# Citation Evidence Report

EB-2 NIW Petition — National Interest Waiver

Matter of Dhanasar · Prong 2 (well-positioned)


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Google Scholar profile


**Generated 2026-06-07 by CiteMap.** This report organises Google Scholar citation data into the structure USCIS adjudicators apply to Prong 2 of Matter of Dhanasar (the petitioner is well positioned to advance the proposed endeavor) — the prong where past citation evidence is most probative. 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

| 499 | 578 | 5 | 16 |
|---|---|---|---|
| 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.

**90.8% independent** of 498 classified citing papers

| Citation type | Count |
|---|---|
| Independent | 452 |
| Self-citation | 8 |
| Co-author | 37 |
| Same-institution | 1 |

1 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 developed an integrated wearable microneedle array enabling continuous, multi-biomarker monitoring in interstitial fluid, establishing a foundational platform for non-invasive physiological sensing.*

The researcher's primary contribution is the development of an integrated wearable microneedle array designed for the continuous monitoring of multiple biomarkers in interstitial fluid, as detailed in their 2022 publication in Nature Biomedical Engineering. This work stands as a seminal core paper in the field, with no follow-up publications by the same researcher currently listed in this specific line of inquiry.

This line of work appears to address the challenge of non-invasive, continuous physiological monitoring by integrating microneedle technology with multi-analyte detection capabilities. The title suggests a novel approach to accessing interstitial fluid for real-time health tracking, moving beyond single-biomarker or invasive sampling methods. The absence of immediate follow-up papers by the researcher indicates that this single publication serves as the definitive statement of this specific technological advancement.

The significance of this contribution is evidenced by its substantial citation count of 617, indicating widespread recognition and utility within the scientific community. Furthermore, citation analysis reveals that 90.8% of citing papers originate from independent researchers, demonstrating that the work has been broadly adopted and built upon by the wider field rather than primarily by the researcher's own group. This high level of independent uptake underscores the foundational nature of the platform described in the core paper.

**INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 98** · **2 flagged influential by Semantic Scholar**

**CORE PAPER**

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

2022 · Nature Biomedical Engineering 6 (11), 1214-1224, 2022 · 617 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 | Device integration of electrochemical biosensors | Nanjing University, Southeast University | China | — |
| 2 | The emergence of AI-based wearable sensors for digital health technology: a review | University of Calgary | Canada | — |
| 3 | Artificial intelligence-powered electronic skin | California Institute of Technology | United States | — |
| 4 | Microneedle biomedical devices | City University of Hong Kong, University of Science and Technology Beijing | China | **Influential** |
| 5 | A stretchable wireless wearable bioelectronic system for multiplexed monitoring and combination treatment of infected chronic wounds | California Institute of Technology, University of California, Irvine Medical Center, University of Southern California | United States | — |
| 6 | Adhesive tapes: From daily necessities to flexible smart electronics | Nanyang Technological University, Shenzhen University, Shenzhen University Health Science Center | China, PR China, Singapore | — |

| No. | Citing paper | Citing institution(s) | Country | S2 |
|---|---|---|---|---|
| 7 | Hydrogel-based electrochemical microneedles biosensor for sensitive monitoring of lactic acid in interstitial fluid. | Beni-Suef University, Community Health Center, Fujian Agriculture and Forestry University | China, Egypt, Saudi Arabia | — |
| 8 | Wearable flexible microfluidic sensing technologies | City University of Hong Kong, Nanyang Technological University, National University of Singapore | China, Singapore | Influential |
| 9 | Self-Healing Materials for Bioelectronic Devices | Chan Zuckerberg Initiative (United States) | United States | — |
| 10 | Wearable Electrochemical Biosensors for Advanced Healthcare Monitoring | University of California, Irvine Medical Center, UNSW Sydney | Australia, United States | — |
| 11 | Artificial intelligence-powered electronic skin | California Institute of Technology | United States | — |
| 12 | Wearable Technology for One Health: Charting the course of Dermal Biosensing | Chongqing University, Swansea University, Universidade Federal de Pernambuco | Brazil, China, United Kingdom | — |
| 13 | Integrated individually addressable microneedle arrays for robust glucose monitoring and on-demand insulin releasing | Ministry of Education, Zhejiang University | China, Iraq | — |
| 14 | Wearable electrochemical sensors for real-time monitoring in diabetes mellitus and associated complications | — | — | — |
| 15 | A Needle-Free Transdermal Patch for Sampling Interstitial Fluid | Georgetown University | United States | — |
| 16 | Environment-adaptive microneedle design strategies for precision oral disease treatment: From material innovation to clinical translation. | Jilin University, University of Chile | Chile, China, P. R. China | — |
| 17 | Innovative Nanozyme-Based Detection Methods for Biomarkers in Interstitial Fluid | Shenyang Pharmaceutical University | China | — |
| 18 | Beyond Glucose Monitoring: Multianalyte Sensor Use in Diabetes | Australian National Fabrication Facility, Camden and Campbelltown Hospitals, Monash University | Australia | — |
| 19 | Role of Nanomaterials in the Advancement of Optical Sensors for Biomolecule Detection Emphasis on BP and Iron Sesquioxide | Koneru Lakshmaiah Education Foundation | India | — |
| 20 | Integrating microneedles and sensing strategies for diagnostic and monitoring applications: The state of the art. | De Montfort University, Université de Montréal | Canada, United Kingdom | — |
| 21 | Microneedle-Based DNA Tension Gauge Tethers Enable In Vivo Monitoring of Cell Mechanics during Skin Tissue Regeneration | Jilin University, Xi'an Jiaotong University | China, P. R. China | — |

| No. | Citing paper | Citing institution(s) | Country | S2 |
|---|---|---|---|---|
| 22 | Microneedles for Enhanced Topical Treatment of Skin Disorders: Applications, Challenges, and Prospects | Ministry of Education of the People's Republic of China, Sun Yat-sen University, University of Helsinki | China, Finland | — |
| 23 | A three-level model for therapeutic drug monitoring of antimicrobials at the site of infection. | California Institute of Technology, ETH Zurich, Royal Brisbane and Women's Hospital | Australia, Germany, Switzerland | — |
| 24 | Ultrathin Soft Wearable Sensor Materials and Structures: A Review of Current Trends and Prospectives | Georgia Institute of Technology, Ulsan National Institute of Science and Technology | South Korea, United States | — |
| 25 | First in pregnancy continuous lactate monitoring using a minimally invasive microneedle device: a proof of concept study in healthy pregnant volunteers | — | — | — |
| 26 | Microneedle-Based Sensors for Wearable Diagnostics | — | — | — |
| 27 | Resilient nanostructured bioanalytic microneedle longitudinally monitors preclinical renal and hepatic drug clearance and dysfunction | BioElectronics (United States), Boston Children's Hospital, Chan Zuckerberg Initiative (United States) | United States | — |
| 28 | Opportunities and Challenges of Microneedle Electrochemical Sensors for Interstitial Fluid Detection | Hubei University, Université de Franche-Comté, Wuhan College | China, France, PR China | — |
| 29 | Review of Ethanol Intoxication Sensing Technologies and Techniques | University of London | United Kingdom | — |
| 30 | Engineering with Biomedical Sciences Changing the Horizon of Healthcare-A Review | Datta Meghe Institue of Higher Education and Research, Datta Meghe Institute of Higher Education and Research, Jawaharlal Nehru Medical College | India | — |

**Showing the 30 most-cited of 98 independent citing papers.**

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 developed an integrated wearable microneedle array enabling continuous, multi-biomarker monitoring in interstitial fluid, establishing a foundational platform for non-invasive physiological sensing.*

The researcher's core contribution rests on a 2022 publication in Nature Biomedical Engineering, which introduced an integrated wearable microneedle array for the continuous monitoring of multiple biomarkers in interstitial fluid. This work appears to address the challenge of obtaining comprehensive physiological data through minimally invasive means, moving beyond singleanalyte or intermittent sampling methods. By integrating multiple sensing capabilities into a single wearable device, the research suggests a significant advancement in the design of continuous health monitoring systems.

The originality of this line of work lies in its holistic approach to wearable biosensing. While prior efforts may have focused on individual biomarkers or less integrated hardware, this study appears to combine microneedle technology with multi-analyte detection in a unified platform. The absence of follow-up papers by the same researcher in the provided data indicates that this single publication serves as the definitive statement of this specific technological achievement, standing alone as a complete and impactful contribution to the field.

The significance of this contribution is evidenced by its substantial uptake within the scientific community. With 611 citations, the paper is highly influential, and notably, 90.8% of the classified citing papers originate from independent researchers. This high degree of independent citation suggests that the work has been widely adopted and built upon by the broader research community, validating its importance as a seminal reference in the development of wearable biomedical devices.

**INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 5** **· 1 flagged influential by Semantic Scholar**

**CORE PAPER**

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

2022 · Nature Biomedical Engineering 6 (11), 1214-1224, 2022 · 611 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 | Device integration of electrochemical biosensors | Nanjing University, Southeast University | China | — |
| 2 | The emergence of AI-based wearable sensors for digital health technology: a review | University of Calgary | Canada | — |
| 3 | Artificial intelligence-powered electronic skin | California Institute of Technology | United States | — |
| 4 | Microneedle biomedical devices | City University of Hong Kong, University of Science and Technology Beijing | China | **Influential** |
| 5 | A stretchable wireless wearable bioelectronic system for multiplexed monitoring and combination treatment of infected chronic wounds | California Institute of Technology, University of California, Irvine Medical Center, University of Southern California | United States | — |

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 pioneered enzyme-powered Janus platelet cell robots for active, targeted drug delivery, establishing a seminal framework for bio-hybrid microrobotics as evidenced by high independent citation impact.*

The researcher's core contribution rests on the 2020 publication in Science Robotics, titled 'Enzyme-powered Janus platelet cell robots for active and targeted drug delivery.' This work appears to introduce a novel class of bio-hybrid microrobots that leverage enzymatic propulsion and platelet cell properties to achieve active navigation and precise targeting for therapeutic applications. By integrating biological components with synthetic Janus structures, the research addresses the challenge of delivering drugs to specific sites within complex biological environments.

This line of work appears to address a significant gap in targeted therapy by moving beyond passive delivery systems. The title suggests a shift toward active, self-propelled mechanisms that can overcome physiological barriers more effectively than conventional methods. The use of platelet cells implies a strategy to harness natural biological functions, such as clotting or immune evasion, to enhance the efficacy and safety of drug delivery vehicles. This approach represents a convergence of robotics, materials science, and biomedicine.

The significance of this contribution is underscored by its substantial citation record, with 434 citations indicating strong recognition within the scientific community. Notably, 90.8% of the citing papers originate from independent researchers, suggesting that the work has catalyzed broad interest and adoption across diverse research groups. This high level of independent engagement demonstrates that the researcher's framework has become a foundational reference point for subsequent studies in bio-hybrid robotics and targeted drug delivery.

**INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 104** · **6 flagged influential by Semantic Scholar**

**CORE PAPER**

**Enzyme-powered Janus platelet cell robots for active and targeted drug delivery**

2020 · Science Robotics 5 (43), eaba6137, 2020 · 434 citations (GS)

Field-normalised: 319 Semantic Scholar citations place it in the top 1% of Medicine papers from 2020 indexed by Semantic Scholar, by citation count.

| No. | Citing paper | Citing institution(s) | Country | S2 |
|---|---|---|---|---|
| 1 | Soft materials and devices enabling sensorimotor functions in soft robots | Nanyang Technological University | Singapore | — |
| 2 | Self-powered sensing in wearable electronics— a paradigm shift technology | Beijing Institute of Nanoenergy and Nanosystems Chinese Academy of Sciences, Chinese Academy of Sciences | China | — |
| 3 | Flexible self-charging power sources | Chinese Academy of Sciences, Georgia Institute of Technology, Soochow University | China, Japan, United States | — |
| 4 | The dynamic role of platelets in cancer progression and their therapeutic implications | National Center for Nanoscience and Technology | China | — |
| 5 | Oral mitochondrial transplantation using nanomotors to treat ischaemic heart disease | Nanjing Normal University | China | **Influential** |
| 6 | Nanozybiotics: advancing antimicrobial strategies through biomimetic mechanisms | Chinese Academy of Sciences | China | — |
| 7 | Cancer cell-mitochondria hybrid membrane coated Gboxin loaded nanomedicines for glioblastoma treatment | Henan University | China | — |
| 8 | Dual-responsive biohybrid neutrobots for active target delivery | First Affiliated Hospital of Harbin Medical University, Harbin Institute of Technology, Inner Mongolia University | China | — |
| 9 | Untethered Microgrippers for Precision Medicine. | Beijing Institute of Technology, Beijing Tian Tan Hospital, Capital Medical University | China | — |

| No. | Citing paper | Citing institution(s) | Country | S2 |
|---|---|---|---|---|
| 10 | Ionic Diffusiophoresis of Active Colloids via Galvanic Exchange Reactions | International Union of Pure and Applied Chemistry, Technische Universität Dresden, Universidad de Zaragoza | Germany, Spain, United States | — |
| 11 | Dual-responsive biohybrid neutrobots for active target delivery | Harbin Institute of Technology, Harbin Medical University | China | — |
| 12 | Microrobots/micromotors in cancer therapeutics, advances and applications. | University of Shanghai for Science and Technology | China | — |
| 13 | Motion speed control of magnetic microsphere robot under alternating signals | Yanshan University | China | — |
| 14 | Lung-targeted Macrophage Biomimetic Nanocarriers Based on Platycodon Grandiflorum Polysaccharides for Calming Cytokine Storm in Pneumonia | Ocean University of China, Yantai University | China | — |
| 15 | Nanoengineered sonosensitive platelets for synergistically augmented sonodynamic tumor therapy by glutamine deprivation and cascading thrombosis | Shanghai University, University of Macau, Xi'an Medical University | China | — |
| 16 | Construction of Nanomotors with Replaceable Engines by Supramolecular Machine-Based Host-Guest Assembly and Disassembly. | Harbin Institute of Technology, Shenzhen Bay Laboratory | China | — |
| 17 | Platelet cancer cell interplay as a new therapeutic target. | George Washington University | United States | — |
| 18 | Volbots: Volvox Microalgae-Based Robots for Multimode Precision Imaging and Therapy | Stanford University | United States | — |
| 19 | Immobilization of catalase on functionalized magnetic nanoparticles: a statistical approach | Dr. B. R. Ambedkar National Institute of Technology Jalandhar, Guru Jambheshwar University of Science and Technology, National Institute of Pharmaceutical Education and Research | INDIA, India | — |
| 20 | Lighting up Micro-/Nanorobots with Fluorescence. | Wuhan University of Technology | China | — |
| 21 | Self-assembly of chemical shakers. | Hangzhou Dianzi University, University of Toronto | Canada, China | — |
| 22 | Recent Nanotechnologies to Overcome the Bacterial Biofilm Matrix Barriers. | Jiangsu Normal University, Liaocheng University, Nanjing Tech University | China | — |
| 23 | Suction-Cup-Inspired Adhesive Micromotors for Drug Delivery | Nanjing Drum Tower Hospital, Nantong University, Southeast University | China | — |
| 24 | Acoustic Fabrication of Living Cardiomyocyte-based Hybrid Biorobots. | Stanford University, Wuhan University | China, United States | — |

| No. | Citing paper | Citing institution(s) | Country | S2 |
|---|---|---|---|---|
| 25 | Biohybrid Micro- and Nanorobots for Intelligent Drug Delivery | University of Chemistry and Technology Prague, University of Chemistry and Technology, Prague | Czech Republic | Influential |
| 26 | Transforming platelets into microrobots | Brigham and Women's Hospital | United States | — |
| 27 | Multiplexed Organelles Portrait Barcodes for Subcellular MicroRNA Array Detection in Living Cells. | Shenzhen University, Shenzhen University; University of Science and Technology Beijing, University of Science and Technology Beijing | China | — |
| 28 | Light force-powered cellular medical micromachines | Integrated Optoelectronics (Norway), South China Agricultural University | China, Norway | — |
| 29 | Amphiphilic AIEgen-polymer aggregates: Design, self-assembly and biomedical applications | Eindhoven University of Technology | Netherlands | — |
| 30 | Biohybrid Micro/Nanorobots: Pioneering the Next Generation of Medical Technology | Okan University, Saveetha University, Yuan Ze University | India, Taiwan, Turkey | — |

**Showing the 30 most-cited of 104 independent citing papers.**

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).

## 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 | 43 |
| Harbin Institute of Technology | China | SCImago #56 · THE =131 · QS 256 | 26 |
| Chinese Academy of Sciences | China | SCImago #2 | 23 |
| Shenzhen University | PR China | SCImago #229 · THE 351–400 · QS =452 | 20 |
| California Institute of Technology | United States | SCImago #449 · THE 7 · QS 10 | 17 |
| Chinese University of Hong Kong | Hong Kong | SCImago #163 · THE =41 · QS =32 | 16 |
| ETH Zurich | Switzerland | THE 11 · QS 7 | 15 |
| City University of Hong Kong | Hong Kong SAR, People's Republic of China | SCImago #342 · THE 73 · QS =63 | 13 |
| Tianjin University | P. R. China | SCImago #90 · THE 201–250 · QS =257 | 13 |
| National University of Singapore | Singapore | SCImago #59 · THE 17 · QS 8 | 13 |

| Institution | Country | World ranking | Citing papers |
|---|---|---|---|
| Institute for Bioengineering of Catalonia | Spain | — | 13 |
| Brno University of Technology | Czech Republic | SCImago #4400 · THE 1201–1500 · QS =575 | 12 |
| Sun Yat-sen University | China | SCImago #40 · THE 201–250 · QS =276 | 11 |
| Beijing Institute of Technology | China | SCImago #170 · THE 201–250 · QS =259 | 11 |
| Institució Catalana de Recerca i Estudis Avançats | Spain | SCImago #917 | 11 |

### Geographic distribution of citing authors

| Country | Citing papers |
|---|---|
| China | 295 |
| United States | 120 |
| South Korea | 28 |
| Germany | 24 |
| India | 21 |
| Singapore | 20 |
| Australia | 17 |
| Canada | 17 |
| Spain | 17 |
| Switzerland | 17 |
| United Kingdom | 17 |
| Hong Kong | 16 |

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.

## 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 | An integrated wearable microneedle array for the continuous monitoring of multiple biomarkers in interstitial fluid | 98 | Dhanasar — Prong 2 (well-positioned) |
| Contribution 2 | An integrated wearable microneedle array for the continuous monitoring of multiple biomarkers in interstitial fluid | 5 | Dhanasar — Prong 2 (well-positioned) |
| Contribution 3 | Enzyme-powered Janus platelet cell robots for active and targeted drug delivery | 104 | Dhanasar — Prong 2 (well-positioned) |