

## ARUNKUMAR PITCHAIMANI



### About Faculty:

**Dr. Arunkumar Pitchaimani**, Associate Professor, VIT, Vellore is an expert in the field of **Nanomedicine and Bioengineering**. He pursued his Doctoral program at **Bharathidasan University**, India and had 6 years of Post-Doctoral research experience in **Istituto italiano di Technologia (IIT), Italy and Kansas State University, USA**. He is a recipient of the prestigious international awards like **Marie-Curie Award (2018) and DBT-Ramalingaswamy award (2021)**. His current area of research includes personalized nanomedicine for Cancer therapy and Neurodegenerative diseases, Artificial cells, Biomimetic nanoplatforms, Implantable microfluidics and microneedles.

### Contact Info:

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Website: Nil

### Google scholar link:

[https://scholar.google.com/citations?hl=en&user=8Z6DPdwAAAAJ&view\\_op=list\\_works](https://scholar.google.com/citations?hl=en&user=8Z6DPdwAAAAJ&view_op=list_works)

### Linked in scholar link:

<https://www.linkedin.com/in/arunkumar-pitchaimani-3b777734/>

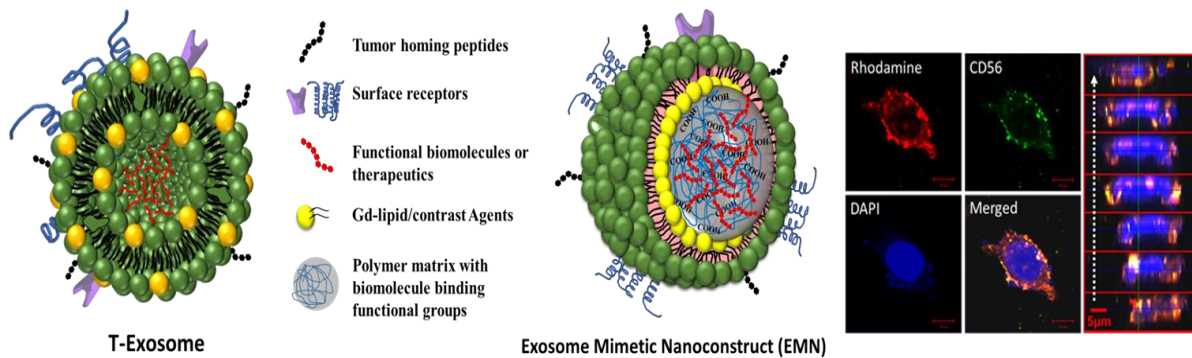
### Research Areas:

- **Personalized Nanomedicine**
- **Bioengineering & Artificial cells**
- **Cancer Theranostics & Bioimaging**
- **Implantable microfluidics and microneedles**

### Research Interest:

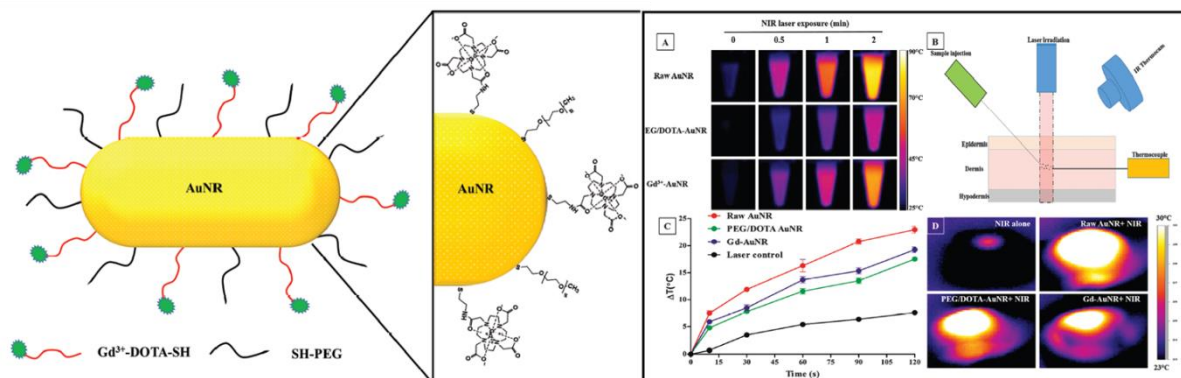
## Biomimetic Nanoconstructs and Bioengineering of Artificial Cells.

Learning from nature is always our priority for any biomedical research initiative. Biological materials are highly organized from the molecular to the nanoscale and microscale often in a hierarchical manner with intricate nano-architecture that ultimately makes up a myriad of different functional elements. The biomimetic system can be designed to enhance the plasma residence time of Nano carrier, for sustained drug delivery system. In this direction, our research utilizes the naturally occurring phospholipids, cellular membrane, and biocompatible/biodegradable polymers to engineer biomimetic nanodevices. With bioengineering approaches, the biological components can be self-assembled in the presence and the absence of synthetic leads molecules to mimic the biological cell morphology and can also be combined with synthetic nanocarriers for various therapeutic application as artificial cells.



## Photodynamic therapy (PDT) and Photothermal (PTT) therapy

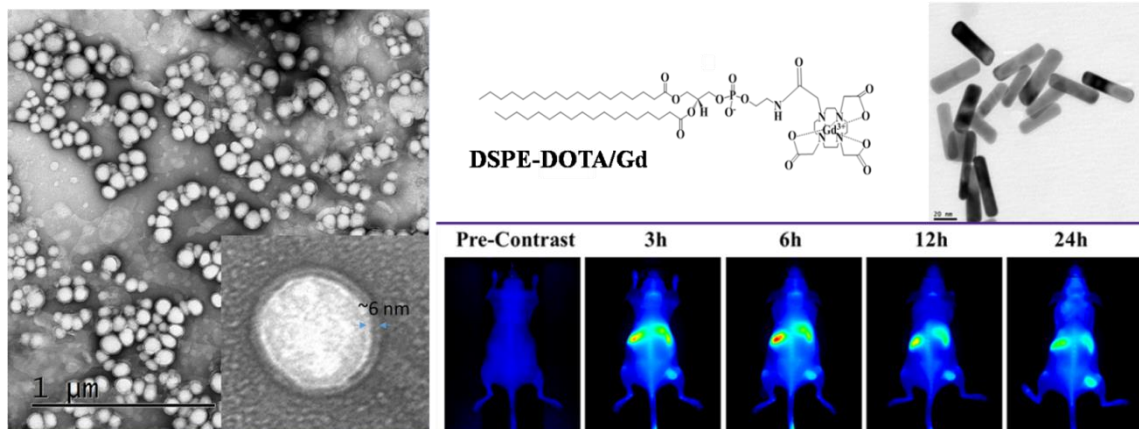
Nano-hyperthermia is a non-invasive technique, where tumor cells are selectively destroyed by irreversible cellular damage by the combinatorial effect of laser energy and noble metallic nanoparticles. Photodynamic therapy involves administration of a photosensitizer into the cancer cells followed by the exposure of appropriate light, which triggers the cells to undergo oxidative stress leading to apoptosis and necrosis of cancer cells. With the focus on non-invasive therapy, our lab is trying to develop certain tracers molecules and nanomaterials for the targeted PDT and PTT. This study also utilizes the personalized biomimetic membrane based extracellular vesicles with nanoconfined approaches for the targeted PDT and PTT.



## Targeted Bioimaging and Theranostics:

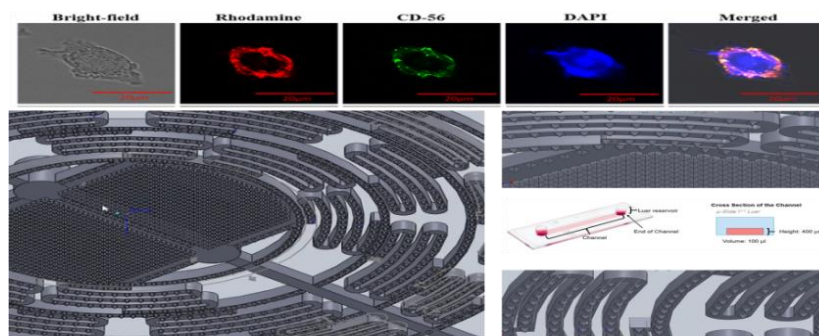
The optical, thermal and size and shape tunable properties of noble metals, expands the window of its biomedical applications. Especially, Gold nanorods (Au NRs) in the tunable properties of absorption and scattering cross-sections with different LSPR resonance make AuNRs a potential

candidate for cancer therapies like photothermal ablation and for *in vivo* imaging studies like photoacoustic imaging, computed tomography, etc., Despite gold nanorods being an excellent nanosource, they have certain limitations in biomedical applications, which include toxicity of the surfactant CTAB, biological stability, and sustainable drug release. Considering its importance, AuNR were fabricated *insitu* in endogenous biological extracellular vesicles with the aid of biocompatible Polymer for stability and drug conjugation and pH sensitive drug release. Exosome or extracellular vesicles confined noble metals will be exploited for various bioimaging applications including magnetic resonance imaging (MRI).



### Implantable Microfluidic and Microneedles Technology:

With the focus of personalized medicine, certain point-of-care technology has been emerged to fulfil the drawbacks of various traditional approaches. Out of it, the recent approaches utilizing the Microfluidic and Microneedles technology, has open the new horizon in the field of medical therapeutics.. As a microfluidic has its own limitation and it can only used to create cartian 3D-disease models. Likewise, the biomedical application of microneedles are limited upto topical application, no forms of implantable has been investigated. Our lab has focused more on bridging the gaps in these technology in the form of implantable devices. Through bioengineering approaches, we aim to create an hybrid platform using both microfluidics and microneedles for a precision therapy.



### Honors & Awards

1. **DBT-Ramalingaswamy Re-entry Fellowship** (2021) –Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, India.
2. **Marie-Curie Fellowship-** (2018)–European Union, Italian Institute of Technology (IIT), Genoa, Italy

3. **ACS Travel Award (2017)** - American Chemical Society, Washington, DC, USA
4. **Travel Awards (2016)**-Johnson Cancer Research Centre, Manhattan, KS, USA
5. **Post-Doctoral Fellowship (2014)**, Institute of Nano Science & Technology (INST), Mohali, India.
6. **Travel Awards (2013) - ICMR and DBT**, Government of India, New Delhi, India.
7. **Senior Research Fellowship (2012)**, Department of Biomedical Science, Bharathidasan University, Tiruchirappalli – 620024.
8. **Junior Research Fellowship (2010)**, Department of Biomedical Science, Bharathidasan University, Tiruchirappalli – 620024.
9. **Best Paper Presentation Award (2011)**, National Conference on Aquatic Biotoxin, Annamali University, Parangipettai- 608 502, Tamilnadu, India.

## Grants:

### Ongoing:

**2021-2026**      **DBT-Ramalingaswamy Re-entry Fellowship Grant 2021**, Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, India. Investigation on the Mechanism of Mucoadhesion and Transcytosis of Microglial Exosomes and its Biomimetic Nanoconstructs for Nose-to-Brain Delivery of Peptide Therapeutics. *Grant size: 1.136 crore. Field: Biomedical Nanotechnology.*

## Publications

### 2021

1. Alessia F, Di Mascolo D, Miguel F, Simone L, Luca B, Andrea A, **Pitchaimani A**, Annalisa P, Paolo D (2021). Vascular-confined multi-passage discoidal nanoconstructs for the low-dose docetaxel inhibition of triple-negative breast cancer growth *Nano Research*, 1-10. **(I.F: 8.9)**.

### 2020

2. M Sampath, **A Pitchaimani**, P Kumpati, B Sengottuvelan (2020). The remarkable role of emulsifier and chitosan, dextran and PEG as capping agents in the enhanced delivery of curcumin by nanoparticles in breast cancer cells. *International Journal of Biological Macromolecules*, 162, 748-761. **(I.F: 6.9)**.

### 2019

3. **Pitchaimani A**, Nguyen TDT, Marasini R, Eliyapura A, Azizi T, Aryal S (2019). Biomimetic Natural Killer Membrane Camouflaged Polymeric Nanoparticle for Targeted Bioimaging. *Advanced Functional Materials*, 29 (4), 1806817. **(I.F: 18.8)**.
4. Nguyen TDT, Aryal S, **Pitchaimani A**, Park S Key Jand Aryal S (2019). Biomimetic surface modification of discoidal polymeric particles. *Nanomedicine: Nanotechnology, Biology and Medicine*. 16, 79-87 **(I.F: 6.5)**.

### 2018

5. **Pitchaimani A**, Nguyen TDT, and Aryal S (2018). Natural killer cell membrane infused biomimetic liposomes for targeted tumor therapy. *Biomaterials*, 160, 124-137 **(I.F: 12.5)**.
6. Marasini R, **Pitchaimani A**, Nguyen TDT, Comer J, Aryal S (2018). Influence of Polyethylene Glycol Passivation on the Surface Plasmon Resonance Induced Photothermal Properties of Gold Nanorods. *Nanoscale*. 10 (28), 13684-13693 **(I.F: 7.8)**.

7. Nguyen TDT, **Pitchaimani A**, Ferrel C, Thakkar R, Aryal S (2018). Nano-confinement-driven enhanced magnetic relaxivity of SPIONs for targeted tumor bioimaging. *Nanoscale*. 10 (1):284-294 (IF: 7.8).

#### 2017

8. **Pitchaimani A**, Nguyen TDT, Koirala M, Zhang Y, Aryal S (2017). Impact of cell adhesion and migration on nanoparticle uptake and cellular toxicity. *Toxicology in Vitro* 43, 29-39 (IF: 3.5).
9. **Pitchaimani A**, Nguyen TDT, Maurmann L, Key J, Bossmann SH, Aryal S (2017). Gd<sup>3+</sup> Tethered Gold Nanorods for Combined Magnetic Resonance Imaging and Photo-Thermal Therapy. *Journal of Biomedical Nanotechnology* 13 (4), 417-426 (IF: 4.5).
10. Aryal S, Nguyen TDT, **Pitchaimani A**, Shrestha TB, Biller D, Troyer DL (2017). Membrane fusion mediated gold nano-plating of red blood cell: a bioengineered CT-contrast agent. *ACS Biomaterial Science and Engineering*, 3 (1), pp 36–41 (IF: 4.7).

#### 2016

11. Nguyen TDT, **Pitchaimani A**, Aryal S (2016). Engineered Nanomedicine with Alendronic Acid Corona Improves Targeting to Osteosarcoma. *Scientific Reports*. 6: 36707 (IF: 4.4).
12. **Pitchaimani A**, Nguyen TD, Wang H, Bossman SH, Aryal S (2016). Design and characterization of gadolinium infused theranostic liposomes. *RSC advances* 6:36898-36905 (IF: 3.4).
13. Nguyen TD, **Pitchaimani A**, Koirala MB, Muhammed F, Aryal S (2016). Engineered biomimetic nanoabsorbent for cellular detoxification of chemotherapeutics. *RSC Advances* 6:33003-33008 (IF: 3.4).

#### 2015

14. **Arunkumar P**, Raju B, Vijay K, Vasantharaja M and Premkumar K (2015). Near Infra-red laser mediated photothermal and antitumor efficacy of Doxorubicin conjugated Gold Nanorods with reduced cardiotoxicity in Swiss albino mice. *Nanomedicine: Nanotechnology, Biology and Medicine*, 11(6):1435-44 (IF: 6.5).
15. Koirala MB, Nguyen TDT, **Pitchaimani A**, Choi SO, Aryal S (2015). Synthesis and characterization of biomimetic hydroxyapatite nanoconstruct using chemical gradient across lipid bilayer. *ACS Applied Materials & Interfaces*, 7 (49), 27382-27390 (IF: 9.2).

#### 2014

16. Kirubakaran P, **Arunkumar P**, Premkumar K and Karthikeyan M (2014). Sighting of Tankyrase inhibitors by structure and ligand based screening and in vitro approach. *Molecular Biosystems*, 10, 2699-2712 (IF: 3.3).
17. **Arunkumar P**, Arun R, Selvamurugan C, Premkumar K (2014). Photo chemotherapeutic effects of UV-C on acridine orange in human breast cancer cells: potential application in anticancer therapy. *RSC Advances*, 4, 22123-22128. (IF: 3.4)

#### 2013

18. Rajiu V\*, **Arunkumar P\***, Kalpana H, Preetham Kumar B, Jeganathan K, Premkumar K (2013). Doxorubicin Conjugated Gold Nanorods: A Sustained Drug Delivering Carrier for Improved Anticancer Therapy. *Journal of Materials Chemistry B*. 1, 1010-1018 [\* equal contribution] (IF: 6.3)

19. Kalpana H, **Arunkumar P**, Premkumar K (2013). Acridine Orange Tethered Gold Nanoparticles: A Dual Functional Probe for Combined Photodynamic and Photothermal Therapy. *RSC Advances*, 3, 20471 (IF: 3.4).
20. **Arunkumar P**, **Thanalakshmi M**, Kumar P, Premkumar K (2013). *Micrococcus luteus* mediated dual mode synthesis of gold nanoparticles: Involvement of extracellular  $\alpha$ -amylase and cell wall teichuronic acid. *Colloids and Surfaces B: Biointerfaces* 103:517-522 (IF: 5.3)
21. Ramamurthy Ch, Sampath KS, **Arunkumar P**, Kumar MS, Sujatha V, Premkumar K, Thirunavukkarasu C. (2013) Green synthesis and characterization of selenium nanoparticles and its augmented cytotoxicity with doxorubicin on cancer cells. *Bioprocess Biosyst Eng.* 36(8):1131-9 (IF: 3.2).
22. **Arunkumar P**, Hemamalini V and Premkumar K (2013). Rapid bioreduction of trivalent aurum using banana stem powder and its cytotoxicity against MCF-7 and HEK-293 cell lines. *Journal of Nanoparticle Research*, 15:1481 (IF: 2.2).

## Patents

2022

### International Patents(PCT) Filed

- 1) Title: **Nanocarrier Systems for Imaging and Delivery of Active Agents.**  
Name: Santosh Aryal, **Arunkumar Pitchaimani**, and Tuyen Duong Thang Nguyen.  
Date of Filing: 11/2019  
Patent No: **WO 2020/112822 A1**

### Indian Patents:

- 1) Title: **Microfluidic needles: microneedles embedded microfluidic device**  
Name: **Arunkumar Pitchaimani**, SuryaPriya Ulaganathan and Motharkar Tanmay  
Date of Filing: 15/02/2021  
Patent No: VIT-IPR0000343

### Invites talks & outreach programs:

1. **Dec 2021** Expert talk-International Webinar on “Emerging trends in Translational research”- *Biomimetic Nanoconstructs for Cancer theranostics*”. AMITY University, Mumbai, India.
2. **June 2021** Invited lecture “Biomedical application of Nanomedicines”-Nehru College of arts and Science, Coimbatore, India.
3. **July 2018** Invited lecture-“Biomimetic Nanoconstructs:a New Frontier in Cancer Research”. Srimad Andvan College of Arts and Science College, Trichy, TN, India.
4. **Feb 2018** International Conference on impact of nanotechnology on health and environment. “Biomimetic Nanoconstructs: a new Frontier in Cancer Research” Quaid-E-Millath Govt. College for Women, Chennai, India.
5. **Nov 2016** Invited Lecturer- In vitro cell-nanoparticle interaction studies: what we learned so far” Department of Chemistry, Kansas State University, USA.

6. **Jan 2016** Invited Video conference-“Nanomedicine: promises and challenges for future”,AVC. College, Mayiladuthurai, Tamilnadu, India.

**2021** Advance instrumentation training on Nanoparticle Tracking Analysis (NTA), CBCMT, Vellore Institute of Technology, Vellore, TN, India.

**Research group:  
Current Members:**



**Surya Priya Ulaganathan**  
**DBT-JRF**  
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**Research Area:** nanotherapeutics for Neuro-degenerative disease

**Thesis title:** Personalized Mitochondrial Therapeutics for the Neurological Disease