clinical validation / labeling is the *only* primary outcome endpoint that saves sponsors \$10s millions



Decrease

- Labor
- In-office visits
- Facility Costs
- Multiple Devices, different models, different calibration needs
- Inventory
- Human error / inconsistency across sites



- Enrollment & Patient retention
- Heterogeneity & confounder identification
- Feasibility study data
- Adaptive from Phase I to post market registry
- Likelihood of therapeutic going to market
- Long-term value for peer review & adoption

Increase



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Proprietary Data Firehose: Best-in-class Signal-to-noise/Volume/Repeatability/Reinforcement → AI

Cardiopulmonary

Cardiopulmonary Coupling

- Ratio of low frequency coupling to high frequency coupling
- Very low frequency coupling
- Low frequency coupling
- High frequency coupling

Impedance

- Impedance vector 1 (Thoracic impedance mean)
- Impedance vector 2 (Thoracic impedance mean)

Pulmonary / Respiratory

- RR mean
- RR median
- RR standard deviation
- RR from power spectrum mean
- RR from power spectrum median
- RR standard deviation from power spectrum
- RR mean from peak counts
- RR median from peak counts
- RR standard deviation from peak counts
- RR mean from fitting a sine curve
- RR median from fitting a sine curve
- RR standard deviation from fitting a sine curve
- mean RR to relative tidal volume ratio
- median RR to relative tidal volume ratio
- mean relative tidal volume
- median relative tidal volume

Activity

- Posture classification
- Activity level
- Postural angle – angle relative to supine posture (left or right)
- Posture angle of elevation

ECG

Acoustic / Sounds Loudness

Heart Rate Variability

Blood Ejection Times

Activity

Impedance Cardiography + Thoracic Impedance

Pulmonary / Respiration

Cardio-pulmonary Coupling

Cardio / Electrocardiographs

- ECG vector 1
- ECG vector 2
- Mean heart rate and variability

Hemodynamics

Blood Ejection Times

- Mean R peak to S1 sound peaks
- Standard deviation R peak to S1 peak
- Mean R peak to S2 sound peaks
- Standard deviation R peak to S2 peak

Acoustic Loudness

- Mean S1 sound RMS loudness
- Standard deviation S1 sound RMS loudness
- Mean S2 sound RMS loudness
- Standard deviation S2 sound RMS loudness
- Mean S3 sound RMS amplitude
- Standard deviation S3 sound RMS loudness

- Mean S1 sound peak loudness
- Standard deviation S1 sound peak loudness
- Mean S2 sound peak loudness
- Standard deviation S2 sound peak loudness
- Mean S3 sound peak loudness
- Standard deviation S3 sound peak loudness

Heart Rate Variability

- RMSSD
- NN50
- pNN50
- SDANN
- SDNNI
- TINN
- LF
- HF
- VLF
- LF to HF ratio
- SD1 to SD2 ratio
- Approximate entropy
- Sample Entropy
- Correlation dimension
- triangular index
- SD1
- SD2
- Detrended fluctuation analysis short-term changes
- Detrended fluctuation analysis long-term changes
- Range of heart rate per breath

71

Customized Closed-Source SimpleSense™ AI Platform + Customized Data Services

85 biomarkers millisecond by millisecond

Anesthesiology And Electrophysiology Wearable

Patient-facing Mobile Application

Cloud-based Machine Learning Algorithms

SimpleSense Ingestion Pipeline

Proprietary closed-loop AI Engine

Customized Data Services

Provider-facing Web Portal

End-to-end interoperable via APIs (Data services can be white labeled)

Smarter Care. Anywhere. Confidential Nanowear Inc 2024, All Rights Reserved. 72

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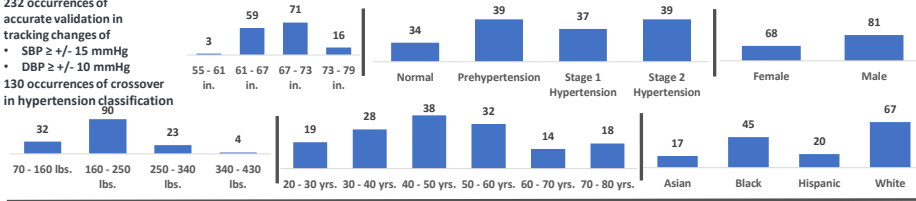
Unrivaled: SimpleSense-BP AI Diagnostic FDA Approval: Trained and validated on Own data



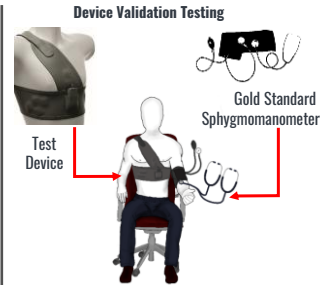
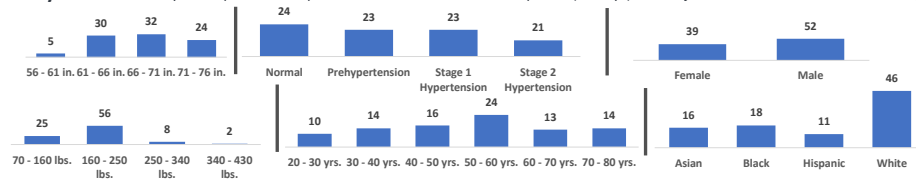
Study Arm 1 – Development and Validation (1) Training Population – **185** subjects (Central Pennsylvania and Georgia) and (2) Test Population – **118** New York and New Jersey

Study Arm 2 – Validation of ability to track natural and significant blood pressure changes **149** subjects from New York and New Jersey

232 occurrences of accurate validation in tracking changes of
 • SBP $\geq \pm 15$ mmHg
 • DBP $\geq \pm 10$ mmHg
 130 occurrences of crossover in hypertension classification



Study Arm 3 – Validity of SimpleSense-BP performance over extended time period (28 days) **91** subjects from New York and New Jersey

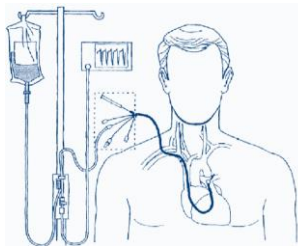


- Simultaneous measurement comparison
- 2 independently affiliated licensed nurse practitioners performing sphygmomanometer measurements



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What's in the AI/ML-hemodynamic pipeline? SimpleSense-HD: the Swan-Ganz replacement



Monitoring of hemodynamic parameters -cardiac output (CO) and stroke volume and pulmonary artery pressure (PAP), pulmonary wedge pressure (PCWP), right ventricle pressure (RVP) and pulmonary vascular resistance (PVR)

SimpleSense (upon validation) is a better alternative to Swan Ganz catheter for temporary percutaneous procedure and permanent implantables – pre-, peri-, and post-operatively



- ❑ Swan-Ganz catheter (Gold standard for CO, PAP, PCWP, RVP, PVR)– invasive, bed side system cannot be used for extensive periods or used at home.
- ❑ Catheter provides signal output to a bedside console for display
- ❑ Requires in-patient procedure and may require X-ray imaging for placement
- ❑ Adjunct device for Heart Pump and LVAD procedure – monitoring possible only when patient in hospital
- ❑ Single patient single use

- ❑ SimpleSense-HD: noninvasive, used for at home monitoring contributing tremendously to self-defined and autonomous (at home) living with improved quality of life.
- ❑ Multiparameter acquisition and Algorithmic estimation of CO and PAP
- ❑ Require no in-patient procedure and can be deployed in out-patient setting or by patient themselves at home
- ❑ Adjunct device for Heart Pump or LVAD procedure – in hospital and at home after the procedure for monitoring progress/recovery. Helps manage patients more closely and tailor their medications to help prevent them from worsening
- ❑ SimpleSense is a single patient multiuse device



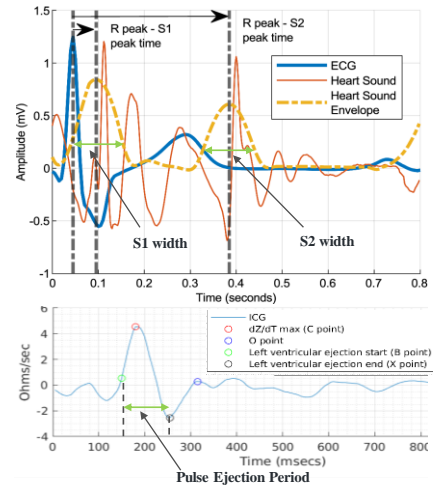
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SimpleSense Data Correlations with RHC pressures and Cardiac Output / Index


Simultaneous RHC and SimpleSense Study Enrollment Status (N=24)

RHC hemodynamic measurement	SimpleSense Feature	Correlation Coefficient	P-Value (< 0.05)
Systolic PCWP	S2 Width	0.959	0.0025
	ECG QRS duration	-0.808	0.0500
Diastolic PCWP	S2 Width	0.928	0.0075
	R to S1 Duration	0.799	0.0500
Mean PCWP	R to S2 Duration	0.866	0.0258
	S2 Width	0.938	0.0056
Systolic PAP	R to S2 Duration	0.818	0.0467
Mean PAP	S2 Width	0.844	0.0345
Systolic RVP	S2 Width	0.806	0.0500
	S1 Width	0.803	0.0500
Diastolic RVP	S2 Width	0.880	0.0209
	R to S1 Duration	-0.847	0.0332
Cardiac output	S1 Width	-0.359	0.0500
	ECG S wave Peak	0.558	0.0017
Cardiac index	ECG QRS duration	-0.521	0.0037
	S1 Width	-0.459	0.0364
	S1 Loudness	-0.451	0.0400
	S2 Loudness	-0.462	0.0349
	ECG S wave Peak	0.536	0.0123
	ECG QRS duration	-0.684	0.0006
	Pulse Ejection Period	0.460	0.0357

Nanowear engineers published figures in Nature Scientific Reports¹



1) Kumar, P.S., Rai, P., Ramasamy, M. et al. Multiparametric cloth-based wearable, SimpleSense, estimates blood pressure. *Sci Rep* 12, 13059 (2022). <https://doi.org/10.1038/s41598-022-17223-x>



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Nanowear – Best in class Technology, Best in class Operations, Best in class People

Funding to Date

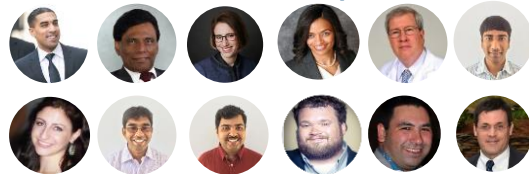
- ~\$19M in Seed and A Rounds
- Current Headcount: 25
- NYC, PA, Nashville, Berkeley



What Has the Market Recognized


- Cloth-Based Nanosensors (1st and Only)
- Scaled Manufacturing w/ ISO 13485 Partners 
- 4 FDA 510(k) clearances (incl. A.I. diagnostic)
- 13 Awarded Patents + 12 Pending
- Graduated Google's A.I. 6-mo scholarship Program
- Enterprise Customer Channels 2023

Executive Team – Diverse and Experienced



Where we are From – Nanowear assembles the “right” talent





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Peer Review Publications, Market Awareness and Media Recognition

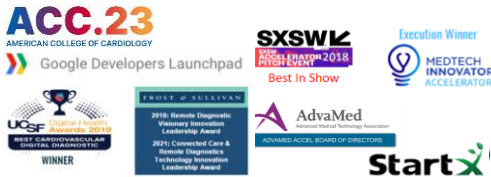
Peer Review Publications and Approvals

- [Nature: Scientific Reports](#)
- [JACC](#)
- [JAMA](#)
- [Nature: Cardiology Reports](#)
- [Journal of Cardiac Failure](#)
- [Cardiovascular Digital Health](#)
- [Cardiac Failure Review](#)
- [Sensors MDPi](#)
- [Electrochemical Society](#)
- [Aesthetic Surgery Journal](#)

White Papers

- [Frost & Sullivan 2021: Best-in-class Technology Leader](#)
- [Neural networks and feature-based machine learning](#)
- [Planning for Machine Learning as a Medtech Startup](#)

Awards



Media Articles

- [Wall Street Journal](#)
- [Healthtech Magazine](#)
- [Politico](#)
- [Fierce Healthcare](#)
- [The Daily Brief](#)
- [MobiHealthNews](#)
- [MDDI](#)
- [Beckers Health IT](#)

Radio Features


- [SiriusXM – “Wearables and Cardiology Show” on Doctor Radio](#)
- [SiriusXM – “The Plastic Surgery Show” on Doctor Radio](#)
- [SiriusXM – Doctor Radio](#)

Podcasts

- [The Financial Times](#)
- [Impetus Healthcare Goes Digital](#)
- [The Harry Glorikian Show](#)

Videos

- [WebMD Interview](#)
- [Google Startup Spotlight: Meet Nanowear](#)
- [Nanowear in 1 Minute](#)
- [UCSF Digital Health Award for Best Cardiovascular Digital Diagnostic](#)
- [Ink: Building a Revolutionary Connected-Care Companion Diagnostic](#)
- [Accenture HealthTech Innovation Challenge 2018: Nanowear Pitch](#)




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Nanowear is already considered an N of 1 scarcity value tech with Key Opinion Leader status

January 2024's novel A.I. hypertension diagnostic FDA approval further accentuates Nanowear one-of-a-kind value and strategic gaps filled in context of future exit



Our Work Industry Updates Member Center Events

← Press Releases

AdvaMed Launches New Digital Health Tech Division, Appoints Board Members

Digital Health / October 9, 2023


WASHINGTON, D.C. – Today, AdvaMed, the Medtech Association, announced the formation of AdvaMed Digital Health Tech, a new division within the organization that represents digital medical technology companies and promotes the critical role of data and digital medtech in transforming health care. The group, which is led by Shaye Mandie, acts as a thought leader and convener for the industry and focuses on four core policy areas: regulation, payment and health care delivery, data stewardship and privacy, and cybersecurity.

The AdvaMed Board of Directors approved the Digital Health Tech Board of Directors during the group's quarterly meeting during The MedTech Conference, selecting Taha Kass-Hout, GE HealthCare Chief Technology Officer, as the first chair of the group.

*Digital technology is rapidly evolving and making a profound impact on the care patients receive, and the medtech

The AdvaMed Board approved the following people for the Digital Health Tech Board:

- **GE HealthCare:** Taha Kass-Hout, CTO – Chair
- **Johnson & Johnson:** Shan Jegatheeswaran, Global Head of Digital, Johnson & Johnson MedTech
- **ResMed:** Urvashi Tyagi, CTO
- **Phillips:** Julia Strandberg, Chief Business Leader, Connected Care
- **Stryker:** Robert Cohen, President, Digital, Robotics & Enabling Technology
- **Siemens:** Christian Eusemann, VP Research & Innovation, Collaboration Officer
- **Medtronic:** Ken Washington, SVP, Chief Technology & Innovation Officer
- **Apple:** Sumbul Desai, M.D., VP Health
- **Google:** Bakul Patel, Sr. Director, Global Health Strategy
- **Microsoft:** David Rhew, M.D., Global CMO & VP Healthcare
- **Verily:** Rich Glenn, Head of Commercial, Care Delivery
- **Applied VR:** Josh Sackman, President & Co-Founder
- **Amazon:** Melissa Cha, Vice President, Amazon Devices & Services
- **Nanowear:** Venk Veradan, Co-Founder & CEO
- **Baxter:** Reaz Rasul, EVP and President, Healthcare Systems & Technologies



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Wednesday, May 15, 2024 | 2pm-3pm ET

Your Career Story: Crafting CVs and Resumes

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Thursday, May 16, 2024 | 2pm-3pm ET

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