

Citation Evidence Report

EB-1A Petition — Original Contributions of Major Significance

8 CFR § 204.5(h)(3)(v) · Criterion 5

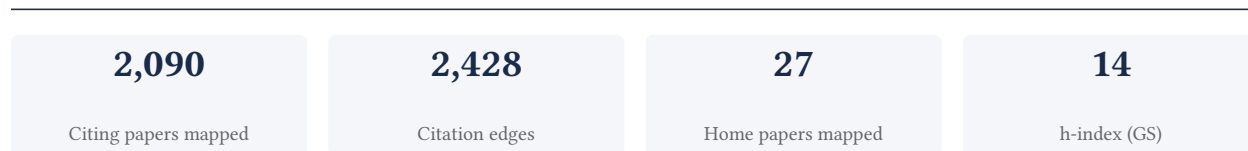
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[Google Scholar profile](#)

Generated 2026-06-01 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



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.

95.4% independent of 1,930 classified citing papers

Citation type	Count
Independent	1,842
Self-citation	12
Co-author	76
Same-institution	0

160 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 laser-engraved wearable sensors for sweat-based metabolite detection, establishing a foundational platform for continuous, non-invasive monitoring of uric acid and tyrosine in precision medicine.

The researcher's core contribution rests on the 2020 publication regarding a laser-engraved wearable sensor for the sensitive detection of uric acid and tyrosine in sweat. This work serves as the foundation for a sustained line of inquiry into skin-interfaced biosensing technologies.

This line of work appears to address the challenge of developing robust, minimally invasive methods for real-time health monitoring. By transitioning from specific analyte detection to broader metabolite and nutrient monitoring in subsequent 2022 and 2023 papers, the researcher demonstrates an evolution from proof-of-concept to comprehensive precision medicine applications.

The significance of this contribution is evidenced by substantial citation metrics, with the core paper accumulating 1304 citations and follow-up works garnering 896 and 650 citations respectively. Notably, 95.4% of citing papers originate from independent researchers, indicating broad adoption and validation of this sensing platform across the global scientific community.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 1,727

CORE PAPER

[A laser-engraved wearable sensor for sensitive detection of uric acid and tyrosine in sweat](#)

2020 · 1,304 citations (GS)

Field-normalised: 999 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	Materials-driven soft wearable bioelectronics for connected healthcare	Monash University	Australia	—
2	End-to-end design of wearable sensors	Imperial College London, University of Freiburg	Germany, United Kingdom	—
3	2D materials in flexible electronics: recent advances and future prospectives	Nanjing University of Science and Technology, University of Massachusetts Amherst, Yonsei University	China, South Korea, United States	—
4	Soft materials and devices enabling sensorimotor functions in soft robots	Nanyang Technological University	Singapore	—
5	Hybrid integration of wearable devices for physiological monitoring	Institute of Materials Research and Engineering, National University of Singapore	Singapore	—
6	Transforming healthcare: intelligent wearable sensors empowered by smart materials and artificial intelligence	National University of Singapore, OsloMet – Oslo Metropolitan University, Simula Metropolitan Center for Digital Engineering	Norway, Singapore, United Kingdom	—
7	Self-powered sensing in wearable electronics— a paradigm shift technology	Beijing Institute of Nanotechnology and Nanosystems Chinese Academy of Sciences, Chinese Academy of Sciences	China	—

No.	Citing paper	Citing institution(s)	Country	S2
8	Noninvasive on-skin biosensors for monitoring diabetes mellitus	Singapore Institute of Manufacturing Technology, The University of Manchester	Singapore, United Kingdom	—
9	Wireless technologies in flexible and wearable sensing: from materials design, system integration to applications	Jiangxi Academy of Sciences, King Abdullah University of Science and Technology, Northwestern Polytechnical University	China, Saudi Arabia	—
10	Soft electronics for health monitoring assisted by machine learning	Sun Yat-sen University, Sun Yat-sen University, Shenzhen Campus, Tsinghua University	China	—
11	Direct laser writing: from materials synthesis and conversion to electronic device processing	NOVA School of Science and Technology	Portugal	—
12	Interindividual-and blood-correlated sweat phenylalanine multimodal analytical biochips for tracking exercise metabolism	Chinese Academy of Sciences	China	—
13	E-tattoos: toward functional but imperceptible interfacing with human skin	The University of Texas at Austin, University of California Davis	United States	—
14	Toward integrated multifunctional laser-induced graphene-based skin-like flexible sensor systems	Chinese Academy of Sciences, Shanghai Jiao Tong University, Zhejiang University	China	—
15	Well-defined in-textile photolithography towards permeable textile electronics	The Hong Kong Polytechnic University	China, P. R. China	—
16	Materials and device strategies to enhance spatiotemporal resolution in bioelectronics	The University of Chicago	United States	—
17	Wearable flexible microfluidic sensing technologies	National University of Singapore	Singapore	—
18	Epidermal wearable optical sensors for sweat monitoring	Shenzhen University	China, PR China	—
19	Liquid metal-polymer conductor-based conformal cyborg devices	Southern University of Science and Technology	China	—
20	Atomically thin bioelectronics	University of Massachusetts Amherst	United States	—
21	Advances in 2D materials for wearable biomonitoring	University of California, Irvine Medical Center	United States	—
22	Electrochemical biosensors and power supplies for wearable health-managing textile systems	Harbin Institute of Technology (Shenzhen)	China	—
23	Stretchable and Smart Wetttable Sensing Patch with Guided Liquid Flow for Multiplexed in Situ Perspiration Analysis	Nanjing University	China	—
24	Skin-interfaced entirely self-contained wearable biosensor for the noninvasive and dynamic monitoring of sweat myo-inositol	Northeast Normal University	China, P. R. China	—
25	A wearable sensor patch for joule-heating sweating and comfortable biofluid monitoring	Shenzhen University	China, PR China	—

No.	Citing paper	Citing institution(s)	Country	S2
26	Recent advances of sweat sampling, sensing, energy-harvesting and data-display toward flexible sweat electronics	City University of Hong Kong	China	—
27	Multifunctional porous soft bioelectronics	University of Missouri	United States	—
28	Recent development in wearable sensors for healthcare applications	University of Guilan	Iran	—
29	3D sponge electrodes for soft wearable bioelectronics	Monash University	Australia	—
30	Ultrafast laser fabrication of a flexible sensor by selective ablation for a dynamic tactile recognition system	The Chinese University of Hong Kong, Tsinghua University	China	—

Showing the 30 most-cited of 716 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).

FOLLOW-UP WORK

[A wearable electrochemical biosensor for the monitoring of metabolites and nutrients](#)

2022 · 896 citations (GS)

No.	Citing paper	Citing institution(s)	Country	S2
1	Device integration of electrochemical biosensors	Nanjing University, Southeast University	China	—
2	Machine-Learning-Aided Advanced Electrochemical Biosensors	McGill University, Montreal General Hospital	Canada	—
3	Skin-inspired soft bioelectronic materials, devices and systems	Stanford University, University of Brescia	Italy, United States	—
4	Materials-driven soft wearable bioelectronics for connected healthcare	Monash University	Australia	—
5	Digital health for aging populations	University of California San Diego	United States	—
6	Smart contact lenses as wearable ophthalmic devices for disease monitoring and health management	Yonsei University	South Korea	—
7	Wearable electrochemical biosensors for advanced healthcare monitoring	The University of New South Wales, The University of Tokyo, UNSW Sydney	Australia, Japan	—
8	Multi-mode/signal biosensors: Electrochemical integrated sensing techniques	Nanjing Forestry University, National University of Singapore	China, Singapore	—
9	Soft sensors and actuators for wearable human-machine interfaces	Ulsan National Institute of Science and Technology	South Korea	—
10	Transforming healthcare: intelligent wearable sensors empowered by smart materials and artificial intelligence	National University of Singapore, OsloMet – Oslo Metropolitan University, Simula Metro-	Norway, Singapore, United Kingdom	—

No.	Citing paper	Citing institution(s)	Country	S2
		politan Center for Digital Engineering		
11	Motion artefact management for soft bioelectronics	University of California, Irvine Medical Center	United States	—
12	Noninvasive on-skin biosensors for monitoring diabetes mellitus	Singapore Institute of Manufacturing Technology, The University of Manchester	Singapore, United Kingdom	—
13	Reshaping healthcare with wearable biosensors	New York University, Queen Mary University of London, University of Georgia	United Kingdom, United States	—
14	Intelligent wearable systems: Opportunities and challenges in health and sports	King Abdullah University of Science and Technology	Saudi Arabia	—
15	Interfacial iontronics in bioelectronics: from skin-attachable to implantable devices	Hanyang University	South Korea	—
16	Direct laser writing: from materials synthesis and conversion to electronic device processing	NOVA School of Science and Technology	Portugal	—
17	Bioadhesive technology platforms	Massachusetts Institute of Technology	United States	—
18	Interindividual-and blood-correlated sweat phenylalanine multimodal analytical biochips for tracking exercise metabolism	Chinese Academy of Sciences	China	—
19	Materials design and integration strategies for soft bioelectronics in digital healthcare	Center for Nanoparticle Research, Institute for Basic Science (IBS), Yonsei University	South Korea	—
20	Toward integrated multifunctional laser-induced graphene-based skin-like flexible sensor systems	Chinese Academy of Sciences, Shanghai Jiao Tong University, Zhejiang University	China	—
21	Electrochemical and electrical biosensors for wearable and implantable electronics based on conducting polymers and carbon-based materials	The University of Auckland	New Zealand	—
22	Flexible and stretchable electrochemical sensors for biological monitoring	Wuhan University	China	—
23	Active-reset protein sensors enable continuous in vivo monitoring of inflammation	Northwestern University, University of Toronto	Canada, United States	—
24	Wearable flexible microfluidic sensing technologies	National University of Singapore	Singapore	—
25	A monolithically integrated in-textile wristband for wireless epidermal biosensing	Southern University of Science and Technology, The Hong Kong Polytechnic University	China, P. R. China	—
26	Epidermal wearable optical sensors for sweat monitoring	Shenzhen University	China, PR China	—
27	Skin-interfaced entirely self-contained wearable biosensor for the noninvasive and dynamic monitoring of sweat myo-inositol	Northeast Normal University	China, P. R. China	—
28	Recent advances in skin-interfaced wearable sweat sensors: opportunities for equitable per-	University of Hawai'i at Mānoa	United States	—

No.	Citing paper	Citing institution(s)	Country	S2
	sonalized medicine and global health diagnostics			
29	Smart textiles for chronic disease management: Advancements, applications, and future prospects	Tianjin University	China	—
30	Computationally-assisted wearable system for continuous cortisol monitoring	Zhejiang University, Zhejiang University of Technology	China	—

Showing the 30 most-cited of 638 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 is Influential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

[Skin-interfaced wearable sweat sensors for precision medicine](#)

2023 · 650 citations (GS)

No.	Citing paper	Citing institution(s)	Country	S2
1	Materials-driven soft wearable bioelectronics for connected healthcare	Monash University	Australia	—
2	Smart contact lenses as wearable ophthalmic devices for disease monitoring and health management	Yonsei University	South Korea	—
3	Wearable electrochemical biosensors for advanced healthcare monitoring	The University of New South Wales, The University of Tokyo, UNSW Sydney	Australia, Japan	—
4	Hybrid integration of wearable devices for physiological monitoring	Institute of Materials Research and Engineering, National University of Singapore	Singapore	—
5	Ultrathin two-dimensional materials: New opportunities and challenges in ultra-sensitive gas sensing	Dalian Institute of Chemical Physics	China	—
6	Self-powered sensing in wearable electronics— a paradigm shift technology	Beijing Institute of Nanotechnology and Nanosystems Chinese Academy of Sciences, Chinese Academy of Sciences	China	—
7	Porous conductive textiles for wearable electronics	The Hong Kong Polytechnic University	China, P. R. China	—
8	Nanomaterials for flexible neuromorphics	Shenzhen University, The Hong Kong Polytechnic University	China	—
9	Wearable flexible microfluidic sensing technologies	National University of Singapore	Singapore	—
10	Advances in 2D materials for wearable biomonitoring	University of California, Irvine Medical Center	United States	—
11	High-performance graphdiyne oxide/Au nanoparticle electrode for electrochemical non-enzymatic glucose sensor	Guangxi University, Science and Technology Innovation High School, Beijing Haidian Shangli	China	—

No.	Citing paper	Citing institution(s)	Country	S2
		Foreign Language School, Shandong University		
12	Electrochemical biosensors and power supplies for wearable health-managing textile systems	Harbin Institute of Technology (Shenzhen)	China	—
13	Wearable sensor patch with hydrogel microneedles for in situ analysis of interstitial fluid	Purdue University	United States	—
14	Fully integrated multiplexed wristwatch for real-time monitoring of electrolyte ions in sweat	Chinese Academy of Sciences	China	—
15	Skin-interfaced entirely self-contained wearable biosensor for the noninvasive and dynamic monitoring of sweat myo-inositol	Northeast Normal University	China, P. R. China	—
16	Redefining metal organic frameworks in biosensors: Where are we now?	Institute of Materials Research and Engineering, Nanyang Technological University	Singapore	—
17	Recent advances in skin-interfaced wearable sweat sensors: opportunities for equitable personalized medicine and global health diagnostics	University of Hawai'i at Mānoa	United States	—
18	Recent studies on smart textile-based wearable sweat sensors for medical monitoring: a systematic review	King Fahd University of Petroleum and Minerals, University of Connecticut	Saudi Arabia, United States	—
19	In-situ generation of Co-Fe bimetallic electrocatalysts on lignosulfonate-derived graphene by direct laser writing for wearable glucose biosensors	Wuhan Institute of Technology	China	—
20	Advances in pH sensing: from traditional approaches to next-generation sensors in biological contexts	Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Jilin University, Khalifa University of Science and Technology	China, United Arab Emirates	—
21	Wireless, flexible, ionic, perspiration-rate sensor system with long-time and high sweat volume functions toward early-stage, real-time detection of dehydration	Osaka Metropolitan University	Japan	—
22	A wearable sensor patch for joule-heating sweating and comfortable biofluid monitoring	Shenzhen University	China, PR China	—
23	Panoramic view of artificial fruit ripening agents sensing technologies and the exigency of developing smart, rapid, and portable detection devices: A review	Dongguk University, Inha University, Korea Food Research Institute	India, South Korea, United States	—
24	Recent advances in laser manufacturing: multifunctional integrative sensing systems for human health and gas monitoring	The Hong Kong University of Science and Technology	China	—
25	Recent advances of sweat sampling, sensing, energy-harvesting and data-display toward flexible sweat electronics	City University of Hong Kong	China	—

No.	Citing paper	Citing institution(s)	Country	S2
26	Recent advances in smart fabric-type wearable electronics toward comfortable wearing	Chongqing University, North Sichuan Medical University, State Grid Corporation of China	China	—
27	Advances in biocarbon and soft material assembly for enthalpy storage: Fundamentals, mechanisms, and multimodal applications	Yonsei University	South Korea	—
28	Water droplets play a role in Internet of Things applications	National University of Singapore	Singapore	—
29	Wet chemically produced nanomaterials for soft wearable biosensors	Australian National University, Griffith University, Macquarie University	Australia, Singapore	—
30	Advancing flexible sensors through on-demand regulation of supramolecular nanostructures	Nanyang Technological University, Peking University, Soochow University	China, Singapore	—

Showing the 30 most-cited of 373 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 a graphene-based multiplexed telemedicine platform for rapid, low-cost SARS-CoV-2 diagnosis and monitoring, published in the high-impact journal Matter.

The researcher's contribution centers on the development of a novel diagnostic infrastructure, anchored by the 2020 publication in *Matter* titled 'SARS-CoV-2 RapidPlex: a graphene-based multiplexed telemedicine platform for rapid and low-cost COVID-19 diagnosis and monitoring.' This work represents a distinct technical achievement in integrating materials science with clinical diagnostics.

This line of work appears to address the critical need for accessible and swift diagnostic solutions during the pandemic. By leveraging graphene-based technology within a multiplexed telemedicine framework, the research suggests a shift toward decentralized, low-cost monitoring capabilities. The absence of follow-up papers by the same researcher indicates that this single publication serves as the definitive statement of this specific technological approach.

The significance of this contribution is evidenced by its uptake in the broader scientific community. With 24 citations, the work has attracted attention from independent researchers, who constitute 95.4% of the citing authors. This high degree of independence suggests that the platform's design or methodology has been recognized and utilized by external parties, validating its utility beyond the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 0

CORE PAPER

[SARS-CoV-2 RapidPlex: a graphene-based multiplexed telemedicine platform for rapid and low-cost COVID-19 diagnosis and monitoring. *Matter* 3: 1981–1998](#)

2020 · 24 citations (GS)

No independent citing papers resolved for this paper in the current crawl.

Contribution 3

Claim – Contribution 3

The researcher pioneered all-printed soft human-machine interfaces for robotic physicochemical sensing, establishing a foundational framework for flexible, integrated sensor systems in robotics.

The researcher’s seminal contribution centers on the development of all-printed soft human-machine interfaces designed for robotic physicochemical sensing, as detailed in their 2022 publication. This work represents a distinct advancement in creating flexible, integrated systems that bridge soft robotics and chemical detection capabilities.

This line of work appears to address the challenge of integrating robust sensing mechanisms into soft robotic platforms. By utilizing all-printed fabrication methods, the research suggests a novel approach to manufacturing compliant interfaces that can perform complex physicochemical analyses, moving beyond rigid traditional sensor architectures.

The significance of this contribution is evidenced by its substantial uptake in the scientific community, with the core paper accumulating 368 citations. Furthermore, analysis of the broader citation landscape reveals that 95.4% of citing papers originate from independent researchers, indicating that this work has served as a widely adopted foundation for diverse, independent lines of inquiry in the field.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 0

CORE PAPER

[All-printed soft human-machine interface for robotic physicochemical sensing](#)

2022 · 368 citations (GS)

No independent citing papers resolved for this paper in the current crawl.

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
California Institute of Technology	United States	SCImago #449 · THE 7 · QS 10	58
Chinese Academy of Sciences	The People's Republic of China	SCImago #2	57
Zhejiang University	PR China	SCImago #6 · THE 39 · QS 49	47
City University of Hong Kong	The People's Republic of China	SCImago #342 · THE 73 · QS =63	46
University of California San Diego	United States	SCImago #120 · THE 47 · QS 66	43
University of California, Irvine Medical Center	United States	—	40
Shenzhen University	PR China	SCImago #229 · THE 351–400 · QS =452	39
Tsinghua University	PR China	SCImago #8 · THE 12 · QS =17	39
National University of Singapore	Singapore	SCImago #59 · THE 17 · QS 8	38
Yonsei University	South Korea	SCImago #238 · THE 86 · QS 50	31
Nanyang Technological University	Singapore	SCImago #137	26
Northwestern University	United States	THE 30 · QS =42	26

Institution	Country	World ranking	Citing papers
Shanghai Jiao Tong University	China	SCImago #10 · THE 40 · QS =47	25
Fudan University	PR China	SCImago #46 · THE 36 · QS 30	24
Huazhong University of Science and Technology	P. R. China	SCImago #25 · THE =176 · QS 319	23

Geographic distribution of citing authors

Country	Citing papers
China	883
United States	451
South Korea	175
India	113
Singapore	65
Australia	57
United Kingdom	57
Japan	53
Canada	52
Italy	45
PR China	39
P. R. China	39

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	A laser-engraved wearable sensor for sensitive detection of uric acid and tyrosine in sweat	1,727	8 CFR 204.5(h)(3)(v) – Criterion 5
Contribution 2	SARS-CoV-2 RapidPlex: a graphene-based multiplexed telemedicine platform for rapid and low-cost COVID-19 diagnosis and monitoring. Matter 3: 1981–1998	0	8 CFR 204.5(h)(3)(v) – Criterion 5
Contribution 3	All-printed soft human-machine interface for robotic physicochemical sensing	0	8 CFR 204.5(h)(3)(v) – Criterion 5