Timothy S. Phan

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Homepage: https://www.greipfrut.com
Google Scholar: https://scholar.google.com/citations?user=WYopCugAAAAJ

Research Interests

Cardiovascular Physiology, Cardioimmunology, Medical Imaging (CMR, Echocardiography), Machine Learning

Education

Ph.D. Immunology and Inflammation *2020-Present*
Sackler Institute of Graduate Biomedical Sciences @ NYU School of Medicine, New York, NY

M.S. Electrical Engineering *2016*
Cardiovascular Research Labs @ Rutgers University, Piscataway, NJ

B.S. Biomedical Engineering *2013*
Rutgers University, Piscataway, NJ

B.S. Electrical & Computer Engineering *2012*
Rutgers University, Piscataway, NJ

Awards & Honors

American Society of Hypertension (ASH), "**2016 ASH Young Investigator Travel Award**"

Rutgers University, "**ECE Research Excellence Award**"

North American Artery (NAA), "**2015 NAA Early Investigator Award**"

American Society of Hypertension (ASH), "**2015 ASH Young Investigator Travel Award**"

Rutgers University, "**ECE Student Development Award**"

Rutgers University, "**Academic Excellence Award**," *for Top 10% of Class*

Rutgers University, "**School of Engineering Dean's List**"

Experience

Research Scientist & Director of Engineering *2017-2020*
Autonomous Healthcare, Inc., Hoboken, NJ

- R&D for autonomous respiratory, drug, and fluid management in the OR and ICU
- Biophysical modeling: cardiopulmonary and homeostatic systems, hemodynamic PK/PD, sepsis, ARDS
- Clinical research and large animal models of hemodynamic control

Graduate Student Research Fellow *2013-2017*
Cardiovascular Research Lab — PI: John K-J. Li @ Rutgers University
Chirinos Lab — PI: Julio A Chirinos @ University of Pennsylvania

- Computational physiology: pulsatile hemodynamics, heart-vascular system coupling
- Inverse-modeling (patient-specific modeling) with analysis of cardiac MRI, echocardiography and arterial tonometry; arterial, atrial, and ventricular dynamics; HFpEF; Aging
- Clinical research and large animal models of pulsatile hemodynamics

Professional Activities

Scientific Peer Reviewer: Swiss National Science Foundation — Circulation: Cardiovascular Imaging — Hypertension — Scientific Reports — Biomechanics and Modeling in Mechanobiology (BMMB) — Vascular Medicine

Member: American Heart Association **(AHA)** - Council on Hypertension — American Physiological Society **(APS)** - Cardiovascular Section — North American Artery **(NAA)**

Misinterpretation of the Determinants of Elevated Forward Wave Amplitude Inflates the Role of the Proximal Aorta,
TS Phan, JKJ Li, P Segers, JA Chirinos
Journal of the American Heart Association 5(2), e003069 JAHA Link

Aging is Associated with an Earlier Arrival of Reflected Waves Without a Distal Shift in Reflection Sites,
TS Phan, JKJ Li, P Segers, MR Koppula, SR Akers, ST Kuna, T Gislason, AI Pack, JA Chirinos
Journal of the American Heart Association 5(9), e003733 JAHA Link

Late Systolic Myocardial Loading Is Associated With Left Atrial Dysfunction in Hypertension,
JA Chirinos, ***TS Phan***, AA Syed, Z Hashmath, HG Oldland, MR Koppula, A Tariq, K Javaid, R Miller, S Varakantam, A Dunde, V Neetha, SR Akers
Circulation: Cardiovascular Imaging. 2017;10:e006023 CIRCIMAGING Link

Beta–Blocker Use Is Associated With Impaired Left Atrial Function in Hypertension,
M Sardana, AA Syed, Z Hashmath, ***TS Phan***, MR Koppula, U Kewan, Z Ahmed, R Chandamuri, S Varakantam, E Shah, R Gorz, SR Akers, JA Chirinos
Journal of the American Heart Association 6 (2), e005163 JAHA

Replicating human expertise of mechanical ventilation waveform analysis in detecting patient-ventilator cycling asynchrony using machine learning,
B Gholami, ***TS Phan***, WM Haddad, A Cason, J Mullis, L Price, JM Bailey
Computers in Biology and Medicine 97, 137-144 CMB

Validation of an Automated System for Detecting Ineffective Triggering Asynchronies During Mechanical Ventilation: A Retrospective Study,
TS Phan, R Costa, WM Haddad, JC Mullis, LT Price, AD Cason, JM Bailey, B Gholami
Journal of Clinical Monitoring and Computing JCMC

Aldosterone, inactive matrix gla-protein, and large artery stiffness in hypertension,
JA Chirinos, M Sardana, AA Syed, MR Koppula, S Varakantam, I Vasim, HG Oldland, ***TS Phan***, NEA Drummen, C Vermeer, RR Townsend, SR Akers, W Wei, EG Lakatta, OV Fedorova
Journal of the American Society of Hypertension 12 (9), 681-689 JASH

Effects of organic and inorganic nitrate on aortic and carotid haemodynamics in heart failure with preserved ejection fraction,
JA Chirinos, F Londono, P Zamani, M Beraun, P Haines, I Vasim, S Varakantam, ***TS Phan***, TP Cappola, KB Margulies, RR Townsend, P Segers
European Journal of Heart Failure EJHF Link

Heart-Femoral Pulse Wave Velocity is a Stronger Marker of Arterial Aging Than Carotid-Femoral Pulse Wave Velocity (Abstract),
TS Phan, AA Syed, HG Oldland, N Sanchez, Z Hashmath, SR Akers, JA Chirinos
Journal of the American College of Cardiology 69(11 Suppl) JACC Link

Cardio-Femoral Vascular Index: A New Marker of Arterial Aging (Abstract),
TS Phan, HG Oldland, K Javaid, U Kewan, I Vasim, S Varakantam, SR Akers, JA Chirinos
Journal of the American College of Cardiology 69(11 Suppl) JACC Link

Decreased Aortic Inertance is Independently Associated with Left Ventricular Hypertrophy: Role in Ventricular-Arterial Coupling (Abstract),
TS Phan, Z Hashmath, AA Syed, I Vassim, U Kewan, S Varakantam, SR Akers, JA Chirinos
Journal of the American College of Cardiology 69(11 Suppl) JACC Link

Acquisition of Time-Resolved Brachial Pressure Waveforms from Cuff-Based Pulse Volume Recordings (Abstract),
TS Phan, J Dakka, AA Syed, I Vasim, HG Oldland, U Kewan, SR Akers, JA Chirinos
Journal of the American College of Cardiology 69(11 Suppl) JACC Link

Effects of Organic and Inorganic Nitrate on Aortic and Carotid Hemodynamics in Heart Failure and Preserved Ejection Fraction (Abstract),
JA Chirinos, F Lonodo-Hoyos, M Beraun, P Haines, I Vassim, S Varakantam, ***TS Phan***, TP Cappola, KB Margulies, RR Townsend, P Segers, P Zamani
Circulation 134 (Suppl 1), A14528-A14528 AHA Link

Circulating Inactive Matrix Gla-protein, Warfarin Use and Large Artery Stiffness in Heart Failure with Reduced Ejection Fraction (Abstract),
JA Chirinos, I Vassim, S Varakantam, ***TS Phan***, AA Syed, P Bhattacharya, M Beraun, H Soto-Calderon, SR Akers
Circulation 134 (Suppl 1), A13951-A13951 AHA Link

Circulating Inactive Matrix Gla-protein is Associated High Aldosterone Levels and Arterial Stiffness in Hypertension (Abstract),
JA Chirinos, AA Syed, MR Koppula, I Vassim, S Varakantam, ***TS Phan***, M Beraun, SR Akers, EG Lakatta, O Fedorova
Circulation 134 (Suppl 1), A15006-A15006 AHA Link

Diffuse Interstitial Myocardial Fibrosis is Associated with Abnormal Left Atrial Mechanics in Hypertension (Abstract),
JA Chirinos, AA Syed, Z Hashmath, ***TS Phan***, MR Koppula, U Kewan, Z Ahmed, R Chandamuri, S Varakantam, E Shah, R Gorz, SR Akers
Circulation 134 (Suppl 1), A15668-A15668 AHA Link

Late Systolic Myocardial Loading is Strongly Related to Left Atrial Dysfunction in Hypertension (Abstract),
JA Chirinos, AA Syed, Z Hashmath, ***TS Phan***, MR Koppula, U Kewan, Z Ahmed, R Chandamuri, S Varakantam, E Shah, R Gorz, SR Akers
Circulation 134 (Suppl 1), A15695-A15695 AHA Link

Longitudinal to Circumferential Diastolic Dyssynchrony in Heart Failure with Preserved Ejection Fraction and its Relationship to Myocardial Fibrosis (Abstract),
JA Chirinos, H Soto-Calderon, S Varakantam, AA Syed, ***TS Phan***, MR Koppula, U Kewan, P Zamani, SR Akers
Circulation 134 (Suppl 1), A15776-A15776 AHA Link

Augmentation Index is Blind to Early-Systolic Effects of Arterial Wave Reflections (Abstract),
TS Phan, F Londono, JA Chirinos, JKJ Li
Journal of the American Society of Hypertension 10(4), e34 JASH Link

Arterial Wave Reflections: Looking Beyond the First Harmonic and Pressure Inflection Points to Assess Late-Systolic Ventricular Loading (Abstract),
TS Phan, JKJ Li, Z Ahmed, E Shah, V Panchal, JA Chirinos
Artery Research 12 (12), 35 Artery Research Link

Inertial-Viscoelastic Minimal Model of the Arterial System Reconciles Arterial Compliance Estimations (Abstract),
TS Phan, JKJ Li, M Koppula, I Vasim, S Varakantam, JA Chirinos
Artery Research 12 (12), 45 Artery Research Link

Role of Pressure-Dependent Arterial Compliance in Modulating the Phase of Wave Reflections: Implications for LV-AS Coupling (Abstract),
TS Phan, JKJ Li
Artery Research 12 (12), 22 Artery Research Link

Forward And Backward Waves At The Aortic Root: Steady-State And Wave Re-Reflection Considerations (Abstract),
TS Phan, JKJ Li, V Panchal, A Syed, E Shah, JA Chirinos
Artery Research 12 (12), 44 Artery Research Link

Evalulating the Logical Relationships of Reflected Wave Transit Time with the Complex Global Reflection Coefficient, Height, and Pulse Wave Velocity (Abstract),
TS Phan, JKJ Li, I Vasim, MR Koppula, S Varakantam, V Panchal, AA Syed, EM Shah, SR Akers, JA Chirinos
Artery Research *(In Press)* Artery Research Link

Independent Modifications to Backward and Forward Pressure Waves Lead to Non-Physiological Aortic Flow (Abstract),
TS Phan, JA Chirinos, JKJ Li
Artery Research *(In Press)* Artery Research Link

"Impedance Matching" Between the Aorta and Large Muscular Arteries? Misinterpretation of Pulse Wave Velocity Gradients (Abstract),
TS Phan, JKJ Li, I Vasim, Z Ahmed, MR Koppula, JA Chirinos
Artery Research *(In Press)* Artery Research Link

Forward Wave Amplitude is Not Solely Dependent on Proximal Aortic Properties: Importance of Wave Reflections (Abstract),
TS Phan, JA Chirinos, JKJ Li
Artery Research *(In Press)* Artery Research Link

Reconciling the Increased Pulse Wave Velocity and Reflected Wave Transit Time Paradox (Abstract),
TS Phan, JKJ Li, S Varakantam, V Panchal, AA Syed, EM Shah, SR Akers, JA Chirinos
Artery Research *(In Press)* Artery Research Link

Wave (Re-)Reflection and Pulse Wave Velocity Determine Forward Wave Amplitude and Morphology (Abstract),
TS Phan, K Khaw, JKJ Li
Journal of the American Society of Hypertension, 9(4) JASH Link

Integrating Increased Pulse Wave Velocity and Reflections on Late Systolic Ventricular Loading and Unloading (Abstract),
TS Phan, K Khaw, JKJ Li
Journal of the American Society of Hypertension, 9(4) JASH Link

A New Pressure-Waveform Derived Vascular Stiffness Index and Its Comparison to Pressure-Dependent Arterial Compliance (Abstract),
TS Phan, JKJ Li
Artery Research 8 (4), 128 Artery Research Link

A New Arterial Stiffness Index Permitting Isobaric Comparisons (Abstract),
TS Phan, K Khaw, JKJ Li
Artery Research 8 (4), 172 Artery Research Link

A New Method for Determining Nonlinear Pressure-Dependent Arterial Compliance in Relation to Hypertension (Abstract),
TS Phan, JKJ Li
Journal of the American Society of Hypertension, 8(8) JASH Link

Propagation of Uncertainty and Analysis of Signal-to-Noise in Nonlinear Compliance Estimations of an Arterial System Model,
TS Phan, JKJ Li IEEE Xplore Link
Information Sciences and Systems (CISS), 2014 48th Annual Conference on

Reduced-Order Nonlinear Arterial Compliance Parameter Estimation Under Vasoactive States,
TS Phan, JKJ Li IEEE Xplore Link
Signal Processing in Medicine and Biology Symposium (SPMB), 2013 IEEE

Conference Presentations

Talk: **Decreased Aortic Inertance Increases Susceptibility of Late-Systolic Left Ventricular Ejection to Arterial Wave Reflections,**
2016 North American Artery Sixth Annual Meeting, Chicago, IL

Talk, *NAA Early Investigator Award*: **Forward Wave Amplitude is Not Solely Dependent on Proximal Aortic Properties: Importance of Wave Reflections,**
2015 North American Artery Fifth Annual Meeting, Chicago, IL

Talk: **Forward And Backward Waves At The Aortic Root: Steady-State And Wave Re-Reflection Considerations,**
ARTERY 15, Krakow, Poland

Talk: **Inertial-Viscoelastic Minimal Model of the Arterial System Reconciles Arterial Compliance Estimations,**
ARTERY 15, Krakow, Poland

Talk: **A New Pressure-Waveform Derived Vascular Stiffness Index and Its Comparison to Pressure-Dependent Arterial Compliance,**
ARTERY 14, Maastricht, The Netherlands

Talk: **Blood Flow in Arteries: A Segue Through Channel Estimation,**
2014 48th Annual Conference on Information Sciences and Systems (CISS), Princeton University, NJ

Poster: **Acquisition of Time-Resolved Brachial Pressure Waveforms from Cuff-Based Pulse Volume Recordings,**
2017 American College of Cardiology (ACC) Scientific Meeting, Washington, DC

Poster: **Decreased Aortic Inertance is Independently Associated with Left Ventricular Hypertrophy: Role in Ventricular-Arterial Coupling,**
2017 American College of Cardiology (ACC) Scientific Meeting, Washington, DC

Poster: **Cardio-Femoral Vascular Index: A New Marker of Arterial Aging,**
2017 American College of Cardiology (ACC) Scientific Meeting, Washington, DC

Poster: **Heart-Femoral Pulse Wave Velocity is a Stronger Marker of Arterial Aging Than Carotid-Femoral Pulse Wave Velocity,**
2017 American College of Cardiology (ACC) Scientific Meeting, Washington, DC

Poster: **Augmentation Index is Blind to Early-Systolic Effects of Arterial Wave Reflections,**
2016 31th American Society of Hypertension (ASH) Annual Scientific Meeting, New York, NY

Poster: **Subject-Specific Pressure Waveforms Conditioned from Cuff-based Pulse Volume Recordings: Proof-of-Concept,**
2016 North American Artery Sixth Annual Meeting, Chicago, IL

Poster: **Aging is Associated with an Earlier Arrival of Reflected Waves Without a Distal Shift in Reflection Sites,**
2016 American Heart Association (AHA) Scientific Sessions, New Orleans, LA

Poster: **Integrating Increased Pulse Wave Velocity and Reflections on Late Systolic Ventricular Loading and Unloading,**
2015 30th American Society of Hypertension (ASH) Annual Scientific Meeting, New York, NY

Poster: **Wave (Re-)Reflection and Pulse Wave Velocity Determine Forward Wave Amplitude and Morphology,**
2015 30th American Society of Hypertension (ASH) Annual Scientific Meeting, New York, NY

Poster: **Reconciling the Increased Pulse Wave Velocity and Reflected Wave Transit Time Paradox,**
2015 North American Artery Fifth Annual Meeting, Chicago, IL

Poster: **"Impedance Matching" Between the Aorta and Large Muscular Arteries? Misinterpretation of Pulse Wave Velocity Gradients,**
2015 North American Artery Fifth Annual Meeting, Chicago, IL

Poster: **Independent Modifications to Backward and Forward Pressure Waves Lead to Non-Physiological Aortic Flow,**
2015 North American Artery Fifth Annual Meeting, Chicago, IL

Poster: **Evaluating the Logical Relationships of Reflected Wave Transit Time with the Complex Global Reflection Coefficient, Height, and Pulse Wave Velocity,**
2015 North American Artery Fifth Annual Meeting, Chicago, IL

Poster: **Role of Pressure-Dependent Arterial Compliance in Modulating the Phase of Wave Reflections: Implications for LV-AS Coupling,**
ARTERY 15, Krakow, Poland

Poster: **Arterial Wave Reflections: Looking Beyond the First Harmonic and Pressure Inflection Points to Assess Late-Systolic Ventricular Loading,**
ARTERY 15, Krakow, Poland

Poster: **Pressure-Dependent Arterial Compliance in Hypertension,**
2014 29th American Society of Hypertension (ASH) Annual Scientific Meeting, New York, NY

Poster: **A New Arterial Stiffness Index Permitting Isobaric Comparisons,**
2014 North American Artery Fourth Annual Meeting, Chicago, IL

Poster: **Nonlinear Arterial Compliance Dynamically Loads the Heart,**
2013 IEEE Signal Processing in Medicine and Biology Symposium (SPMB), New York University, NY

Skills

Software: Python, C++14, MATLAB, Java, Kotlin, Docker, Vagrant, Terraform, Telegraf, InfluxDB, Chronograf, Kapacitor, Grafana, BentoML, Data Version Control (DVC), BIOPAC, Autodesk Fusion 360

Data Analysis Stack: statsmodels (Python), scikit-learn (Python), pandas (Python), SciPy (Python), NumPy (Python), matplotlib/seaborn (Python), Keras (Python), STATA, SPSS

Engineering: Cardiovascular Biomechanics, Transport Phenomena, Control Systems, Signal Processing, Machine Learning (Pattern Recognition), Analog & Digital Electronics