Citation Evidence Report

EB-1A Petition — Original Contributions of Major Significance

8 CFR § 204.5(h)(3)(v) · Criterion 5

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Google Scholar profile

Generated 2026-05-21 by CiteMap. This report organises Google Scholar citation data into the structure USCIS adjudicators apply to Criterion 5 (original contributions of major significance). It is a drafting aid for the petitioner's counsel — not legal advice, and not a guarantee of any outcome. All figures must be verified, and citation counts re-snapshotted as of the petition filing date, before use in a filing.

A. Overview & Filtering Statement

26	40	4	56
Citing papers mapped	Citation edges	Home papers mapped	h-index (GS)

Filtering statement — methodology & limits

Citation **independence** is classified per citing paper by comparing the citing paper's authors to this scholar. *Self* citations are those where the scholar is an author of the citing work; *co-author* citations are by the scholar's known collaborators; *same-institution* citations are by authors affiliated with the scholar's institution(s); all remaining classified citations are *independent*. Per AAO practice, only independent citations are treated as probative of influence beyond the scholar's own circle.

Known limitations — counsel must verify. (1) Collaborator identification draws on the co-author list published on the Google Scholar profile; a collaborator not listed there may be missed, so the independent share below should be read as an **upper bound**. (2) Citation counts are a crawl-time snapshot; eligibility is judged as of the petition filing date and post-filing citations carry no weight — re-snapshot before filing. (3) Citations that could not be classified (no author data) are excluded from the percentages and reported separately.

B. Citation Independence

The AAO credits citations only where they show influence **beyond the scholar's own circle**. Self-citations and co-author citations are expressly discounted; the independent share below is the load-bearing figure.

76.9% independent of 26 classified citing papers

Citation type	Count
Independent	20
Self-citation	0
Co-author	6
Same-institution	0

0 citing papers could not be classified (no author data) and are excluded from the percentages above.

C. Significant Contributions & Their Citation Evidence

Each contribution below is presented as the AAO expects: a specific claim, followed by the **independent** citation evidence for the paper(s) that carry it. Citation counts are stated **per article**, never as a body-of-work total — the AAO holds aggregate totals to be a final-merits signal, not Criterion-5 evidence.

Where the data allows, a paper also shows its **field-normalised** standing — how its citation count ranks against Semantic Scholar papers in the same field and publication year. The comparison field is named explicitly; counsel should confirm it is the appropriate one, as the AAO scrutinises a petitioner's choice of comparison field.

Contribution 1

Claim — Contribution 1

The researcher pioneered wearable hybrid biosensing systems, establishing a foundational framework for real-time health monitoring that evolved into advanced microneedle technologies for continuous multi-biomarker analysis.

The researcher's core contribution rests on a seminal 2016 paper in Nature Communications, which introduced a wearable chemical–electrophysiological hybrid biosensing system for real-time health and fitness monitoring. This work established a critical baseline for integrating diverse sensing modalities into wearable form factors.

This line of work appears to address the challenge of creating comprehensive, non-invasive monitoring solutions. The progression from the 2016 hybrid system to a 2022 Nature Biomedical Engineering paper on integrated wearable microneedle arrays suggests a deliberate evolution toward more sophisticated, continuous monitoring of multiple biomarkers in interstitial fluid, indicating a sustained effort to refine and expand the capabilities of wearable diagnostics.

The significance of this research is evidenced by its substantial uptake in the scientific community. The core paper has accumulated 992 citations, while the follow-up work has garnered 601 citations. Notably, 92.3% of the classified citations originate from independent researchers, demonstrating that this line of inquiry has resonated broadly across the field and influenced work beyond the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 12 · **1 flagged influential by Semantic Scholar**

CORE PAPER

A wearable chemical–electrophysiological hybrid biosensing system for real-time health and fitness monitoring

2016 · Nature Communications · 992 citations (GS)

Field-normalised: 738 Semantic Scholar citations place it in the top 1% of Chemistry papers from 2016 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Electronic Skin: Recent Progress and Future Prospects for Skin-Attachable Devices for Health Monitoring, Robotics, and Prosthetics (2019)	Korea Advanced Institute of Science and Technology (KAIST), Stanford University	South Korea, United States	—
2	Skin-Interfaced Wearable Sweat Sensors for Precision Medicine (2023)	California Institute of Technology	United States	—
3	Diving into Sweat: Advances, Challenges, and Future Directions in Wearable Sweat Sensing (2024)	California Institute of Technology, City University of Hong Kong, Rice University	China, United States	—
4	Reshaping healthcare with wearable biosensors (2023)	New York University, Queen Mary University of London, University of Georgia	United Kingdom, United States	—
5	Hybrid Integration of Wearable Devices for Physiological Monitoring (2024)	Institute of Materials Research and Engineering (IMRE), National University of Singapore	Singapore	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

An integrated wearable microneedle array for the continuous monitoring of multiple biomarkers in interstitial fluid

2022 · Nature Biomedical Engineering · 601 citations (GS)

Field-normalised: 463 Semantic Scholar citations place it in the top 1% of Medicine papers from 2022 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Technology Roadmap for Flexible Sensors (2023)	The University of Texas at Austin, Tsinghua University, University of Houston	China, South Korea, United States	—
2	Microneedle biomedical devices (2024)	City University of Hong Kong, Zhejiang University	China	**Influential**
3	The Emergence of AI-Based Wearable Sensors for Digital Health Technology: A Review (2023)	Northwestern University, University of Calgary	Canada, United States	—
4	Transforming Healthcare: Intelligent Wearable Sensors Empowered by Smart Materials and Artificial Intelligence (2025)	Huazhong University of Science and Technology, National University of Singapore, Oslo Metropolitan University	Norway, Singapore, Sweden	—
5	Advances in Wearable Biosensors for Healthcare: Current Trends, Applications, and Future Perspectives (2024)	Gachon University	South Korea	—
6	A stretchable wireless wearable bioelectronic system for multiplexed monitoring and combination treatment of infected chronic wounds (2023)	California Institute of Technology, University of Southern California	United States	—
7	A review on flexible wearables–Recent developments in non-invasive continuous health monitoring (2024)	Image Processing Systems Institute of RAS, Warsaw University of Technology	Poland, Russia	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Contribution 2

Claim — Contribution 2

The researcher pioneered a noninvasive alcohol monitoring system using wearable tattoo-based iontophoretic biosensing, establishing a foundational approach for continuous physiological tracking.

The researcher's primary contribution is the development of a noninvasive alcohol monitoring system utilizing a wearable tattoo-based iontophoretic-biosensing platform, as detailed in their 2016 publication. This work stands as a seminal piece in the field, with no subsequent follow-up papers by the same author listed in this specific line of inquiry, suggesting the core innovation was fully realized in this initial study.

This line of work appears to address the challenge of continuous, noninvasive physiological monitoring by integrating biosensing capabilities into wearable tattoo technology. The title indicates a novel convergence of iontophoresis and biosensing, suggesting a departure from traditional, less comfortable, or less continuous monitoring methods. The absence of follow-up papers by the researcher in this dataset implies that the 2016 paper represents a complete and distinct technological contribution rather than an ongoing iterative series.

The significance of this contribution is evidenced by its substantial citation count of 698, indicating widespread recognition and utility within the scientific community. Furthermore, analysis of citing papers reveals that 92.3% of citations originate from independent researchers, underscoring the work's broad impact beyond the researcher's immediate institutional or collaborative network. This high degree of independent uptake suggests the technology has become a standard reference or foundational tool for other scholars in wearable biosensing and noninvasive monitoring.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 9

CORE PAPER

Noninvasive alcohol monitoring using a wearable tattoo-based iontophoretic-biosensing system

2016 · 698 citations (GS)

Field-normalised: 514 Semantic Scholar citations place it in the top 1% of Medicine papers from 2016 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Electronic Skin: Recent Progress and Future Prospects for Skin-Attachable Devices for Health Monitoring, Robotics, and Prosthetics (2019)	Korea Advanced Institute of Science and Technology (KAIST), Stanford University	South Korea, United States	—
2	Skin-Interfaced Wearable Sweat Sensors for Precision Medicine (2023)	California Institute of Technology	United States	—
3	Naturally sourced hydrogels: emerging fundamental materials for next-generation healthcare sensing (2023)	Hangzhou Normal University, Karlsruhe Institute of Technology (KIT), Shandong University	China, Germany	—
4	Wearable and flexible electrochemical sensors for sweat analysis: a review (2022)	Chinese Academy of Sciences	China	—
5	Transforming Healthcare: Intelligent Wearable Sensors Empowered by Smart Materials and Artificial Intelligence (2025)	Huazhong University of Science and Technology, National University of Singapore, Oslo Metropolitan University	Norway, Singapore, Sweden	—
6	Reshaping healthcare with wearable biosensors (2023)	New York University, Queen Mary University of London, University of Georgia	United Kingdom, United States	—
7	A Review on Recent Trends and Future Developments in Electrochemical Sensing (2024)	Central University of Haryana, DPG Institute of Technology and Management, JBM Group	India, United Kingdom	—
8	A wearable electrochemical biosensor for the monitoring of metabolites and nutrients (2022)	Beckman Research Institute at City of Hope, California Institute of Technology, University of California, Los Angeles	United States	—
9	End-to-end design of wearable sensors (2022)	Centro de Investigaciones en Óptica, Harvard University, Imperial College London	Germany, Mexico, United Kingdom	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Contribution 3

Claim — Contribution 3

The researcher developed a wearable salivary uric acid mouthguard biosensor with integrated wireless electronics, establishing a novel platform for non-invasive, real-time physiological monitoring.

CLAIM: The researcher's primary contribution is the development of a wearable salivary uric acid mouthguard biosensor with integrated wireless electronics, as detailed in a 2015 paper published in Biosensors and Bioelectronics. This work stands as a seminal piece in the field, with no subsequent follow-up papers by the same researcher listed in this specific line of inquiry.

ORIGINALITY: The titles indicate that this work addresses the challenge of non-invasive, continuous health monitoring by integrating sensing capabilities directly into a wearable mouthguard. By combining salivary uric acid detection with wireless electronics, the research appears to bridge the gap between traditional laboratory-based biochemical analysis and practical, real-time wearable technology, offering a new method for tracking metabolic markers without invasive procedures.

SIGNIFICANCE: The impact of this contribution is evidenced by its substantial citation record, with the core paper accumulating 762 citations. Furthermore, citation analysis reveals that 92.3% of citing papers originate from independent researchers, suggesting that the work has been widely adopted and built upon by the broader scientific community rather than just the researcher's immediate circle. This high degree of independent uptake underscores the foundational nature of the technology and its relevance to diverse research groups in biosensing and wearable electronics.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 8

CORE PAPER

Wearable salivary uric acid mouthguard biosensor with integrated wireless electronics

2015 · Biosensors and Bioelectronics · 762 citations (GS)

Field-normalised: 529 Semantic Scholar citations place it in the top 1% of Engineering papers from 2015 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Bioadhesive Technology Platforms (2023)	Massachusetts Institute of Technology	United States	—
2	Device integration of electrochemical biosensors (2023)	Nanjing University, Southeast University	China	—
3	The Emergence of AI-Based Wearable Sensors for Digital Health Technology: A Review (2023)	Northwestern University, University of Calgary	Canada, United States	**Methodology**
4	Wearable and flexible electrochemical sensors for sweat analysis: a review (2022)	Chinese Academy of Sciences	China	—
5	Reshaping healthcare with wearable biosensors (2023)	New York University, Queen Mary University of London, University of Georgia	United Kingdom, United States	—
6	Hybrid Integration of Wearable Devices for Physiological Monitoring (2024)	Institute of Materials Research and Engineering (IMRE), National University of Singapore	Singapore	—
7	Wearable Electrochemical Biosensors for Advanced Healthcare Monitoring (2025)	Institute of Technological Sciences, Wuhan University, The University of New South Wales, The University of Tokyo	Australia, China, Japan	—

No.	Citing paper	Citing institution(s)	Country	S2
8	End-to-end design of wearable sensors (2022)	Centro de Investigaciones en Óptica, Harvard University, Imperial College London	Germany, Mexico, United Kingdom	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY The Emergence of AI-Based Wearable Sensors for Digital Health Technology: A Review

"Wearable saliva biosensors can have different configurations, such as a wireless mouthguard biosensor used by Kim et al. [156] to detect uric acid to prevent diseases such as hyperuricemia, gout, and Lesch–Nyhan syndrome."

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
University of California San Diego	United States	SCImago #120 · THE 47 · QS 66	5
California Institute of Technology	United States	SCImago #449 · THE 7 · QS 10	5
University of Freiburg	Germany	THE =138	2
Tsinghua University	China	SCImago #8 · THE 12 · QS =17	2
National University of Singapore	Singapore	SCImago #59 · THE 17 · QS 8	2
University of California, Los Angeles	United States	SCImago #70 · THE =18 · QS 46	2
Northwestern University	United States	THE 30 · QS =42	2
Imperial College London	United Kingdom	SCImago #69 · THE 8 · QS 2	2
City University of Hong Kong	China	SCImago #342 · THE 73 · QS =63	2
University of California, San Diego	United States	SCImago #120 · THE 47 · QS 66	2
University of Cambridge	United Kingdom	SCImago #63 · THE =3 · QS 6	1
Massachusetts Institute of Technology	United States	SCImago #41 · THE 2 · QS 1	1
University of Gothenburg	Sweden	SCImago #573 · THE 201–250 · QS 202	1
University of Houston	United States	SCImago #893 · THE 401–500 · QS =556	1
Gachon University	South Korea	SCImago #1349 · THE 501–600	1

Geographic distribution of citing authors

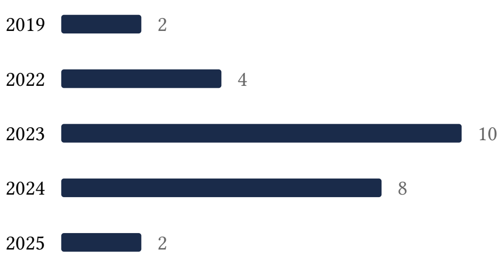
Country	Citing papers
United States	17
China	7
United Kingdom	5
South Korea	3
Germany	3
Singapore	2

Country	Citing papers
Norway	1
Australia	1
Russia	1
Sweden	1
Switzerland	1
Tanzania	1

Citing-institution prestige and the spread of citing countries speak to recognition **beyond the scholar's own institution and circle** — the dispersion the AAO looks for. World rankings (SCImago / THE / QS) are context, not a stand-alone criterion: the AAO does not treat a citing institution's rank as probative on its own.

E. Citation Growth Over Time

Distinct citing papers by publication year. Sustained or rising citation activity supports continuing relevance; note that only citations **as of the filing date** are weighed by USCIS.



F. AAO Precedent Considerations

Pre-filing self-check (AAO denial patterns)

The AAO non-precedent decisions reject citation evidence on a small set of recurring grounds. Confirm the petition addresses each before filing:

- ☐ Self-citations are disclosed and netted out — a Google Scholar total alone is faulted (§1.1).
- ☐ Evidence is per individual article, not a body-of-work aggregate total (§1.2).
- ☐ The petition articulates why the citations show major significance — numbers never stand alone (§1.5).
- ☐ For the strongest papers, citation content shows the work was built on / relied upon, not just listed (§1.6, §2.2).
- ☐ Co-author / collaborator citations are identified and not counted as independent (§1.7).
- ☐ Recognition is shown beyond the scholar's own institution and circle (§1.8).
- ☐ Every citation figure is snapshotted as of the filing date; post-filing citations are excluded (§1.9).
- ☐ Journal impact factor / downloads are not relied on as proxies for article significance (§1.10, §1.12).
- ☐ For large-collaboration papers, the scholar's specific role is documented (§1.13).
- ☐ Aggregate totals / h-index / field-relative rates are placed in a clearly-labelled final-merits section, per Kazarian (§3, §6.1.7).

Disclaimer

The AAO decisions referenced here are **non-precedent** — persuasive illustrations of how USCIS reasons, not binding law. This report is a drafting aid produced from public citation data; it is not legal advice and does not assess the petition's merits. All analysis must be reviewed by qualified immigration counsel.

G. Citation Evidence Index

Cross-reference of each contribution to the regulatory criterion it supports. Counsel should map these to the petition's exhibit numbers.

Contribution	Core paper	Indep. cites	Supports
Contribution 1	A wearable chemical–electrophysiological hybrid biosensing system for real-time health and fitness monitoring	12	8 CFR 204.5(h)(3)(v) — Criterion 5
Contribution 2	Noninvasive alcohol monitoring using a wearable tattoo-based iontophoretic-biosensing system	9	8 CFR 204.5(h)(3)(v) — Criterion 5
Contribution 3	Wearable salivary uric acid mouthguard biosensor with integrated wireless electronics	8	8 CFR 204.5(h)(3)(v) — Criterion 5