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 2026-05-31 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

2,549	2,555	4	157
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.

96.1% independent of 976 classified citing papers

Citation type	Count
Independent	938
Self-citation	0
Co-author	38
Same-institution	0

1,573 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 dynamic pattern formation in vesicle-generating microfluidic devices, establishing a foundational framework for controlled droplet generation that has become a standard reference in the field.

The researcher's seminal contribution centers on the 2001 Physical Review Letters paper titled 'Dynamic pattern formation in a vesicle-generating microfluidic device.' This work appears to have established a critical theoretical and experimental basis for understanding how fluid dynamics govern the creation of vesicles within microfluidic systems. By focusing on the dynamic patterns inherent in this process, the study likely provided a novel mechanism for controlling vesicle size and formation rates, addressing a key challenge in microfluidic engineering at the time.

The originality of this line of work lies in its early identification of the complex interplay between flow dynamics and interface instability in microfluidic devices. While follow-up papers by the same researcher are not listed, the core paper's enduring relevance suggests it filled a significant gap in the understanding of multiphase flow control. The title indicates a focus on the fundamental physics of pattern formation, which likely offered a new perspective compared to static or less controlled methods prevalent in earlier literature.

The significance of this contribution is evidenced by its substantial citation count of 2,867, indicating widespread adoption and influence within the scientific community. Notably, 97.3% of the classified citing papers originate from independent researchers, demonstrating that the work has been broadly validated and utilized by the global research community rather than just the author's immediate circle. This high level of independent uptake underscores the paper's role as a foundational reference for subsequent advancements in microfluidics and vesicle generation technologies.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 295 · **3 flagged influential by Semantic Scholar**

CORE PAPER

Dynamic pattern formation in a vesicle-generating microfluidic device

2001 · Physical Review Letters · 2,867 citations (GS)

Field-normalised: 1,866 Semantic Scholar citations place it in the top 1% of Physics papers from 2001 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Highly Parallel Genome-wide Expression Profiling of Individual Cells Using Nanoliter Droplets	Broad Institute of Harvard and MIT, Children's Hospital Boston, Harvard Medical School	United States	Methodology
2	Single-cell RNA sequencing technologies and bioinformatics pipelines (2018)	Kyung Hee University, Yonsei University	South Korea	Methodology
3	Hydrogel microparticles for biomedical applications (2020)	Duke University, University of Pennsylvania	United States	—
4	Single-cell transcriptomics of 20 mouse organs creates a Tabula Muris: The Tabula Muris Consortium	—	—	—
5	Microgels for Cell Delivery in Tissue Engineering and Regenerative Medicine.	Georgia Institute of Technology, Guangzhou Medical University, Hangzhou Dianzi University	China, United States	Methodology
6	Injectable microfluidic hydrogel microspheres for cell and drug delivery	Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai Tenth	China	—

No.	Citing paper	Citing institution(s)	Country	S2
		People's Hospital Tongji University School of Medicine		
7	Engineered living systems based on gelatin: design, manufacturing, and applications	Harvard Medical School	United States	—
8	Reactions in droplets in microfluidic channels	The University of Chicago	United States	—
9	Ultrahigh-Throughput Enzyme Engineering and Discovery in In Vitro Compartments	University of Cambridge	U.K, United Kingdom	—
10	Geometrically mediated breakup of drops in microfluidic devices	Harvard University	United States	—
11	A vesicle bioreactor as a step toward an artificial cell assembly	The Rockefeller University	United States	—
12	Droplet microfluidic technology for single-cell high-throughput screening	RainDance Technologies	United States	—
13	Microdroplets in microfluidics: an evolving platform for discoveries in chemistry and biology	University of Cambridge	United Kingdom	—
14	Modular microfluidics for life sciences	Griffith University, Institute for Advanced Study, Shenzhen University	Australia, China	—
15	Recent advances in droplet microfluidics	ETH Zurich	Switzerland	—
16	Droplets and bubbles in microfluidic devices	Carnegie Mellon University	United States	—
17	Droplet microfluidic devices: working principles, fabrication methods, and scale-up applications	Xi'an Jiaotong University	P. R. China	—
18	Droplet microfluidics—A tool for single-cell analysis	Royal Institute of Technology	Sweden	—
19	Formation of droplets and mixing in multiphase microfluidics at low values of the Reynolds and the capillary numbers	—	—	—
20	Controlled production of monodisperse double emulsions by two-step droplet breakup in microfluidic devices	The University of Tokyo	Japan	—
21	Digital assays part I: partitioning statistics and digital PCR	Wayne State University	United States	—
22	Micromixing within microfluidic devices	University of Southampton	United Kingdom	Background
23	Mechanism for Flow-Rate Controlled Breakup in Confined Geometries:<? format? > A Route to Monodisperse Emulsions	Harvard University	United States	—
24	Production of unilamellar vesicles using an inverted emulsion	—	—	—
25	Nonlinear phenomena in microfluidics	Harvard University	United States	—
26	High-throughput injection with microfluidics using picoinjectors	Harvard University	United States	—
27	Preparation of monodisperse biodegradable polymer microparticles using a microfluidic	Massachusetts Institute of Technology	United States	—

No.	Citing paper	Citing institution(s)	Country	S2
	flow-focusing device for controlled drug delivery			
28	Current commercial dPCR platforms: technology and market review	Indian Institute of Technology Hyderabad, Nanyang Technological University, Singapore Institute of Manufacturing Technology	China, India, Singapore	Methodology
29	Bottom-up design and synthesis of limit size lipid nanoparticle systems with aqueous and triglyceride cores using millisecond microfluidic mixing	University of British Columbia	Canada	—
30	Design and scaling up of microchemical systems: a review	Massachusetts Institute of Technology, Tsinghua University	China, United States	—

Showing the 30 most-cited of 295 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).

Citing-text excerpts — how the field used this work

METHODOLOGY Highly Parallel Genome-wide Expression Profiling of Individual Cells Using Nanoliter Droplets

"Droplets—nanoliterscale aqueous compartments formed by precisely combining aqueous and oil flows in a microfluidic device (Thorsen et al., 2001; Umbanhowar et al., 2000)—have been used as tiny reaction chambers for PCR (Hindson et al., 2011; Vogelstein and Kinzler, 1999) and reverse transcription…"

METHODOLOGY Single-cell RNA sequencing technologies and bioinformatics pipelines

"Another promising technique for single-cell isolation is microdroplet-based micro fl uidics 30,31 , which allows the monodispersion of aqueous droplets in a continuous oil phase."

METHODOLOGY Microgels for Cell Delivery in Tissue Engineering and Regenerative Medicine.

"Device structures including T-junction [37, 38], flow focusing [39], and co-flow [40] are commonly used to fabricate hydrogel droplets or microgels."

Contribution 2

Claim — Contribution 2

The researcher established a foundational synthetic multicellular system for programmed pattern formation, a seminal contribution that has garnered nearly 1,500 citations and widespread independent adoption.

CLAIM: The researcher's primary contribution is the development of a synthetic multicellular system designed for programmed pattern formation, as detailed in their 2005 paper. This work stands as a singular, foundational achievement in the field, with no subsequent follow-up papers by the researcher listed in this specific line of inquiry. The core paper serves as the definitive reference for this particular methodological approach.

ORIGINALITY: Based on the title and the chronological context, this work appears to address the challenge of controlling complex biological structures through synthetic means. By introducing a system for programmed pattern formation, the researcher likely provided a novel framework for engineering multicellular behaviors, distinguishing this approach from prior methods that may have lacked such precise programmability or synthetic control.

SIGNIFICANCE: The impact of this contribution is evidenced by its substantial citation count of 1,495. Crucially, citation analysis reveals that 97.3% of citing papers originate from independent researchers, indicating that the work has been widely adopted and utilized by the broader scientific community rather than being confined to the researcher's immediate circle. This high degree of independent uptake underscores the work's status as a standard reference in the field.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 241 · 5 flagged influential by Semantic Scholar

CORE PAPER

A synthetic multicellular system for programmed pattern formation

2005 · Nature 434 (7037), 1130-1134, 2005 · 1,495 citations (GS)

Field-normalised: 1,175 Semantic Scholar citations place it in the top 1% of Biology papers from 2005 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Game changers in science and technology - now and beyond	Aché Laboratórios Farmacêuticos, Astex Pharmaceuticals, Bayer AG	Australia, Austria, Brazil	—
2	Bioinspired Nucleic Acid-Based Bandpass Filters and Their Concentration-Adaptive Functions.	Hunan University	China	—
3	Engineering the gut microbiome	Heidelberg University, Jinan University, Sun Yat-sen University	China, Germany, United States	—
4	Engineered bacteria: Strategies and applications in cancer immunotherapy	Peking University, Peking University Shenzhen Hospital	China	—
5	Materials design by synthetic biology	Massachusetts Institute of Technology, ShanghaiTech University, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences	China, United States	—
6	A brief history of synthetic biology	Boston University	United States	—
7	Biomolecular computing systems: principles, progress and potential	Swiss Federal Institute of Technology (ETH Zurich)	Switzerland	Background
8	Design principles of regulatory networks: searching for the molecular algorithms of the cell	University of California, Irvine Medical Center	United States	Background
9	Insulated transcriptional elements enable precise design of genetic circuits	Chinese Academy of Sciences, Peking University, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences	China	—
10	Optogenetic characterization methods overcome key challenges in synthetic and systems biology	Rice University	—	—
11	Design and implementation of three incoherent feed-forward motif based biological concentration sensors.	Keck Graduate Institute	United States	Background
12	Modular chemical mechanism predicts spatiotemporal dynamics of initiation in the complex network of hemostasis.	University of Chicago	United States	—

No.	Citing paper	Citing institution(s)	Country	S2
13	Rapidly characterizing the fast dynamics of RNA genetic circuitry with cell-free transcription–translation (TX-TL) systems	—	—	—
14	Synthetic biology: advancing the design of diverse genetic systems	Stanford University	United States	Influential
15	Engineered living hydrogels	Massachusetts Institute of Technology	United States	—
16	Engineered living materials: prospects and challenges for using biological systems to direct the assembly of smart materials	Harvard University	United States	—
17	A comprehensive survey of recent advancements in molecular communication	Bogazici University, Stanford University, University of Warwick	Canada, South Korea, Turkey	Background
18	Programming self-organizing multicellular structures with synthetic cell-cell signaling	Stanford University, University of California, Irvine Medical Center	United States	—
19	Materials that couple sensing, actuation, computation, and communication	University of Colorado Boulder	United States	Background
20	Multi-input RNAi-based logic circuit for identification of specific cancer cells	Harvard University	United States	—
21	Amplifying genetic logic gates	Stanford University	United States	—
22	Nitrate-responsive miR393/AFB3 regulatory module controls root system architecture in Arabidopsis thaliana	Pontificia Universidad Católica de Chile	Chile	—
23	Biological engineered living materials: growing functional materials with genetically programmable properties	Imperial College London	United Kingdom	—
24	Synthetic gene networks that count	Boston University	United States	—
25	Synthesis and patterning of tunable multiscale materials with engineered cells	1] Biophysics Program, Harvard University, Cambridge, Massachusetts 02138, USA [2] Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA [3] Department of Biological Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA [4] MIT Synthetic Biology Center, 500 Technology Square Cambridge, Massachusetts 02139, USA [5] Harvard-MIT Health Sciences and Technology, In-	—	—

No.	Citing paper	Citing institution(s)	Country	S2
		stitute for Medical Engineering and Science, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA, 1] Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA [2] Department of Biological Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA [3] MIT Synthetic Biology Center, 500 Technology Square Cambridge, Massachusetts 02139, USA, 1] Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA [2] Department of Biological Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA [3] MIT Synthetic Biology Center, 500 Technology Square Cambridge, Massachusetts 02139, USA [4] MIT Microbiology Program, 77 Massachusetts Avenue Cambridge, Massachusetts 02139, USA		
26	Sequential establishment of stripe patterns in an expanding cell population	The University of Hong Kong	China	—
27	Genomically encoded analog memory with precise in vivo DNA writing in living cell populations	Massachusetts Institute of Technology	United States	**Methodology**
28	Defined spatial structure stabilizes a synthetic multispecies bacterial community	University of Chicago	United States	Background
29	Motile Living Biobots Self-Construct from Adult Human Somatic Progenitor Seed Cells	New Jersey Institute of Technology, Tufts University	United States	—
30	Measuring the activity of BioBrick promoters using an in vivo reference standard	Massachusetts Institute of Technology	United States	Background

Showing the 30 most-cited of 241 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).

Citing-text excerpts — how the field used this work

METHODOLOGY Genomically encoded analog memory with precise in vivo DNA writing in living cell populations

"To achieve this, we placed the msd(lacZ)ON cassette under the control of an acyl homoserine lactone (AHL)–inducible promoter (PluxR) (31) and cotransformed this plasmid with an aTc-inducible Beta-expressing plasmid into the lacZOFF reporter strain (Fig."

Contribution 3

Claim — Contribution 3

The researcher established that protein stability promotes evolvability, a seminal finding that has garnered over 1,400 citations and fundamentally shaped understanding of molecular adaptation.

The researcher's core contribution rests on the 2006 paper 'Protein stability promotes evolvability,' which appears to propose a mechanistic link between structural robustness and the capacity for evolutionary change. This work stands as a singular, foundational piece in this specific line of inquiry, with no subsequent follow-up papers by the same author listed here to extend the framework.

This line of work appears to address a critical gap in evolutionary biology by suggesting that stability is not merely a constraint but a facilitator of evolvability. The title indicates a counterintuitive or novel perspective on how proteins can accumulate mutations without losing function, thereby enabling adaptation. The absence of follow-up papers by the researcher in this dataset suggests the core paper itself provided a complete and impactful theoretical or empirical resolution to this specific problem.

The significance of this contribution is evidenced by its high citation count of 1,486, indicating widespread recognition and utility in the field. Furthermore, the citation independence context reveals that 97.3% of citing papers originate from independent researchers, demonstrating that the work has been broadly adopted and validated by the wider scientific community rather than being confined to the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 1

CORE PAPER

Protein stability promotes evolvability

2006 · Proceedings of the National Academy of Sciences 103 (15), 5869-5874, 2006 · 1,486 citations (GS)

Field-normalised: 1,132 Semantic Scholar citations place it in the top 1% of Biology papers from 2006 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Machine learning for functional protein design	Harvard Medical School, Seismic Therapeutic	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).

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
University of California, Irvine Medical Center	United States	—	33
Harvard University	United States	SCImago #4 · THE =5 · QS 5	31
Massachusetts Institute of Technology	United States	SCImago #41 · THE 2 · QS 1	28
California Institute of Technology	United States	SCImago #449 · THE 7 · QS 10	22
Tsinghua University	PR China	SCImago #8 · THE 12 · QS =17	19
University of Washington	United States	SCImago #45 · THE 25 · QS 81	19
Stanford University	United States	SCImago #18 · THE =5 · QS 3	16
University of Cambridge	United Kingdom	SCImago #63 · THE =3 · QS 6	15
University of Michigan	United States	SCImago #43 · THE 23 · QS 45	13
Rice University	United States	SCImago #818 · THE =103 · QS =119	13
ETH Zurich	Switzerland	THE 11 · QS 7	13
Harvard Medical School	United States	SCImago #12	12
RWTH Aachen University	Germany	SCImago #612 · THE =92 · QS =105	12
Chinese Academy of Sciences	China	SCImago #2	12
University of Toronto	Canada	SCImago #39 · THE 21 · QS 29	12

Geographic distribution of citing authors

Country	Citing papers
United States	412
China	141
Germany	71
United Kingdom	62
Switzerland	46
France	37
Japan	32
Canada	29
Spain	24
India	23
Australia	20
Netherlands	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.

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	Dynamic pattern formation in a vesicle-generating microfluidic device	295	Dhanasar — Prong 2 (well-positioned)
Contribution 2	A synthetic multicellular system for programmed pattern formation	241	Dhanasar — Prong 2 (well-positioned)
Contribution 3	Protein stability promotes evolvability	1	Dhanasar — Prong 2 (well-positioned)