



Anand Nagar, Krishnankoil - 626126, Srivilliputtur (via), Virudhunagar District, Tamilnadu.

APPLICATION FOR ADMISSION TO Ph.D. PROGRAMMES

Date of Application:04-09-2023

Department	BIOTECHNOLOGY	Application No.	202312010
Area of Research	CANCER, MOLECULAR BIOLOGY, AND STEM CELLS	Research Mode	FULL TIME

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Qualification						
Degree	Discipline	College/university	Year Passed	AVG/CGPA	Class	Mode
M.SC	ZOOLOGY	ALAGAPPA UNIVERSITY	2022	8.31	FIRST CLASS - DISTINCTION	REGULAR
B.SC	ZOOLOGY	AYYA NADAR JANAKI AMMAL COLLEGE	2017	7.22	FIRST CLASS	REGULAR

Experience				
Organization	Designation	Experience From	Experience TO	Work Nature

Payment Details				
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Investigating the Role of Immune Protein Interaction in Regulating Breast Cancer Stem Cell (BCSCs) Plasticity and Tumor Progression

By
N. Aathimoolam

1. Introduction

The concept of cancer stem cells (CSCs) has evolved over several decades, (Nguyen et al., 2012) Early observations hinted at the existence of distinct populations of cells within tumors, with varying abilities to initiate tumors upon transplantation. (Dick, 2008) The concept of CSCs continues to evolve, influencing cancer research, drug development, and clinical trials. The understanding of CSCs roles in therapy resistance and relapse is informing the design of more targeted and effective treatments. (Eccles et al., 2013) Cancer stem cells (CSCs) are a sub-population of cells within tumors that exhibit properties similar to those of normal stem cells. These cells can self-renew and differentiate into various cell types, giving rise to the heterogeneous populations of cells found in tumors. (Prince et al., 2007) Cancer Stem Cells (CSCs) are believed to play a pivotal role in cancer initiation, progression, metastasis, and treatment resistance. While the precise causes of CSCs are not fully elucidated, several factors are known to influence their development and behavior. (Ayob & Ramasamy, 2018)

Microenvironmental factors play a crucial role in regulating the behavior, maintenance, and properties of Cancer Stem cells (CSCs). The tumor microenvironment provides a complex milieu of signals that influence CSC self-renewal, differentiation, survival, and interactions with surrounding cells. It has to influence the Microenvironmental factors in cancer stem cells like Hypoxia, Nutrient Availability, Extracellular Matrix Components, Cancer-Associated Fibroblasts (CAFs), Oxygen-Gradient-Driven Niches, etc., (Cabarcas et al., 2011)

The interaction between immune cells and cancer stem cells (CSCs) is a complex and dynamic process that has important implications for cancer progression, treatment, and outcomes. Immune cells can have both positive and negative effects on CSCs, shaping their behavior and influencing tumor development. (Müller et al., 2020) These immunosuppressive strategies collectively enable CSCs to evade the immune system's surveillance and destruction. Overcoming these mechanisms is a significant challenge in cancer therapy, especially in the

context of targeting CSCs. (Elmusrati et al., 2021) Immune checkpoint inhibitors and other immunotherapeutic approaches aim to counteract these immunosuppressive mechanisms and enhance the immune response against CSCs and other tumor cells. (Rückert et al., 2021)

Cancer stem cells (CSCs) can release various proteins, peptides, and enzymes within the tumor microenvironment that contribute to immunosuppression. These molecules create an environment that hinders the immune system's ability to recognize and attack cancer cells, (Inman et al., 2014) Including CSCs Tumor-Associated Macrophages (TAMs) are a type of immune cell that can be present in the tumor microenvironment. Depending on the context, TAMs can support or inhibit CSC behavior. Some TAMs can promote inflammation and CSC self-renewal, contributing to tumor growth. (Plaks et al., 2015) Collectively, these released molecules contribute to the creation of an immunosuppressive microenvironment that supports CSC survival and progression. (Lorusso & Rüegg, 2008)

CSCs can upregulate immune checkpoint molecules like PD-L1, which interact with immune cells (such as T cells) and suppress their activity. This inhibits the immune response against CSCs and other tumor cells. (Dianat-Moghadam et al., 2022) CSCs can attract regulatory T cells (Tregs) and myeloid-derived suppressor cells (MDSCs) to the tumor microenvironment. These cells suppress the activity of other immune cells, allowing CSCs to escape immune detection. (Vahidian et al., 2019) CSCs can secrete immunosuppressive cytokines, such as TGF- β and IL-10, which inhibit the function of immune cells and promote an immunosuppressive environment. (Lorenzo-Sanz & Muñoz, 2019) IL-10 is an anti-inflammatory cytokine released by CSCs that suppresses immune responses and can inhibit the function of antigen-presenting cells (APCs) and cytotoxic T cells. (Yang et al., 2021)

Immune cell cultures are used to study cell behavior, responses to stimuli, interactions with Breast Cancer stem cells (BCSCs), and Potential therapeutic applications. During the interaction of cells are produced a lot of proteins, peptides, and enzymes there are used to Target these Immunosuppressive factors is an area of active research in cancer therapy, to enhance the immune response against BCSCs and improve treatment outcomes.

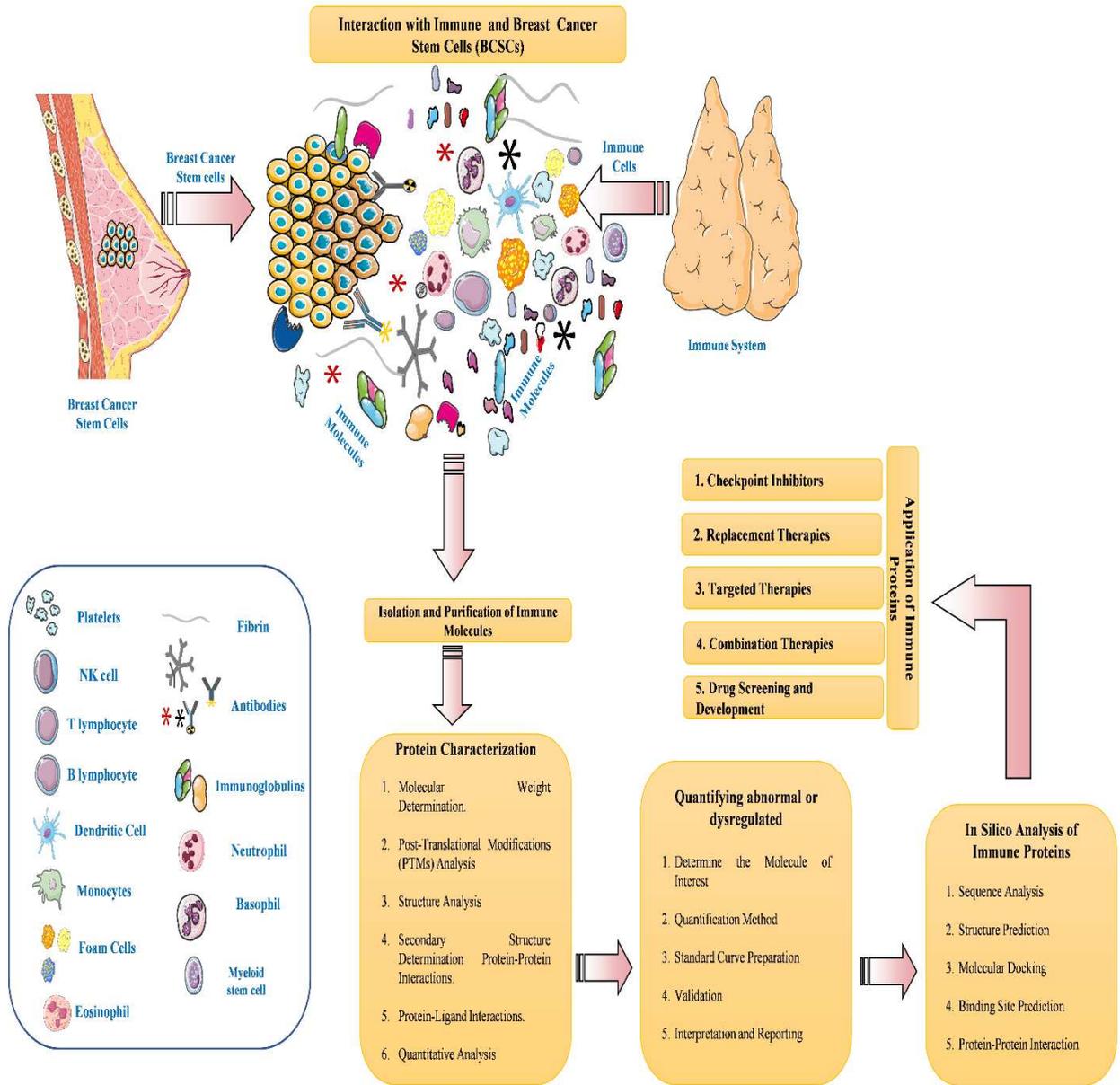
2. Research Gap

In recent times, numerous researchers are diligently working to address the complexities of Cancer. However, there is a noticeable scarcity of studies investigating the intricate interplay between Breast Cancer Stem cells (BCSCs) and Immune Cells, as well as the behavior, properties, and characteristics of proteins involved. I anticipate that this study could unveil novel Immune Proteins capable of eradicating Breast Cancer and Cancer Stem Cells. This dynamic research will provide a comprehensive perspective on the interactions among cancer, cancer stem cells, immune proteins, and immune cells.

3. Objectives

- ✚ The cultured Immune and Breast Cancer Stem Cells (BCSCs) interact with the Laboratory Environment.
- ✚ Identifying and characterizing the Immune Proteins.
- ✚ Integrate techniques from genomics, proteomics, bioinformatics, and other fields to gain a comprehensive understanding of Immune Proteins.
- ✚ Investigate the molecular mechanisms underlying Immune Protein properties, such as Self-renewal, Differentiation, and therapy resistance. This might involve studying Signaling pathways, and Microenvironment Interactions.
- ✚ Explore how the tumor Microenvironment influences BCSCs behavior, including factors like Immune cell interactions, hypoxia, and extracellular matrix components.
- ✚ Develop relevant animal models to study Immune Protein behavior in a more clinical context and explore potential therapeutic interventions.

Schematic Diagram of Study plan:



4. Materials and Methods

4.1 Identification and Isolation of Breast Cancer Stem Cells (BCSCs):

The identification and isolation of Breast cancer stem cells (BCSCs) is a crucial step in understanding their properties, behaviors, and potential therapeutic implications. BCSCs often express unique cell surface markers that distinguish them from other tumor cells. These markers can be identified through techniques like flow cytometry, where fluorescently labeled antibodies are used to specifically bind to BCSCs-specific surface proteins. Common Breast Cancer stem cell (BCSC) markers vary depending on the cancer type but may include CD44, CD133, EpCAM, ALDH1, and others. BCSCs are defined not only by their surface markers but also by their ability to initiate and sustain tumor growth.

Functional assays, such as the ability to form tumor spheres in non-adherent culture conditions (spheroid formation), can help identify cells with self-renewal properties characteristic of BCSCs. Breast cancer stem cells (BCSCs) often have distinct gene expression profiles compared to other tumor cells. Transcriptomic analyses, such as RNA sequencing, can identify genes and pathways enriched in BCSCs, providing insights into their molecular characteristics. The Isolated cells are cultured in the artificial environment, Cultured Both cells of Immune and Breast Cancer Stem cells interact. This interaction of both cells produces an enormous immune molecule, these are needed to isolate, and then Purified molecules are characterized.

4.2 Purification of Immune Proteins:

The Isolated Cell contents need to be lysed to release their protein content. This can be achieved using various lysis buffers containing detergents, protease inhibitors, and reducing agents. Mechanical methods like sonication or grinding can also be employed. The lysate is further processed to solubilize proteins and remove insoluble debris. Fractionation methods, such as differential centrifugation, can help separate cellular compartments and enrich specific protein fractions. Techniques like Sodium Dodecyl Sulfate-Polyacrylamide gel electrophoresis (SDS-PAGE) or liquid chromatography (LC) can be used to separate proteins based on size and charge. SDS-PAGE separates proteins by molecular weight, while LC separates them by interactions with a stationary phase. Proteins of interest are often identified using mass spectrometry. In this step, proteins are enzymatically digested into peptides (usually using trypsin). The resulting peptides are analyzed using LC-MS/MS, and ELISA the data are used to identify the proteins present. It's important to validate the quantification results using multiple methods when possible.

4.3 Protein Characterization:

Protein characterization involves a series of analyses and techniques aimed at understanding the structural, functional, and biochemical properties of these molecules. Characterization provides valuable insights into the biological roles, interactions, and potential applications of proteins.

4.3.1 Molecular Weight Determination

- ✚ SDS-PAGE
- ✚ Mass spectrometry
- ✚ Size exclusion chromatography

4.3.2 Post-Translational Modifications (PTMs) Analysis

4.3.3 Structure Analysis:

- ✚ X-ray crystallography
- ✚ Nuclear magnetic resonance (NMR) spectroscopy
- ✚ Cryo-electron microscopy (cryo-EM)

4.3.4 Secondary Structure Determination:

- ✚ Circular dichroism (CD) spectroscopy
- ✚ Fourier-transform infrared (FTIR) spectroscopy

4.3.5 Protein-Protein Interactions:

- ✚ Co-immunoprecipitation
- ✚ Surface Plasmon Resonance (SPR)

4.3.6 Protein-Ligand Interactions:

- ✚ Isothermal titration calorimetry (ITC)
- ✚ Fluorescence-based assays

4.3.7 Quantitative Analysis:

- ✚ Mass spectrometry-based label-free quantification
- ✚ Stable isotope labeling

4.4 Quantifying abnormal or dysregulated Molecules

Quantifying abnormal or dysregulated molecules, such as proteins, is a critical aspect of biomedical research, particularly in the context of diseases like cancer. Accurate quantification of these molecules can provide insights into disease mechanisms, biomarker discovery, and the development of targeted therapies.

4.4.1 Determine the Molecule of Interest:

Identify the specific protein that is dysregulated in the disease context. This might involve a literature review, omics data analysis, or preliminary experiments.

4.4.2. Quantification Method:

✚ PCR or qRT-PCR

✚ Flow Cytometry

4.4.3 Standard Curve Preparation:

For techniques like ELISA or qRT-PCR, prepare a standard curve using known concentrations of a purified standard protein or synthetic nucleic acid to calibrate the assay.

4.4.4 Validation:

validate quantification results using complementary techniques. If possible, validate using an independent cohort of samples.

4.4.5 Interpretation and Reporting:

Interpret the results in the context of the research question. Discuss the implications of the abnormal molecule's quantification and its potential relevance to disease mechanisms, diagnosis, or therapy.

4.5 In-Silico Analysis of Immune Proteins:

In silico analysis refers to the use of computational methods and tools to analyze and predict various aspects of proteins. These analyses can provide valuable insights into their structure, function, interactions, and properties without the need for laboratory experiments.

4.5.1 Sequence Analysis:

Comparing protein or peptide sequences to identify similarities, conserved motifs, and domains using tools like BLAST or Clustal W.

4.5.2 Structure Prediction:

Predicting protein structures based on the known structures of related proteins using tools like SWISS-MODEL or MODELLER.

4.5.3 Molecular Docking:

Predicting the binding orientation and affinity of small molecules (ligands) to a protein's active site using software like Auto Dock or GOLD.

4.5.4 Binding Site Prediction:

Identifying potential binding sites on a protein's surface that could interact with ligands or other proteins using tools like CASTp or Site Map.

4.5.5 Protein-Protein Interaction:

Predicting protein-protein interactions and constructing interaction networks using databases like STRING or bioinformatics tools like Cytoscape.

These in silico analyses can be highly informative and cost-effective, serving as a preliminary step before embarking on experimental studies.

4.6 Application of Immune Proteins:

These proteins are used to modulate the immune response, enhance the body's defense mechanisms, and treat various diseases, including cancer. Studying Immune proteins provides insights into the mechanisms of tumor initiation, progression, and recurrence. By understanding the properties and behavior of Immune proteins, researchers can identify potential therapeutic targets and develop more effective treatment strategies.

4.6.1 Drug Screening and Development:

Immune proteins are often associated with resistance to conventional cancer treatments. This approach aims to improve the efficacy of therapies and reduce the risk of recurrence.

4.6.2 Targeted Therapies:

Developing therapies that specifically target Immune proteins holds promise for reducing the risk of recurrence and improving patient outcomes. Targeted therapies that disrupt the signaling pathways and survival mechanisms of Immune proteins could be developed based on their unique characteristics.

4.6.3 Combination Therapies:

Immune proteins are often responsible for treatment resistance and relapse. Combination therapies that target both the bulk of the tumor cells and Immune proteins can potentially improve treatment outcomes by preventing the survival and re-growth of treatment-resistant cells.

4.6.4 Immunotherapies:

Developing immune-based strategies to target BCSCs may enhance the body's ability to recognize and eliminate these cells.

4.6.4.1 Checkpoint Inhibitors:

They have shown success in some cancers by blocking the inhibitory signals that cancer cells use to evade the immune system.

4.6.4.2 Replacement Therapies:

Patients with immunodeficiency disorders like primary immunodeficiency diseases can receive immune protein replacement therapies, such as intravenous immunoglobulin (IVIG) or specific immune components.

4.7 Statistical Analysis:

It's important to note that proper statistical analysis requires careful consideration of study design, data collection methods, and the appropriateness of the chosen statistical techniques for the research question at hand. Additionally, ethical considerations such as proper handling of data and transparent reporting of methods and results are essential throughout the process.

5. Expected outcomes

- ✚ A comprehensive understanding of Immune Protein properties, behavior, and interactions within the tumor Microenvironment, shedding light on their roles in cancer initiation, progression, and treatment resistance.
- ✚ Identification of potential therapeutic targets specifically associated with Immune Protein, which can guide the development of novel and more effective BCSCs therapies.
- ✚ Uncovering molecular mechanisms underlying Immune Protein-related processes, such as self-renewal, differentiation, and metastasis, leads to fundamental insights into cancer biology.
- ✚ Development of relevant preclinical models that closely mimic Immune Protein behavior, facilitating translational studies and drug testing.
- ✚ Integration of genomic, proteomic, and transcriptomic data to provide a holistic view Immune Proteins and its implications.
- ✚ Publication of research findings in peer-reviewed journals, contributing to the scientific literature, and advancing the field of cancer research.
- ✚ Establishment of collaborations with other researchers and institutions, contributing to a network of experts in the field.
- ✚ Dissemination of research findings through presentations at conferences and scientific meetings, sharing insights with peers and experts in the field.
- ✚ Acquiring specialized expertise in Immune Protein research can open doors to academic, industry, and clinical research opportunities.

6. Tentative Timeline

The proposed research will be conducted over Three to four years, with regular milestones and progress evaluations throughout the Ph.D. program.

7. Ethical Consideration

The research will adhere to ethical guidelines for human and animal research. Informed consent and animal welfare will be strictly followed during the study.

8. Budget

The budget will include expenses for laboratory supplies, equipment, animal models, and publication fees.

9. Conclusion

This research proposal outlines a comprehensive plan to “Investigate the Role of Immune Protein Interactions in Regulating Breast Cancer Stem Cells (BCSCs) Plasticity and Tumor Progression” that can guide the development of novel and more effective BCSCs therapies. The proposed study seeks to contribute to the understanding of the Interaction of immune cells and BCSCs and to provide valuable insights into Immune protein-based therapies. By conducting Integrate techniques from genomics, proteomics, bioinformatics, and other fields to gain a comprehensive understanding of Immune Proteins. We anticipate uncovering meaningful patterns, relationships, and trends in the data.

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MASTER OF SCIENCE (M.Sc) GRADUATION
CERTIFICATE



அழகப்பா பல்கலைக்கழகம்
ALAGAPPA UNIVERSITY

(Accredited with A+ Grade by NAAC (CGPA: 3.64) in the Third Cycle,
Graded as Category - I University and Granted Autonomy by MHRD - UGC)

KARAIKUDI - 630 003, TAMILNADU, INDIA



Reg. No.: 2020509001

அறிவியற்புலம்

அழகப்பா பல்கலைக்கழக ஆட்சிக்குழு

ஆதிமூலம் நா

என்பவருக்கு

விலங்கியலில் அறிவியல் நிறைஞர்

பட்டத்தை அதற்குரிய தேவைகளை நிறைவு செய்தமையால்
தனிச்சிறப்பு முதல் வகுப்பில் ஏப்ரல் 2022 இல் அளிக்கிறது

பல்கலைக்கழக முத்திரை பெறுகிறது

FACULTY OF SCIENCE

The Syndicate of the Alagappa University

hereby confers the degree of

MASTER OF SCIENCE IN ZOOLOGY

on

AATHIMOOLAM N

with FIRST CLASS - DISTINCTION in APRIL 2022 for having

fulfilled the requirements for the degree

Given under the seal of the University

Medium of Instruction: ENGLISH



Sl. No. 157067

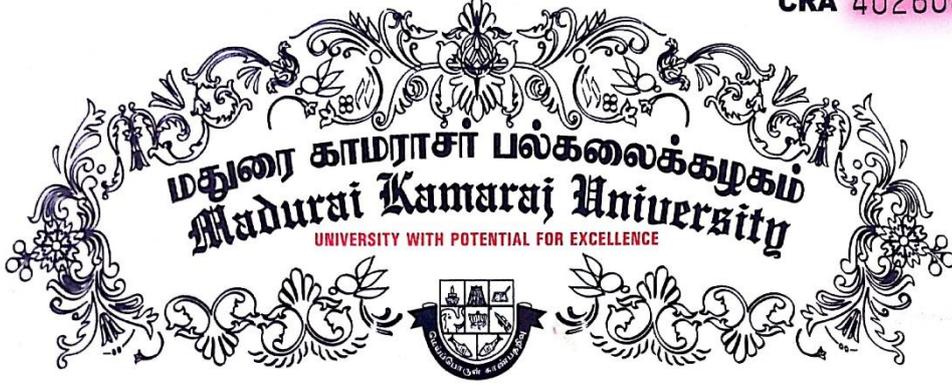
Date: 22-JAN-2023

பதிவாளர்
Registrar

துணைவேந்தர்
Vice - Chancellor

BACHELOR OF SCIENCE (B.Sc) GRADUATION
CERTIFICATE

CRA 40260440



அறிவியல் புலம்
FACULTY OF SCIENCE

மதுரை காமராஜர் பல்கலைக்கழக ஆட்சிப்பேரவை

ஆதிமூலம். நர.

இப்பல்கலைக்கழகத்தில் இணைந்த

தன்னாட்சிக் கல்லூரியான

அய்யநாடார் ஜானகி அம்மல் கல்லூரி, சிவகாசி

விதித்திருந்த பாடப் பயிற்சியினையும் தேர்வினையும் நன்கு முடித்த பின்னர் ஏப்ரல் 2020 இல் நடைபெற்ற தேர்வில்

முதல் வகுப்பு

பெற்று தேர்வுற்றார் எனக் கல்லூரித் தேர்வு ஏற்புக்குழு பரிந்துரைத்தவாறு,

விலங்கியல் பீச்வில் அறிவியல் இளையர் பட்டம்

பெறுதற்கு உரியவர் ஆகின்றார் என இதன்வழி அறிவிக்கின்றது.

பல்கலைக்கழக இலச்சினையுடன் இது வழங்கப்படுகின்றது.

The Senate of the MADURAI KAMARAJ UNIVERSITY

hereby makes known that

AATHIMOOLAM N

has been admitted to the

DEGREE OF BACHELOR OF SCIENCE IN ZOOLOGY

he/she having successfully completed the course of studies and examination prescribed therefor by the

AYYA NADAR JANAKI AMMAL COLLEGE, SIVAKASI

(an Autonomous College of this University) and upon the recommendation by the College Awards Committee and

having been placed by them in the

FIRST CLASS

at the Examination held in

APRIL 2020

Register No. :

17UZ36

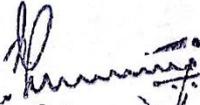
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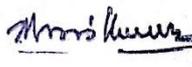
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பல்கலைநகர், மதுரை - 625 021
Palkalai Nagar, Madurai - 625 021
நாள் Dated 13 July 2022


தேர்வாளர்
Controller of Examinations

வாரியர்
in-charge


பதிவாளர்
Registrar

வாரியர்
in-charge


துணைவேந்தர்
Vice-Chancellor

ACADEMIC TRANSCRIPT OF M.SC

 ALAGAPPA UNIVERSITY (Accredited with A+ Grade by NAAC (CGPA 3.64) in the Third Cycle, Graded as Category-I University and Granted Autonomy by MHRD - UGC, 2019: Asia Rank - 216, QS BRICS Rank - 104, QS India Rank - 20) KARAIKUDI - 630 003, TAMILNADU, INDIA													
CONSOLIDATED STATEMENT OF GRADES (UNDER CHOICE BASED CREDIT SYSTEM)													
DEGREE PROGRAMME MASTER OF SCIENCE		SUBJECT ZOOLOGY											
NAME OF THE CANDIDATE		REGISTER NUMBER	DATE OF BIRTH										
AATHIMOOLAM N		2020509001	19-04-2000										
FOLIO NUMBER		1656											
DEPARTMENT / CENTRE NAME		DEPARTMENT OF ANIMAL HEALTH AND MANAGEMENT											
COURSE CODE	TITLE OF THE COURSE	MAX. MARKS			MARKS SECURED			CGY	CDT	GRD	GPT	RESULT	MM-YYYY of PASSING
		ESE	CIA	TOTAL	ESE	CIA	TOTAL						
509101	ANIMAL DIVERSITY - I INVERTERBRATE	75	25	100	63	21	84	1	4	D+	8.5	P	NOV20
509102	ANIMAL DIVERSITY - II CHORDATA	75	25	100	63	20	83	1	4	D+	8.5	P	NOV20
509103	BIOCHEMISTRY	75	25	100	61	21	82	1	4	D+	8.5	P	NOV20
509104	CELL AND MOLECULAR BIOLOGY	75	25	100	54	18	72	1	4	A++	7.5	P	NOV20
509105	LAB - I : ANIMAL DIVERSITY I & II, BIOCHEMISTRY, CELL AND MOLECULAR BIOLOGY	75	25	100	56	22	78	2	4	D	8.0	P	NOV20
509501	ENDOCRINOLOGY	75	25	100	61	20	81	5	3	D+	8.5	P	NOV20
509201	ANIMAL PHYSIOLOGY	75	25	100	56	21	77	1	4	D	8.0	P	APR21
509202	MICROBIOLOGY	75	25	100	61	22	83	1	4	D+	8.5	P	APR21
509203	IMMUNOLOGY	75	25	100	50	18	68	1	4	A+	7.0	P	APR21
509204	GENETICS	75	25	100	58	23	81	1	4	D+	8.5	P	APR21
509205	LAB - II : ANIMAL PHYSIOLOGY, MICROBIOLOGY, IMMUNOLOGY AND GENETICS	75	25	100	58	23	81	2	4	D+	8.5	P	APR21
509504	ECONOMIC ZOOLOGY	75	25	100	63	24	87	5	3	D++	9.0	P	APR21
502701	MOLECULAR MODELING AND DRUG AND DESIGN	75	25	100	50	19	69	3	2	A+	7.0	P	APR21
509301	DEVELOPMENTAL BIOLOGY	75	25	100	64	23	87	1	4	D++	9.0	P	NOV21
509302	ECOLOGY AND CONSERVATION BIOLOGY	75	25	100	63	20	83	1	4	D+	8.5	P	NOV21
509303	EVOLUTION	75	25	100	60	22	82	1	4	D+	8.5	P	NOV21
509304	FISHERY BIOLOGY AND AQUACULTURE	75	25	100	61	21	82	1	4	D+	8.5	P	NOV21
509305	LAB - III : DEVELOPMENTAL BIOLOGY, ECOLOGY AND CONSERVATION BIOLOGY, EVOLUTION AND FISHERY BIOLOGY & AQUACULTURE	75	25	100	54	23	77	2	4	D	8.0	P	NOV21
509506	ENTOMOLOGY	75	25	100	59	23	82	5	3	D+	8.5	P	NOV21
533702	NANOTECHNOLOGY AND ADVANCED DRUG DELIVERY SYSTEM	75	25	100	41	19	60	3	2	B	6.0	P	NOV21
509401	ANIMAL BIOTECHNOLOGY	75	25	100	58	21	79	1	5	D	8.0	P	APR22
509999	DISSERTATION WORK	75	25	100	67	20	87	8	12	D++	9.0	P	APR22

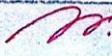
SEMESTER	I	II	III	IV	CREDITS	
GPA	8.23	8.12	8.30	8.70	MINIMUM REQUIRED FOR PASS	ACTUALLY EARNED
CGPA	8.31				90	90

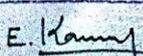
Date of Publication 22.07.2022 Medium of Instruction : ENGLISH
 Date of Issue 07.10.2022



ALAGAPPA UNIVERSITY
KARAIKUDI


Deputy Registrar


Dr. S. Arun
Deputy Controller


Dr. E. KANNAPIRAN
CONTROLLER OF EXAMINATIONS

SL No: 206183
 (Details Overleaf)
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ACADEMIC TRANSCRIPT OF M.SC



AYYA NADAR JANAKI AMMAL COLLEGE, SIVAKASI

(Autonomous, Affiliated to Madurai Kamaraj University, Re-accredited (3rd cycle) with 'A' grade (CGPA 3.67 out of 4) by NAAC and recognized as College of Excellence by UGC, Star College by DBT)

B.Sc., Degree Examinations, APRIL 2020

STATEMENT OF MARKS AND GRADES

(CHOICE BASED CREDIT SYSTEM)



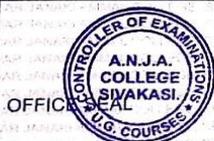
AJC 163025

NAME : AATHIMOOLAM, N			REGISTER No. : 17UZ36											
MAJOR : ZOOLOGY			ADMITTED IN : JUNE 2017											
PART	SEMESTER	PAPER CODE	TITLE OF THE PAPER	CREDIT	Maximum			Marks Secured			GRADE POINT	GRADE	RESULT	M & YR.
					INTERNAL	EXTERNAL	TOTAL	INTERNAL	EXTERNAL	TOTAL				
I	1	T1S01	TAMIL PAPER-I	3	40	60	100	32	39	71	7.1	A++	P	N17
II	1	E1S01	ENGLISH PAPER-I	3	40	60	100	23	36	59	5.9	B+	P	N17
III	1	Z1C01	INVERTEBRATE ZOOLOGY	6	40	60	100	32	25	57	5.7	B+	P	N17
III	1	CLA01	CHEMISTRY FOR BIOLOGICAL SCIENCES-I	4	40	60	100	33	34	67	6.7	A+	P	N17
IV	1	N1S02	SUPPLEMENTARY FOR SCIENCES	1	100	100	100	62	62	124	6.2	A	P	N17
I	2	T2S02	TAMIL PAPER-II	3	40	60	100	32	43	75	7.5	D	P	A18
II	2	E2S02	ENGLISH PAPER-II	3	40	60	100	21	32	53	5.3	B	P	A18
III	2	Z2C02	CHORDATE ZOOLOGY	5	40	60	100	31	35	66	6.6	A+	P	A18
III	2	Z2C03	CORE PRACTICAL-I	2	50	50	100	48	42	90	9.0	O	P	A18
III	2	C2A02	CHEMISTRY FOR BIO. SCIENCES-II	4	40	60	100	30	41	71	7.1	A++	P	A18
III	2	C2A03	ALLIED CHEMISTRY PRAC. FOR BIO.SCI.	2	50	50	100	45	50	95	9.5	O+	P	A18
IV	2	O2N01	STEM CELLS	1	100	100	100	44	44	88	4.4	C+	P	A18
IV	2	F2T01	INFORMATION TECHNOLOGY-THEORY	1	40	60	100	33	52	85	8.5	D++	P	A18
IV	2	F2T02	INFORMATION TECHNOLOGY-PRACTICAL	1	50	50	100	44	47	91	9.1	O	P	A18
IV	2	F2P01	PHYSICAL EDUCATION PRACTICAL	1	100	100	100	43	43	86	4.3	C+	P	A18
I	3	T3S03	TAMIL PAPER-III	3	40	60	100	31	41	72	7.2	A++	P	N18
II	3	E3S03	ENGLISH PAPER-III	3	40	60	100	25	29	54	5.4	B	P	N18
III	3	Z3C04	CELL BIOLOGY	5	40	60	100	32	43	75	7.5	D	P	N18
III	3	Z3C05	ECOLOGY AND BIODIVERSITY	5	40	60	100	31	36	67	6.7	A+	P	N18
III	3	B3A04	CRYPTOGAMIC BOTANY	4	40	60	100	29	21	50	5.0	B	P	N18
IV	3	N3G01	GK AND TEST OF REASONING	1	100	100	100	56	56	112	5.6	B+	P	N18
I	4	T4S04	TAMIL PAPER-IV	3	40	60	100	29	38	67	6.7	A+	P	A19
II	4	E4S04	ENGLISH PAPER-IV	3	40	60	100	22	37	59	5.9	B+	P	A19
III	4	Z4C06	EMBRYOLOGY	5	40	60	100	32	37	69	6.9	A+	P	A19
III	4	Z4C07	CORE PRACTICAL-II	2	50	50	100	41	40	81	8.1	D+	P	A19
III	4	B4A05	PHANEROGAMIC BOTANY	4	40	60	100	30	45	75	7.5	D	P	A19
III	4	B4A06	ALLIED BOTANY PRACTICAL	2	50	50	100	37	36	73	7.3	A++	P	A19
III	4	Z4E01	ORNAMENTAL FISH CULTURE	5	40	60	100	31	27	58	5.8	B+	P	A19
IV	4	F4S01	SOFT SKILL DEVELOPMENT	1	100	100	100	78	78	156	7.8	D	P	A19
V	4	X4R01	RED RIBBON CLUB	1	100	100	100	78	78	156	7.8	D	P	A19
III	5	Z5C08	GENETICS & BIostatISTICS	5	40	60	100	29	40	69	6.9	A+	P	N19
III	5	Z5C09	BIOCHEMISTRY & PHYSIOLOGY	5	40	60	100	25	43	68	6.8	A+	P	N19
III	5	Z5C10	MICROBIOLOGY & IMMUNOLOGY	5	40	60	100	28	39	67	6.7	A+	P	N19
III	5	Z5C11	CORE PRACTICAL-III	3	50	50	100	50	40	90	9.0	O	P	N19
III	5	B5E02	BIO-FERTILIZERS	5	40	60	100	25	50	75	7.5	D	P	N19
IV	5	F5E01	ENVIRONMENTAL STUDIES	1	25	75	100	23	61	84	8.4	D+	P	N19
IV	5	F5V01	VALUE EDU., PROFESSIONAL ETHICS, HUMAN RIGHTS AND WOMEN STUDIES	1	100	100	100	51	51	102	5.1	B	P	N19
III	6	Z6C12	ANIMAL BIOTECHNOLOGY	5	40	60	100	29	43	72	7.2	A++	P	A20
III	6	Z6C13	ETHOLOGY & EVOLUTION	5	40	60	100	35	44	79	7.9	D	P	A20
III	6	Z6C14	CORE PRACTICAL - IV	3	50	50	100	50	50	100	10.0	O+	P	A20
III	6	Z6C15	COMPREHENSION AND VIVA VOCE	1	100	100	100	94	94	188	9.4	O	P	A20
III	6	Z6L01	GENERAL & APPLIED ENTOMOLOGY	8	40	60	100	33	44	77	7.7	D	P	A20
III	6	Z6E03	HEALTH AND NUTRITION	5	40	60	100	33	48	81	8.1	D+	P	A20
IV	6	J6T03	PHARMACEUTICAL MARKETING	1	100	100	100	91	91	182	9.1	O	P	A20

MEDIUM OF INSTRUCTION : ENGLISH

CUMULATIVE PERFORMANCE				DATE OF BIRTH : 19/04/2000	
PART	CREDITS EARNED IN ALL SEMESTERS	CGPA	GRADE	CLASSIFICATION	
I	12 / 12	7.125	A++	FIRST CLASS	
II	12 / 12	5.625	B+	SECOND CLASS	
III	105 / 105	7.221	A++	FIRST CLASS	
IV	10 / 10	6.850			
V	1 / 1	7.800			
Total Credits	140 / 140				

Signature of the Candidate



16 OCTOBER 2020
DATE OF ISSUE



Dr. C. Ashok
PRINCIPAL

Dr. M.K.Rajjan
 CONTROLLER OF EXAMINATIONS
 (UG COURSES)



ALAGAPPA UNIVERSITY

[A State University Accredited with A+ Grade by NAAC (CGPA : 3.64) in the Third Cycle,
Graded as Category - I University and Granted Autonomy by MHRD - UGC]
NIRF (2020) Rank : 36, QS India (2020) Rank : 24, QS Asia (2021) Rank : 199

Karaikudi - 630 003, TAMIL NADU, INDIA

TRANSFER CUM CONDUCT CERTIFICATE

Sl.No. 13081

Register No : 2020509001

1. Name of the Student

AATHIMOOLAM.N

2. Name of the Parent / Guardian

NARAYANAN

3. Date of birth as entered in the

19.04.2000

TC submitted (in words also)

(Nineteenth April - Two Thousand)

4. Nationality and Religion

INDIAN - HINDU

5. Community

Refer the Certificate issued by the
Competent Authority

6. a) Programme in which the student was studying at the time of leaving

M.Sc. (Zoology)

b) Major subject studied

Zoology

c) Duration of the programme

Two Year

7. Date of admission

13.08.2020

8. Date of leaving

18.05.2022

9. Conduct of the student

Good

10. Examination result

Refer Mark Statement

11. Reason for leaving the institution

Programme Completed / Discontinued

12. Medium of Instruction

English

Head of the Department

Professor & Head
Department of Animal Health & Management

Alagappa University
Karaikudi - 630 003, Tamilnadu, India

Dean

DEAN

FACULTY OF SCIENCE
ALAGAPPA UNIVERSITY
KARAIKUDI - 630 003

Date : 07.09.2022

Curriculum Vitae

N. Aathimoolam

Tamil Nadu, India - 626 121

Date of Birth: 19/04/2000

Mobile: +916369385857

Email: npaathi03@gmail.com

Website: <https://npaathi.blogspot.com/>



OBJECTIVES

Highly motivated and dedicated candidate with a strong background in Molecular Biology and Zoology seeking a challenging research position to contribute to cutting-edge advancements in the field of Cell biology.

EDUCATION

Master of Science in Zoology Alagappa University – 630 003	2020 - 2022 CGPA: 8.37
Bachelor of Science in Zoology Ayya Nadar Janaki Ammal College, Sivakasi - 626 124	2017 - 2020 CGPA: 7.22
Higher Secondary School (Biology & Mathematics) Sevugapandia Gov Her Sec School, Seithur - 626 121	2016 - 2017 Percentage – 80.33%

OTHER COURSES

Introduction to Professional Scientific Communication NPTEL Online Certification	2020 - 2021 Percentage: 63.0%
Medical Laboratory Technology (CMLT) Ayya Nadar Janaki Ammal College, Sivakasi – 626 124	2018 - 2019 CGPA: 8.0
Biotechnology Ayya Nadar Janaki Ammal College, Sivakasi – 626 124	2017 - 2018 CGPA: 8.55

RESEARCH EXPERIENCE: PROJECTS WORKED & GRADUATE

Research assistant, Alagappa University, Assistant Professor: Dr. P. Kumar	06/2022-06/2023 Tamil Nadu, India
---	--------------------------------------

Project List:

1. Anticancer activity of phloroglucinol derived carbon quantum dots.
2. Cinnamic acid carbon quantum dots: an excellent biosensor for detection of epicatechin.
3. Impact of penicillin on *hydra vulgaris*: a toxicological approach.
4. Chloramphenicol induces apoptosis in *hydra vulgaris*.
5. Research on the influence of rifampicin on *hydra vulgaris*.
6. Kanamycin impacts the growth of *hydra vulgaris*.

Master of Science in Zoology, Alagappa University, Professor: Dr. P. Srinivasan, Thesis: Studies on Antibacterial, Antioxidant, Anticancer, and Toxicity assay of green synthesized silver nanoparticle from <i>sepioteuthis lessoniana</i> ink. [Dissertation Link]	12/2021-05/2022 Tamil Nadu, India
---	--------------------------------------

Internship, Par Life Sciences and Research Pvt ltd, Advanced Molecular techniques	18/10/2021-21/10/2021 Tamil Nadu, India
--	--

Bachelor of Science in Zoology,
Ayya Nadar Janaki Ammal college,
Assistant Professor: Dr. T. Veni

12/2019-06/2020
Tamil Nadu, India

Thesis: A Survey of Medicinal plants in Sastha Kovil, Virudhunagar District, Tamil Nadu.
[\[Dissertation Link\]](#)

CONFERENCE PRESENTATION

- **Narayanan Aathimoolam**, Sabapathi Durgadevi, Selvaraj Anitha, Alagarsamy Arun, Ponnuchamy Kumar*, (2023) “*Eco-toxicological assessment of paracetamol utilizing Hydra as a model organism*”, Oral Presentation at the “4th International Conference on Recent Trends in Microbiology (RTM-2023).

CONFERENCES & SEMINRS

- Participated the National Conference on “**Recent Advanced in Structural Biology**” held on 4th & 5th November National College (Autonomous), Tiruchirappalli.
- Participated the National Seminar on “**Next Generation Technology for Sustainable Fisheries**” held on 29th & 30th March 2022 at Alagappa university, Karaikudi.
- Participate the RUSA 2.0 – BCTRC on “**Brainstorming Lecture Series on Cancer Theragnostic (Online Mode)**” held from 12th to 23rd September 2022, organized by Bharathiar Cancer Theranostic Research Centre, Bharathiar University, Coimbatore.
- Participated the Southern India Regional Young Peace Makers Programme on “**National Integration & Peace, Leadership, Active Listening, Identifying Problems in the Community & Project Development**” held on 26th to 28th November 2021, National Council of YMCAs of India, Karaikudi.
- Participated the International Webinar on “**Aqua Probiotics Conference (FEEDBACK)**” held on 25 September 2023, Envozyme Technologies Private Limited.
- Participated the National Webinar on “**Biomedical Waste Impact during Pandemic Times**” held on 12th June, 2021, Centre for Environmental Education and Ecological Development (CEED), Acharya Nagarjuna University, Andhra Pradesh.
- Participated the Online Programme on “**Three Days Online Course on Apiculture**” held on 13th to 15th May 2020, Ayya Nadar Janaki Ammal college, Sivakasi.
- Participated the Awareness Programmed on “**Academic Writing and Research Ethics**” held on 28th February 2020, Ayya Nadar Janaki Ammal college, Sivakasi.
- Participated the Awareness Programmed on “**Trending research avenues in biological sciences**” held on 31th January 2020, Sri S. Ramasamy Naidu Memorial college, Sattur.

WORKSHOPS

- Participated the National level workshop on “**One-Day National Level Workshop Patenting and Collaboration with Industries**” held on January 30th, 2023, Organized by Industry and Consultancy wing & University Business Collaboration Centre, Alagappa University, Karaikudi.
- Participated the awareness programmed on “**Microbial Fertilizers and Uses**” held on 03rd to 4th October 2019, Ayya Nadar Janaki Ammal College and National Bank for Agriculture and Rural Development, Sivakasi.
- Participated the workshop programmed on “**Molecular Techniques**” held on 09th February 2018, Ayya Nadar Janaki Ammal college, Sivakasi.

RESEARCH AND LABORATORY SKILLS

- **Cancer:** Cancer Cell culture Techniques, MTT, Fluorescence Techniques (AO/EtBr, DAPI, Hoechst, PI, DCFDA- H₂, ROS).
- **Molecular Techniques:** Primer design for Gene Expression Study, DNA & RNA Isolation, Electrophoresis.
- **Ecological Model Organism (*Hydra vulgaris*):** Culture of *Hydra vulgaris*, *Hydra* Maintain.
- **Model Organism (*Hydra vulgaris*) analytical techniques:** Acute Toxicity Test, Biological Staining (AO, DAPI, DCFDA-H₂), Battery Cell Complex, Regeneration Study, Population Study.
- **Microbes:** Isolation of Bacteria, Anti-bacteria, Bacterial staining.
- **Instruments Handling:** UV-Vis Spectroscopy, FTIR, Inverted Phase Contrast Fluorescence Microscope, ELISA Plate Reader, etc.,
- **Computer Skills:** Proficient with Microsoft Office (Word, Excel and PowerPoint), and Statistical analysis (SPSS, Originlab, Graph pad) etc.,

ACADAMIC REFERENCES

1. **Dr. SP. Sevarkodiyone,**
Head & Associate Professor,
P.G and Research Department of Zoology,
Ayya Nadar Janaki Amma College (Autonomous),
Sivakasi, Tamil Nadu, India - 626124
Email ID: sevarkodiyone@gmail.com
Contact no: +919865132654
2. **Dr. R. Ramakrishnan,**
Associate Professor,
P.G and Research Department of Zoology,
Ayya Nadar Janaki Ammal College (Autonomous),
Sivakasi, Tamil Nadu, India – 626 124
Email ID: jairams.zoo@gmail.com
Contact no: +9163826337525

आयकर विभाग
INCOME TAX DEPARTMENT

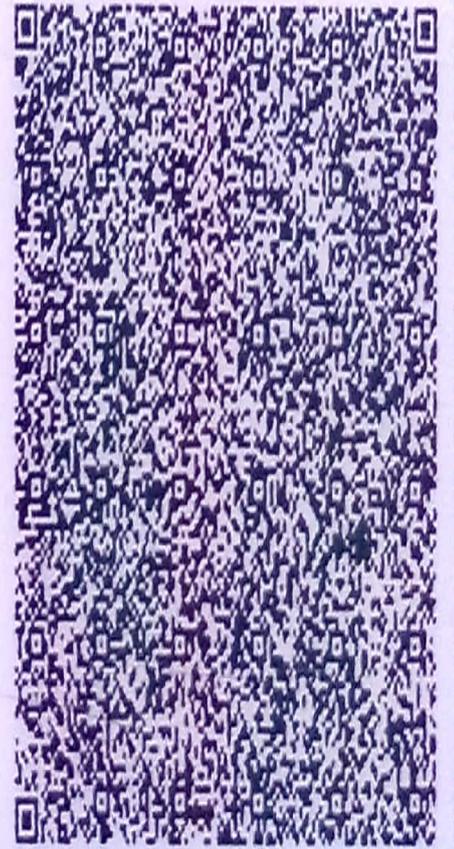


भारत सरकार
GOVT. OF INDIA



स्थायी लेखा संख्या कार्ड
Permanent Account Number Card

DRIPA6282A



नाम / Name
AATHIMOOLAM N

पिता का नाम / Father's Name
NARAYANAN

20052020

जन्म की तारीख /
Date of Birth
19/04/2000

N. Aathimoolam

हस्ताक्षर / Signature

इस कार्ड के खोने/पाने पर कृपया सूचित करें/लौटाएं:

आयकर पैन सेवा इकाई, एन एस डी एल
चौथी मंजिल, मंत्री स्टर्लिंग,
प्लॉट नं. 341, सर्वे नं. 997/8,
मॉडल कालोनी, दीप बंगला चौक के पास,
पुणे - 411 016.



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please inform / return to :*

Income Tax PAN Services Unit, NSDL
4th Floor, Mantri Sterling,
Plot No. 341, Survey No. 997/8,
Model Colony, Near Deep Bungalow Chowk,
Pune - 411 016.

Tel: 91-20-2721 8080, Fax: 91-20-2721 8081
e-mail: tininfo@nsdl.co.in



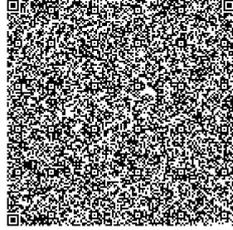
இந்திய அரசாங்கம்
Government of India

இந்திய தனிப்பட்ட அடையாள ஆணைய அமைப்பு
Unique Identification Authority of India

பதிவேட்டு எண்/ Enrolment No.: 2193/13221/57258

To
ஆதிமூலம் நா
Aathimoolam N
S/O: Narayanan
164
MAIN ROAD
Sethur
Virudhunagar Tamil Nadu - 626121
6369385857

Signature Not Verified
Digitally Signed by
UNIQUE IDENTIFICATION
AUTHORITY OF INDIA 05
Date: 2023.05.17 09:23:01
UTC



உங்கள் ஆதார் எண் / Your Aadhaar No. :

4782 3596 8059

VID : 9195 3536 2474 4149

எனது ஆதார், எனது அடையாளம்



இந்திய அரசாங்கம்
Government of India



ஆதிமூலம் நா
Aathimoolam N
பிறந்த நாள்/DOB: 19/04/2000
ஆண்/ MALE

4782 3596 8059

VID : 9195 3536 2474 4149

எனது ஆதார், எனது அடையாளம்



Government of India



தகவல் / INFORMATION

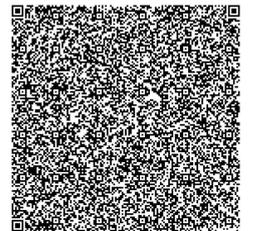
- ஆதார் என்பது அடையாளச் சான்று. குடியுரிமைக்கான சான்று அல்ல
- ஆதார் தனித்துவமானது மற்றும் பாதுகாப்பானது.
- பாதுகாப்பான QR குறியீடு/ஆஃப்லைன் XML / ஆன்லைன் அங்கீகாரத்தைப் பயன்படுத்தி அடையாளத்தைச் சரிபார்க்கவும்
- ஆதார் கடிதம், விவிசி கார்டுகள், இ ஆதார் மற்றும் எம் ஆதார் போன்ற அனைத்து வகையான ஆதாரங்களும் சமமாக செல்லுபடியாகும். 12 இலக்க ஆதார் எண்ணுக்கு பதிலாக மெய்நிகர் ஆதார் அடையாளத்தை (VID) பயன்படுத்தலாம்.
- 10 ஆண்டுகளுக்கு ஒரு முறையாவது ஆதாரை புதுப்பிக்கவும்
- பல்வேறு அரசு மற்றும் அரசு சாரா பலன்கள் / சேவைகளைப் பெற ஆதார் உங்களுக்கு உதவுகிறது
- உங்கள் மொபைல் எண் மற்றும் மின்னஞ்சல் ஐடியை ஆதாரில் புதுப்பிக்கவும்.
- ஆதார் சேவைகளைப் பெற உங்கள் ஸ்மார்ட் போன்களில் எம் ஆதார் செயலியைப் பதிவிறக்கவும்
- பாதுகாப்பை உறுதிப்படுத்த ஆதார் / பயோமெட்ரிக்ஸ் லாக் / அன்லாக் அம்சத்தைப் பயன்படுத்தவும்
- ஆதார் கோரும் நிறுவனங்கள் உரிய ஒப்புதலைப் பெற வேண்டும்
- Aadhaar is a proof of identity, not of citizenship.
- Aadhaar is unique and secure.
- Verify identity using secure QR code/offline XML/online Authentication.
- All forms of Aadhaar like Aadhaar letter, PVC Cards, eAadhaar and mAadhaar are equally valid. Virtual Aadhaar Identity (VID) can also be used in place of 12 digit Aadhaar number.
- Update Aadhaar at least once in 10 years.
- Aadhaar helps you avail various Government and Non- Government benefits/services.
- Keep your mobile number and email id updated in Aadhaar.
- Download mAadhaar app on smart phones to avail Aadhaar Services.
- Use the feature of lock/unlock Aadhaar/biometrics to ensure security.
- Entities seeking Aadhaar are obligated to seek due consent.



இந்திய தனிப்பட்ட அடையாள ஆணைய அமைப்பு
Unique Identification Authority of India



முகவரி:
தந்தை / தாய் பெயர்: நாராயணன், 164,
மெய்நிகர் ரோடு, சேத்தூர், விருதுநகர்,
தமிழ் நாடு - 626121
Address:
S/O: Narayanan, 164, MAIN ROAD, Sethur,
Virudhunagar,
Tamil Nadu - 626121



4782 3596 8059

VID : 9195 3536 2474 4149

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R.Dis : 21189 / 14-09-2016

மாவட்டக் குறியீடு எண் / District Code : 2 6



வட்டக் குறியீடு எண் / Taluk Code : 0 1

சான்றிதழ் எண் / Certificate No
686C768C6A687C86

கிராமக் குறியீடு எண் / Village Code : 0 0 9

சாதிச் சான்றிதழ் COMMUNITY CERTIFICATE

விருதுநகர் மாவட்டம் இராஜபாளையம் வட்டம் சேத்தூர் கிராமம் / நகரம் கதவு எண் 164, சேத்தூர் பெருமாள்கோவில் தெரு, தெருவில் வசிக்கும் நா.ஆதிமூலம் தந்தை பெரா நாராயணன் என்பவர் மறவர வகுப்பைச் சார்ந்தவர். அரசு ஆணை நிலை எண்:28, பிற்பட்ட மற்றும் மிகவும் பிற்பட்ட பிரிவின நலத்துறை நாள 19.07.1994 வரிசை எண் 36 படி சீமரபினா பிரிவினைச் சார்ந்தவர் எனச் சான்றளிக்கப்படுகிறது.
This is to certify that **AATHIMOOLAM N** son son of Thiru **NARAYANAN** residing at Door No **164 SEITHUR PERUMALKOIL ST**, Street, **Seithur** Village / Town of **Rajapalayam** Taluk of **Virudhunagar** District of the State of Tamil Nadu belongs to **Maravars** Community, which is recognized as a Denotified Community as per Government Order (Ms.) No. 28, Backward Classes and Most Backward Classes Welfare, dated 19th July 1994 vide Serial No. 36.

1. நா.ஆதிமூலம் என்பவரும் அவருடைய குடும்பத்தினரும் தமிழ்நாட்டில் விருதுநகர் மாவட்டத்தில் இராஜபாளையம் வட்டத்தில் சேத்தூர் கிராமத்தில்/நகரத்தில், கதவு எண் 164, சேத்தூர் பெருமாள்கோவில் தெரு தெரு, என்ற ஓலாசத்தில் வசித்து வருகிறார்கள் எனச் சான்றளிக்கப்படுகிறது.
2. It is certified that **AATHIMOOLAM N** and his family ordinarily reside(s) at Door No. **164, PERUMALKOIL ST Street, SEITHUR, Seithur** Village / Town of **Rajapalayam** Taluk of **Virudhunagar** District of Tamil Nadu.

மின்கையொப்பம்/Digital Signature : 14-09-2016 அன்று 6:26:47 AM நேரத்தில் இடப்பட்டது.
பெயர்/Name : Vadivel M
பதவி /Designation : மண்டல துணை வட்டாட்சியா / Zonal Deputy Tahsildar
இடம் /Place : இராஜபாளையம் வட்டம் / Rajapalayam Taluk , விருதுநகர் மாவட்டம் / Virudhunagar District

குறிப்பு/ Remarks :

1. இதற்கவலகை 14-09-2016 அன்று 0:28:30 PM நேரத்தில் அச்சடிக்கப்பட்டது.
The certificate was printed on 14-09-2016 at 0:28:30 PM hrs.
2. ஆவண விவரங்களை மேலும் உறுதி செய்துகொள்ள வேண்டுமெனில் தூங்கு வட்டாட்சியா அலுவலகத்தை அணுகி உறுதிப்படுத்திக்கொள்ளவும்.
For Further certificate confirmation and details, you may approach the Tahsildar concerned.



ஆவண விவரங்களை உறுதி செய்ய :
(அ) **686C768C6A687C86** என்ற தனிப்பட்ட சான்றிதழ் எண்ணை <https://edistricts.tn.gov.in/revenue/verifyCertificate.html> ல் உள்ளீடு செய்து சரிபார்க்கவும்.
(ஆ) கைப்பேசி கேமராவின் 2D barcode படிப்பான மூலம் படித்து 3G/GPRS வழி இணையத்தளத்தில் சரிபார்க்கவும்.
Genuineness of the certificate can be verified by
(a) Keying in the unique certificate number **686C768C6A687C86** in the URL <https://edistricts.tn.gov.in/revenue/verifyCertificate.html>
(b) Reading the 2D barcode with mobile barcode reader and seeing online using 3G/GPRS.