Doctor *honoris causa*

Jagat Narula

Universitat Autònoma de Barcelona

Doctor *honoris causa*

JAGAT NARULA

Discurs llegit
a la cerimònia d'investidura
celebrada a l'Aula Magna
de la Casa de Convalescència de Barcelona,
el dia 1 de setembre
de l'any 2017

UAB
Universitat Autònoma de Barcelona

Índex

PRESENTACIÓ
DE
JAGAT NARULA
PER
IGNASI CARRIÓ GASSET

Jagat Narula, el científic i l'home

Jagat Narula, nascut el 16 de juliol de 1956 a Ajmer (Índia), és una de les figures més rellevants del món en l'àrea de les ciències cardiovasculars i en particular en l'àmbit de la utilització de les tecnologies d'imatge en cardiologia. La seva impressionant trajectòria comença quan completa la seva formació en cardiologia, que inclou un doctorat en immunologia cardiovascular a l'All India Institute of Medical Sciences de Delhi. El 1989 es va traslladar al Massachusetts General Hospital (MGH) i a la Harvard Medical School, on va realitzar postdoctorats en cardiologia, insuficiència cardíaca, trasplantament i cardiologia nuclear, i va entrar a formar part del cos de professors de cardiologia.

El 1997, es va traslladar a la Hahnemann University School of Medicine de Filadèlfia, on va ser professor de medicina «Thomas J. Vischer», cap de la Divisió de Cardiologia, sotsdirector del Departament de Medicina Interna i director del Centre d'Insuficiència Cardíaca i Trasplantament. A continuació, el 2003, va anar a la Irvine School of Medicine de la Universitat de Califòrnia com a cap de la Divisió de Cardiologia, degà adjunt per a Recerca i director del Centre Cardiovascular del Douglas Hospital de la Universitat de Califòrnia a Irvine. També va ser director del Memorial Heart & Vascular Institute i del Long Beach Memorial Hospital, i director mèdic de l'Edwards Lifesciences Center for Advanced Cardiovas-

cular Technology a la Henry Samueli School of Engineering de la Universitat de Califòrnia a Irvine.

A continuació es va traslladar a Nova York, on és professor de Medicina «Philip J. and Harriet L. Goodhart», cap de la Divisió de Cardiologia i director del Programa d'Imatge Cardiovascular a l'Institut Cardiovascular «Zena and Michael A. Wiener» del Mount Sinai i al Centre «Marie-Josée and Henry R. Kravis» de Salut Cardiovascular. És també degà adjunt de Salut Mundial a la Mount Sinai School of Medicine.

El Dr. Narula és reconegut com un científic que combina de manera única la patologia subcel·lular i molecular amb les tecnologies d'imatge, amb la capacitat translacional de portar la seva recerca a la clínica en l'àmbit de la insuficiència cardíaca i les plaques d'arteriosclerosi d'alt risc tot desenvolupant noves estratègies de prevenció de les malalties cardiovasculars i la promoció de la salut cardiovascular, tant en els països desenvolupats com en els que estan en vies de desenvolupament.

El Dr. Narula ha fet contribucions científiques de gran nivell en les àrees de l'apoptosi del múscul cardíac en la insuficiència cardíaca i en les plaques d'arteriosclerosi susceptibles de ruptura i de produir un episodi cardíac agut. En aquestes àrees, ha portat la seva recerca bàsica a la clínica per tal de definir la seva aplicabilitat en l'àmbit comunitari. Així mateix, ha estat convidat a pronunciar nombroses conferències arreu del món.

El Dr. Narula és l'editor en cap del *Journal of American College of Cardiology: Cardiovascular Imaging*, revista que sota la seva direcció ha obtingut un gran factor d'impacte (7.815, WOS 2015). També és l'editor en cap de *Global Heart* (la revista oficial de la World Heart Federation). D'altra banda, està activament involucrat en nombrosos programes de prevenció, com ara el HAPPY (Heart Attack Prevention

Program for You). Per la seva experiència en medicina global, és membre del consell assessor per a la prevenció global de malalties cardiovasculars de l'Institute of Medicine de les National Academies of Sciences.

Si repassem el seu currículum de publicacions, ens en sorprèn no solament el nombre sinó també la gran qualitat d'aquestes. La seva recerca ha estat finançada en part per beques del National Institute of Health. El Dr. Narula és reconegut com un autèntic científic «translacional» i és un dels infreqüents investigadors que han publicat en les millors revistes de ciència bàsica i en les millors de ciència clínica, com ara *Science*, *Nature Medicine*, *Proceedings of the National Academy of Sciences*, *New England Journal of Medicine*, *Lancet*, *Circulation* i *Journal of the American College of Cardiology*. Té més de mil publicacions originals i més de trenta-cinc llibres editats. L'any 2012, el Dr. Narula va ser nomenat Best Educator i també Innovator in Cardiovascular Medicine per l'American College of Cardiology, i el març de 2013, Master of the American College of Cardiology.

La relació del Departament de Medicina amb el professor Jagat Narula va començar el gener de 1997, quan col·laboràvem amb ell en el desenvolupament d'anticossos monoclonals antimiosina per visualitzar *in vivo* el dany miocardíac, i va venir a fer una estada de tres mesos a Barcelona com a professor visitant. Des d'aleshores contínuament visita Barcelona, com es pot veure amb més detall en el seu CV, i ha tingut becaris nostres que han anat a formar-se amb ell i que com a resultat han llegit la seva tesi doctoral. En són un exemple:

Mireia Puig. 1998. «Apoptosis in Cardiac Transplant Rejection».

Vicens Brossa. 1999. «Noninvasive Assessment of Efficacy of Immunosupp-ressive Agents in Cardiac Transplant Rejection».

Albert Flotats. 2002. «Antimyosin antibodies and myocardial damage in HIV».

Carina Marí. 2000–2001. «Somatostatin Receptor Imaging for Prediction of Cardiac Transplant Rejection».

Chiara Gaeta. 2011–2012. «Imaging methods of glucose metabolism in the myocardium».

Les col·laboracions del nostre departament amb el Dr. Narula han donat lloc a diverses publicacions conjuntes i múltiples presentacions en congressos (vegeu el CV del Dr. Narula). Per exemple:

1. Lamich, R.; Ballester, M.; Brossa, V.; Aymat, R.; Martí, V.; Carrió, I.; Bernà, L.; Puig, M.; Campreciós, M.; Estorch, M.; Flotats, A.; Bordes, R.; Garcia, J.; Augè, J. M.; Padró, J. M.; Caralps, J. M.; **Narula J.** «Efficacy of augmented immunosuppressive therapy for early vasculopathy in heart transplantation». *J Am Coll Cardiol* 32 (1998): 413–9.

2. Ballester, M.; Bordes, R.; Tazelaar, H. D.; Carrió, I.; Marrugat, J.; **Narula, J.;** Billingham, M. E. «An evaluation of biopsy classification for rejection: relationship to the detection of myocardial damage by monoclonal antimyosin antibody imaging». *J Am Coll Cardiol* 31(1998): 1.357–61.

3. Estorch, M.; Camprecios, M.; Flotats, A.; Mari, C.; Berna, L.; Catafau, A. M.; Ballester, M.; **Narula, J.;** Carrio, I. «Sympathetic reinnervation of cardiac allografts evaluated by ^{123}I-MIBG imaging». *J Nucl Med* 40 (1999): 911–6.

4. Estorch, M.; Serra-Grima, R.; Flotats, A.; Mari, C.; Berna, L.; Catafau, A.; Martín, J. C.; Tembl, A.; **Narula, J.;** Carrió, I. «Myocardial sympathetic innervation in the athlete's sinus bradycardia: is there selective inferior myocardial wall denervation? *J Nucl Cardiol* 7 (2000): 354–8.

5. Puig, M.; Ballester, M.; Matías-Guiu, X.; Bordes, R.; Carrió, I.; Aymat, M. R.; Marrugat, J.; Padró, J. M.; Caralps, J. M.; **Narula, J.** «Burden of myocardial damage in cardiac allograft rejection: scintigraphic evidence of myocardial injury and histologic evidence of myocyte necrosis and apoptosis». *J Nucl Cardiol* 7 (2000): 132–9.

6. Estorch, M.; Serra, R.; Flotats, A.; Berna, L.; Catafu, A.; Martín, J. C.; Tembl, A.; **Narula, J.;** Carrió, I. «Myocardial sympathetic innervation in the athlete's sinus bradycardia: is there selective inferior myocardial wall denervation? *J Nucl Cardiol* 7 (2000): 354–8.

7. Aparici, C. M.; **Narula, J.;** Puig, M.; Campreciós, M.; Flotats, A.; Estorch, M.; Catafu, A. M.; Ballester, M.; Carrió, I. «Somatostatin receptor scintigraphy predicts impending cardiac allograft rejection before endomyocardial biopsy». *Eur J Nucl Med*. 27 (2000): 1.754–9.

8. Pons-Lladó, G.; Ballester, M.; Carrió, I.; Borrás, X.; Carreras, F.; López-Contreras, J.; Roca-Cusachs, A.; **Narula, J.** «The increasing degrees of left ventricular hypertrophy in hypertension determine the severity of myocardial damage». *J Am Coll Cardiol* 36 (2000): 2.198–203.

9. Estorch, M.; **Narula, J.;** Flotats, A.; Catafu, A. M.; Tembl, M.; Serra-Grima, R.; Carrió, I. «Concordance between rest MIBG and exercise tetrofosmin defects: possible use of rest MIBG imaging as a marker of reversible ischaemia». *Eur J Nucl Med* 28 (2001): 614–9.

10. Torrent-Guasp, F.; Ballester, M.; Buckberg, G. D.; Carreras, F.; Flotats, A.; Carrió, I.; Ferreira, A.; Samuels, L. E.; **Narula, J.** «Spatial orientation of the ventricular muscle band: physiologic contribution and surgical implications». *J Thorac Cardiovasc Surg* 122 (2001): 389–92.

11. Flotats, A.; Ballester, M.; Carrió, I.; Farreira, A.; Torrent-Guasp, F.; **Narula, J.** «Phase analysis of the activation sequence from the first pass and radionuclide ventriculographic study confirm spatial disposition of ventricular myocardial band». *J Nucl Cardiol* 9 (2002): 104–9.

12. Martín, M. E.; Moya-Mur, J. L.; Casanova, M.; Crespo-Díez, A.; Asín-Cardiel, E.; Castro-Beiras, J. M.; Díez-Jiménez, L.; Ballester, M.; Carrió, I.; **Narula, J.** «Role of noninvasive antimyosin imaging in infants and children with clinically suspected miocarditis». *J Nucl Med* 45 (2004): 429–37.

13. Estorch, M.; Carrió, I.; Mena, E.; Flotats, A.; Camacho, V.; Fuertes, J.; Kulisewsky, J.; **Narula, J**. «Challenging the neuronal MIBG uptake by pharmacological intervention: effect of a single dose of oral amitriptyline on regional cardiac MIBG uptake». *Eur J Nucl Med Mol Imaging* 31 (2004): 1.575–80.

14. Ballester-Rodes, M., Flotats, A.; Torrent-Guasp, F.; Carrió-Gasset, I.; Ballester-Alomar, M.; Carreras, F.; Ferreira, A.; **Narula, J**. «The sequence of regional ventricular motion». *Eur J Cardiothorac Surg* 29 (2006): S139–44.

Aquestes activitats de recerca condueixen a millorar la caracterització molecular i funcional de diferents estats patològics cardiovasculars mitjançant tecnologies d'imatge, com ara PET, TAC, RM i altres, a investigar la interacció de substàncies biològiques i drogues amb els seus receptors, i a investigar el benefici de noves modalitats terapèutiques mitjançant les tecnologies d'imatge molecular.

1. Investigació de la patologia, patogènesi i mecanismes moleculars de l'erosió i ruptura de les plaques d'arteriosclerosi, desenvolupant noves tecnologies d'imatge per identificar les plaques de risc amb CT, PET, imatge intracoronària i nous mètodes d'imatge

molecular, desenvolupant algoritmes d'estratificació de risc per als pacients susceptibles de patir esdeveniments cardiovasculars aguts.

2. Investigació dels fenòmens que porten al suïcidi cel·lular (apoptosi) en la progressió de la insuficiència cardíaca desenvolupant noves tecnologies d'imatge per visualitzar *in vivo* la cascada apoptòtica, la necrosi i la fibrosi intersticial durant el procés de remodelació adversa.

Des de Nova York, el professor Jagat Narula manté un contacte viu i constant amb tots els seus exbecaris i col·laboradors, així com un contacte continuat amb el nostre departament i serveis hospitalaris. Això fa que per a nosaltres hagi estat fàcil d'establir des d'aquí una línia de col·laboració fructífera amb ell i el seu grup, que ha donat lloc a publicacions, tesis doctorals, beques d'organismes oficials i múltiples intercanvis personals. Aquesta col·laboració entre ambdós departaments universitaris continuarà en el futur amb la mateixa intensitat i resultats.

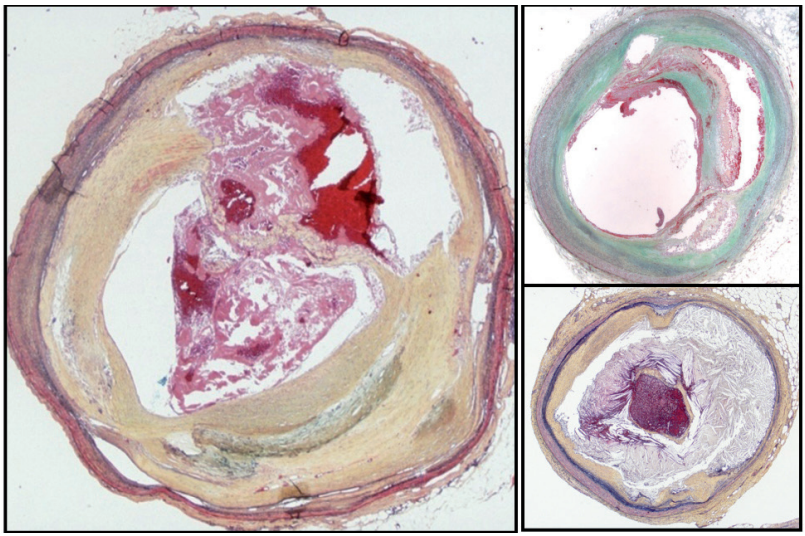
Les principals qualitats humanes del Dr. Jagat Narula són la intel·ligència, la cultura i la sensibilitat per escoltar i apreciar la diversitat, i el talent per estimular la recerca d'altres. Aquestes qualitats, juntament amb la tenacitat i una extraordinària capacitat de treball, l'han fet un líder indiscutible en l'àmbit de la cardiologia. Al seu entorn ha sorgit una escola que ha produït investigadors i col·laboradors escampats arreu del món. És per tot això que tinc el plaer, l'honor i el privilegi de demanar a la Rectora Magnífica de la Universitat Autònoma de Barcelona que s'atorgui el grau de doctor *honoris causa* al senyor Jagat Narula.

DISCURS
DE
JAGAT NARULA

Can we eliminate coronary disease in our lifetime?

Jagat Narula MD, PHD, MACC
Philip J. & Harriet L. Professor Chair of Cardiology
Icahn School of Medicine at Mount Sinai, New York

Coronary artery disease continues to be the most important cause of mortality across the world both for men and women. Although the health systems have not paid much attention to noncommunicable disease prevention and health promotion, acute coronary events sustained by some very prominent personalities have frequently brought this problem into focus and highlighted the need for a concerted effort from the community. It is reasonably well established that the heart attacks or sudden coronary death results from disruption of atherosclerotic plaques in the coronary arteries and that the high-risk plaques have distinct pathological characteristics. These features include large lipid-rich plaques that are covered only by a thin and inflamed fibrous caps that are susceptible to rupture. Rupture of these thin fibrous caps brings the luminal blood into contact with thrombogenic lipid-rich cores resulting in formation of luminal clot and heart attacks or sudden death. It has been proposed that identification of such plaques should allow interventional measures and hence could prevent occurrence of acute events.



Characteristics of atherosclerotic plaques that result in acute events. Culprit plaques from 3 victims of sudden cardiac death. They show same pathological signatures with large lipid areas, and thin inflamed fibrous caps. The lumens are not always necessarily compromised even in the presence of large necrotic enclosures. Large lipid cores can be accommodated by the outward expansion of the plaque (positive remodeling). It is only after substantial occupation of the cross-sectional vascular area that the luminal encroachment starts. That's why sudden deat or heart attacks might be the first manifestation of the coronary involvement in subjects with luminally unobstructive disease.

Framingham Heart Study demonstrated a close association between certain clinical and biochemical parameters and heart attacks. These factors were termed *risk factors*. There is a directly proportional relationship between the risk factors and the disease and resolution of risk factors diminishes the risk of an event. INTERHEART study of 27K subjects confirmed that the risk factors explain more than 90% of the risk for an adverse event. These risk factors include high cholesterol, smoking, high blood pressure, diabetes, obesity and mental stress, whereas the protection is afforded by substantial consumption of fruits and vegetables, physical activity and modest alcohol use. The risk factors were universally applicable in all countries and continents and demonstrated similar hazard ratios for the disease causation.

RF	Cholesterol	Smoking	High BP	Diabetes	Obesity	Stress	Vegetables /Fruit	Alcohol	Physical Activity
OR	3.25	2.37	1.91	2.37	1.12	2.67	-0.7	-0.86	-0.91
PAR	49.2	35.7	17.2	9.9	20.1	32.5	13.7	12.2	6.7

Interheart study identified the risk factor (RF) relationship to heart attacks in a case-control stdy with odds ratios (OR); population attributable risk (PAR) are calculated

Since these risk factors are predominantly considered a curse of modernization it was hypothesized that the disease should not have existed 3-4 millennia ago. With this expectation vascular calcification was explored in a large number of Egyptian mummies. Contrary to expectations, one-thirds of the mummies had evidence of vascular calcification. Only the Egyptian elites underwent this mummification process, who lived sedentary life as they were carried around in palanquins. They consumed goat meat frequently and feasted on eggs. To evaluate other populations, we diverted our attention to Peruvian mummies from Andes foothills which have been preserved naturally for over 1000 years. This population although was physically active and consumed either vegetarian diet or relatively leaner alpaca meat, showed evidence of large vessel calcification in little less than 25% of mummies imaged. The atherosclerosis was seen in women and those autopsied revealed black lungs confirming exposure to abundant firewood smoke during cooking. Other more recent mummies of hunter gatherer tribes from Aleutian Island and southeast Utah, which were physically very active and accustomed to frugal dietary pattern showed extensive coronary calcification owing to entrapped smoke from the indoor firewood lit for warmth within their subterranean houses. These studies spanning to about 4000 years ago demonstrated the evidence of disease secondary to exposure to risk factors.

Imaging of Mummies for Evaluation of Vascular Calcification and Atherosclerosis: Since atherosclerosis is considered the disease of modernization, it was hypothesized that vascular calcification should not be found in mummies. However, 34% of Egyptian mummies showed an evidence of atherosclerosis that could be attributed to their life style.

We evaluated naturally mummified remains of the Peruvian (circa 1000 CE) and also Unagan hunter-gatherers (circa 1750) where arterial calcification was seen almost to the same extent. Although they were physically active and consumed much healthier diets, they were exposed to significant quantities of firewood smoke or indoor smoke, respectively. Peruvian mummies with atherosclerosis also demonstrated black lungs alluding the side-effects of smoking.

In our subsequent study, we did a cross-sectional cohort coronary artery calcium scoring study in Tsimane tribe (a forager-horticulturalist population of the Bolivian Amazon) aged 40 years or older. We assessed the difference between the Tsimane and participants from the Multi-Ethnic Study of Atherosclerosis (MESA), wherein calcium scores higher than 100 were considered representative of significant atherosclerotic disease. More than 85% of Tsimane had no coronary calcium, and only 3% had calcium scores higher than 100. Tsimane men and women had low cholesterol levels, and obesity, hypertension, high blood sugar, and cigarette smoking were rare. This is the lowest ever reported prevalence of coronary disease even though the tribal had high levels of

inflammatory markers. These findings suggested that coronary atherosclerosis can be avoided in most people by achieving a lifetime with very low LDL, low blood pressure, low glucose, normal body-mass index, no smoking, and plenty of physical activity.

Living Tsimane Population with the Least Atherosclerotic Burden. The Hunntergatherers of Bolivian Jungles, is physically active (15-17K steps/day), nonsmoking population with lifetime LDL cholesterol of <70mg/dl, sugar <80mg/dl and systolic blood pressure of 110mmHg.

Although widespread statin use has demonstrated a significant decline in mortality from coronary disease, it is believed that we would need even stricter control of cholesterol epidemic to conquer the coronary artery disease epidemic. The newer drugs have allowed us the capa-

bility to lower the LDL cholesterol levels to what we were born with. A lifetime low cholesterol levels combined with low blood pressure, avoidance of diabetes and smoking, and intense physical activity should help eliminate the most dreaded scourge.

The control of cholesterol and other risk factors may also have significant bearing on other noncommunicable diseases as well. It has been suggested that the coronary risk factors are closely associated with development of Alzheimer's Disease. Recently, the brain imaging was performed for the assessment of amyloid deposition in brain (suggestive of degenerative brain disease). Mid-life abundance of risk factors including hypercholesterolemia, diabetes, hypertension, smoking and obesity determined higher likelihood of amyloid deposition 2 decades later; the correlation persisted even after normalizing for genetic basis of Alzheimer's disease. Similarly, use of statins has been demonstrated to be directly related to lower incidence of malignancies. The experimental data suggest that the cholesterol metabolite 27-hydroxy cholesterol promotes the breast tumor growth in mice. 27-hydroxy cholesterol has been demonstrated to bind to estrogen receptor and its antagonist is equally effective as inhibition of estrogen receptors. Similarly, in clinical scenario, circulating 27-hydroxy cholesterol levels are higher in patients with breast tumor recurrence.

Heart Healthy in the Amazon; New York Times, April 6, 2017.

Learning from Our Parents' Heart Healthy Mistakes; New York Times, April 10, 2017.

It is imperative that we pay attention to lifestyle and behavioral modification. We must lay the foundation for a healthier planet and leave a disease-free world for our grandchildren.

CURRICULUM VITAE
DE
JAGAT NARULA

JAGAT NARULA MD, DM, PhD, MACC, FRCP

Philip J. and Harriet L. Goodhart Chair of Cardiology
Chief, Divisions of Cardiology, Mount Sinai West & St. Luke's Hospitals
Professor of Medicine and Radiology, Icahn School of Medicine at Mount Sinai
Associate Dean, Arnhold Institute for Global Health at Mount Sinai
Executive Editor, Journal of the American College of Cardiology
Editor-in-Chief, Journal of the American College of Cardiology-Cardiovascular Imaging
Editor-in-Chief, Global Heart (The World Heart Federation)
Executive Editor, Annals of Global Health

1. EDUCATION:

- Medical School, SMS Medical College, Jaipur, India, 1978
- Residency, Internal Medicine, SMS Medical College, Jaipur, India, 1983
- Fellowship, Cardiology, All India Institute of Medical Sciences, Delhi, India, 1986
- PhD, CV Immunology, All India Institute of Medical Sciences, Delhi, India; Completed 1989, defended 1994
- Fellowship, Cardiology, Massachusetts General Hospital, Harvard Medical School, Boston, 1991
- Fellowship, Radiology, Massachusetts General Hospital, Boston, 1994
- Fellowship, Heart Failure & Transplantation, Massachusetts General, Harvard Medical School, Boston, 1996

2. APPOINTMENTS:

- Assistant Professor of Cardiology, and Director, Center for Advanced Research in Rheumatic Fever & Rheumatic Heart Disease, All India Institute of Medical Sciences, Delhi, until 1991
- Clinical Assistant in Medicine (Cardiology), Massachusetts General Hospital; Instructor in Medicne, Harvard Medical School, Boston, until 1997
- Thomas J. Vischer Professor of Medicine; Chief, Division of Cardiology; Vice-Chairman, Department of Internal Medicine for Resaerch; Director, Heart Failure & Transplantation Center, Hahnemann University Hospital, Drexel University College of Medicine, Philadelphia, until 2003.
- Professor of Medicine; Chief, Division of Cardiology; Associate Dean for Research, Director, Cardiovascular Center- UCI Douglas Hospital; Director, Memorial Heart & Vascular Institute-Long Beach Memorial Hospital; Medical Director, Edwards Lifesciences Center for Advanced CV Technology, University of California- Irvine, until 2011.
- CURRENT APPOINTMENT: Philip J. and Harriet L. Chair in Cardiovascular Medicine, Chief, Divisions of Cardiology- Mount Sinai West & St. Luke's Hospitals; Professor of Medicine and Radiology, Icahn School of Medicine at Mount Sinai; Associate Dean, Arnhold Institute for Global Health at Mount Sinai; Director, Cardiovascular Imaging Program, Mount Sinai Health System

3. RESEARCH CONTRIBUTIONS:

- Prevention of acute coronary events: From bench to bedside to population. Pathology, pathogenesis and molecular mechanisms of the plaque rupture and plaque erosion underlying acute coronary events, developing novel imaging techniques for identification of high-risk plaques by CT angiographic investigation, intracoronary imaging and molecular imaging, developing algorithms for risk stratification of asymptomatic subjects susceptible to coronary events, initiation of numerous population-based prevention programs for acute coronary events including HAPPY [Heart Attack Prevention Program for You], and unique global collaborative projects addressing the risk factors and pathogenesis

of atherosclerosis icluding HORUS initiative [imaging mummies and ancient humans].

- Description of the phenomenon of heart muscle cell suicide (or apoptosis) in progression of heart failure, development of imaging techniques targeting myocardial apoptosis, autoschizis, necrosis and interstitial fibrosis during evolution of adverse cardiac remodeling.
- Funded, in part, by the grants from National Institutes of Health
- Considered to be a true translationist with a distinction of publishing in the best basic science and the best clinical journals including Science, Nature (Medicine), PNAS, New England Journal of Medicine and Lancet.
- Contributed >700 original research publications and 500 presentations, with editor of 50 books or journal supplements.

4. EDITORIAL RESPONSIBILITIES:

- Executive Editor of the Journal of American College of Cardiology 2014-2019.
- Editor-in-chief of the Journal of American College of Cardiology-Cardiovascular Imaging 2007-2017.
- Editor-in-Chief of 'Global Heart' (official publication of World Heart Federation), 2011-2020.
- Founder editor of the Heart Failure Clinics of North America, 2005-2007.
- Co-editor-in-chief of the Hurst's The Heart, 14th edition, 2017.

5. LEADERSHIP ROLES:

- Board of Trustees, American College of Cardiology, 2015-2020
- Chairman, Science, Policy and Advocacy Committee, World Heart Federation, 2015-2020
- Advisory Board; Institute of Medicine (National Academies of Sciences, USA) Global Prevention of Cardiovascular Diseases, 2009
- President, Orange County Chapter, American Heart Association, 2008-2010; Chaired(ing) numerous committees of the American College of Cardiology, since 2008.

6. RECENT AWARDS:

- Maseri-Florio International Lecture, American College of Cardiology 2016
- Agatsoton Award of the Society of Cardiovascular Computed Tomography, 2016
- Distinguished Scientist Award (Translational Domain), American College of Cardiology 2015
- Master of the American Society of Nuclear Cardiology 2014
- Paul Wood Award, National Heart, Lung Institute, UK 2014, Imperial College, London
- Mario Verani Oration of the American Society of Nuclear Cardiology, 2014, Boston
- Howard Morgan Award for Distinguished Achievements in Cardiovascular Research, International Academy of
- Cardiovascular Sciences, 2014, Winnipeg, Canada
- Harold Buchwald Distinguished Oration, Cardiovascular Forum for Promoting Centres of Excellence and
- Young Investigators, 2014, Winnipeg, Canada
- Anand & Saroj Aggarwal Endowed Lectureship for South Asian Heart Health, Ottawa Heart Institute 2014
- Featured: Roberts WC. A conversation with the editor. *Am J Cardiol*. 2014;113(12):2070-85. PMID: 24878131
- Master of the American College of Cardiology 2013
- Innovators of the Cardiovascular Medicine (American College of Cardiology) 2012
- Gifted Educator Award (American College of Cardiology) 2012
- American Heart Association, Orange County Distinguished Scientist Award, 2011
- James Seward & Jamil Tajik Award for Excellence in Cardiovascular Imaging, Mayo Clinic, Rochester, 2010
- Einthoven Medal for contribution to Cardiovascular Imaging Leiden, the Netherlands, 2009
- Honor of the City of Maastricht, the Netherlands by the Mayor of the City, for contributions to
- Heart Health of the City, 2008
- Awarded as the best young investigator on several occasions for research contributions in the field of cardiovascular imaging.
- More than 35 young investigator awards have been won by my mentees

Visiting Professorships:

Apr 2017	Orgeon Health Sciences University, Portland, OR
Apr 2016	University of Chicago School of Medicine, Chicago, IL
Mar 2016	Weill Cornell Medicine, Internal Medicine, New York, NY
May 2016	Weill Cornell Medicine, Cardiology, New York, NY
Nov 2015-Oct 2017	Hon. Professor, Public Health Foundation of India
May 2015	MD Anderson Cancer Center, Houston, TX
May 2015	Henry Ford Medical Center, Detroit
May 2015	Stony Brook Medicine, Heart Institute, Hauppauge, NY
Apr 2015	Duke University School of Medicine, Durham, NC
Feb 2015	George Washington University Heart & Vascular Institute Washington DC
May 2014	University of Virginia, Charlottesville, VA
May 2014	University of Maryland School of Medicine, Baltimore, MD
April 2014	Christ Medical Center, Chicago
Jan 2014	New York University School of Medicine, New York, NY
Oct 2013	Brigham & Women's Hospital & Harvard Medical School Boston, MA
June 2013	Mayo Clinic Rochester, MN

Oct 2011	University of Texas, Houston, TX James T. Willerson Distinguished Professor
Jun 2011	University of California, Irvine, CA, Graduation Speaker Ralph J. Cicerone Distinguished Professor
May 2011	Columbia University, College of Physicians and Surgeons New York, NY
Feb 2011	Cleveland Clinic Foundation, Cleveland
Sep 2010	Mayo Clinic, Rochester, MN
Sep 2010	All India Institute of Medical Sciences, Delhi, India
May 2010	Massachusetts General Hospital, Boston, MA
Jun 2009	University of California, Davis, CA
Jun 2009	University of British Columbia, Vancuver, BC
Mar 2009	Northwestern University, Chicago, IL
Jan 2009	Leiden University Medical Center, Leiden, The Netherlands
Dec 2008	SMS Medical College, Jaipur, India
Nov 2008	Post-Graduate Institute of Education & Research Chandigarh, India
Feb 2007	Yale University School of Medicine, New Haven, CT
Jan 2007	Columbia University College of Physicians and Surgeons New York, NY
Dec 2006	*Molecular Imaging Program at Stanford (MIPS)* Stanford University School of Medicine, Stanford

Apr 2006	Massachusetts General Hospital, Boston
Apr 2006	University of Maryland, Baltimore
Jun 2004-Sep 2005	University of Maastricht, the Netherlands *Hein JJ Wellens Distinguished Professo*r
Nov 2005	Fujita University of Health Sciences Toyoaki, Japan
Apr 2004	The University of Toronto, Toronto, Canada Heart & Stroke Foundation Professor
Apr 2004	University of Toronto, Toronto, Canada *Merck-Frost Distinguished Visiting Professo*r
Jul 2004	*Distinguished Braun Professor* University of California, Los Angeles
Oct 2004	University of California, San Diego
Oct 2004	Mayo Clinic Foundation, Rochester
Sep 2003	University of Arkansas Medical Centre, Little Rock, AR
Sep 2003	University of Alabama Medical Centre, Birmingham, AL
Jan 2003	*Joint Program in Nuclear Medicine* Harvard Medical School, Boston
Jan 2003	Rush-Presbyterian-St. Luke's Medical Centre, Chicago, IL
Dec 2002	Academic University of Maastricht, The Netherlands
Oct 2002	University of Minnesota School of Medicine Minneapolis VA Hospital, Minneapolis

Dec 2001	Triviglio Hospital, University of Bergamo, Treviglio, Italy
Dec 2001	Ospedale M. Bufalini, Cesena, Italy *Bufalini Distinguished Visiting Professor*
Nov 2001	University of Michigan, Ann Arbor, MI
Jul 2001	University of Texas Medical Branch, Galvastone, TX
Sep 2000	University of Arkansas Medical Centre, Little Rock, AR
Oct 1999	Weill Medical College, Cornell University, New York *Howard Gilman Foundation Distinguished Visiting Professor*
Apr 1999	University of Virginia School of Medicine, Charlottesville, VA
Feb 1997-Apr 1997	Autonomous University of Barcelona and Sant Pau Hospital Barcelona, Spain

Grant Support, Contracts and Research Awards

07/20/12-04/30/17	NIH/NHLBI R01 HL 115150 PI: James Min (Weill Cornell Medical College) [Role: Jagat Narula, Co-Investigator] Gender-Specific Plaque Characteristics and Risk of Myocardial Infarction
09/08/14-08/31/15	NIH R43 HL122012-01A1 Primary Awardee: Rubicon Biotechnology, Los Angeles Total Cost $74,000 [Role: Jagat Narula, Scientific PI; sub-awardee] *Intracellular Targeting Hsp70 for myocardial cyto-protection after infarction*

09/08/14-08/31/15	NHLBI HHS-N268201400043C; SBIR Topic 85 Phase I Primary Awardee: Molecular Targeting Technology Menlo Park, PA Total Cost $73,421 [Role: Jagat Narula, Scientific PI; sub-awardee] *PE-Specific Molecular Imaging to Detect High Risk Atherosclerotic Plaque*
09/08/14–08/31/15 Pending	1 R43 HL127892-01 Primary Awardee: Molecular Targeting Technology Menlo Park, PA Total Cost $74,000 [Role: Jagat Narula, Scientific PI; sub-awardee] *A PE-specific SPECT probe for the early detection of cancer treatment-induced cardiotoxicity*
01/01/10-12/31/14	NIH RO1 EB010090-01 PI: Zongping Chen, University of California, Irvine Direct Cost $2,176,372 [Role: Jagat Narula, Co-Investigator] *Integrated multi-modality IVUS imaging system*
Pending	AN # 3689990 RO-1 [PI: Jagat Narula] Submitted April 16, 2014 *Cardioprotective role of minocycline in patients with STEMI and NSTEMI undergoing PCI* Being resubmitted in December 2014
Pending	AN # 3689956 RO-1 [PI: Jagat Narula] Submitted April 16, 2014 *Evaluation of LV Dynamics for Optimizing Mitral Valve Repair* Being resubmitted in December 2014
12/01/14-11/30/17	# 0249- 2258GCO/ 14-0701/AstraZeneca TAN-SNIP [TransAtlantic Network to Study step-wise Noninvasive

	Imaging as a tool for cardiovascular prognosis and Prevention] [PI: Valentin Fuster; Site PI Project 3: Jagat Narula] Total cost $5,400,000
07/01/14-06/30/17	AHA 14-FRN20490315/0266-2723GCO HARLEM Project Center for Strategically Focused Prevention Research Network [PI: Valentin Fuster; Role: Jagat Narula, Co-I, Mentorship] Total cost $3,700,000
Pending	Investigator Initiated Study; AstraZeneca PLATELET: A systembased PLAtelet Transcriptome and intracoronary imaging study for Learning Efficacy of Ticagrelor [Co-PIs Jagat Narula & Annapoorna Kini] Total cost $ 4,700,000
Pending	Investigator Initiated Study; AstraZeneca PERADAM: Plaque ERosion in Acute MI Diagnosis and Management [Co-PIs Jagat Narula & Amir Lerman Kini] Total cost $ 2,400,000
05/01/11-	Philips Healthcare Grants [PI: Jagat Narula] SEEING IS BELIEVING Medical Education 40 Hahnd-Held Units to be loaned to Sinai [pending]
	Exhibit B-19: PETMR added value in carotid high-risk plaque patients,$28,000
	Exhibit B-23: Assessment of LVF in Non-ischemic mitral regurgitation using Speckle Tracking, $120,000 & iE33

	Exhibit B-29 Investigate Relationship between the extent of CV disease and the onset of Alzheimer Disease using PET-MR, $100,000 Exhibit B-30: CV disease and the onset of Alzheimer Disease using PET-MR-Plaqueview Tool, $25,000 Exhibit B-32: Bioimage Two ultrasound & $90,000 for Coordinator (Pending) Exhibit B-33: Heart to Head $130,000 & One Epiq ultrasound (pending)
09/01/12-06/30/14	GE Healthcare Grants [PI: Jagat Narula] SEEING IS BELIEVING Medical Education and Residency Training 80 Hahnd-Held Units loaned to Sinai
01/25/12-	Panasonic Healthcare Grants [PI: Jagat Narula] Rapid Screening for Subclinical Atherosclerosis by Carotid Ultrasound Examination: The HAPPY Sub-study Risk Factor Assessment in Tsimane Bolivian population
10/01/04-09/30/09	NIH/NHLBI R01 HL 078681 Direct Cost $1000,000 [PI: Jagat Narula] Targeting MMPs to image atherosclerosis
12/01/01–11/30/07	NIH/NHLBI RO1 HL 68657 (Jagat Narula) Direct Cost $750,000 [PI: Jagat Narula]

	Imaging Apoptosis to Detect Unstable Atherosclerotic Plaque
12/01/04–11/30/07	NIH 5 R01 HL075038 PI: Dennis McNamara; University of Pittsburgh, Direct Subcontract Cost: $15,500 ($887.5/patient×10) [Co-I: Jagat Narula] *Genetic Modulation of LV Recovery in* Recent *Onset Cardiomyopathy*
11/01/05–10/31/08	TOSHIBA Unrestricted educational Grant University of California Irvine [PI: Jagat Narula] Direct Cost $1,500,000 (For 3 Years) Detection of Vulnerable Plaques (e-APP) # 879 (Jagat Narula) *Heart Attack Prevention Program for You (HAPPY): Cohort Study for Possible Prevention of Acute Coronary Events* (e-APP) # 259 (Jagat Narula) *The Effect of a low carbohydrate, FAt BUrning diet on Life-Style For Overweight Under Statin (FABULOUS) Protection*
03/01/09–02/28/10	Investigator-Initiated Grant, Clear Vascular, Inc. [PI: Jagat Narula] Direct Cost $80,000 *Molecular Imaging of Atherosclerosis*
01/23/09–07/31/09	Investigator-Initiated Grant, Malinckrodt, Inc. [PI: Jagat Narula] Direct Cost $44,500 *Imaging Apoptosis with Intracellular Molecular Probes*
09/01/07–08/31/08	Investigator Initiated Award No. CVI-42867, Clear Vascular, [PI: Jagat Narula] Direct Cost $334,500 *Sn-117-Labeled-Annexin A5 Apoptosis Imaging*

09/01/07–08/31/09 Award 42865 HS#2007-5763
Direct Cost $34,500
[Site PI: Jagat Narula]
SPARC Multicenter Study: A study of Myocardial Perfusion and Coronary Anatomy: Imaging Roles in CAD

10/01/05–08/31/08 Award GEHC 156-00-222
General Electric Healthcare America
[Site PI: Jagat Narula; Chair Scientific Writing Group]
Direct Cost $ 168,631 ($7,900/patient×15)
MBG 312 An Open-label, multicentre, Phase 3 study evaluating the prognostic usefulness of I-123 mIBG scintigraphy for identifying subjects with heart failure who will experience an adverse cardiac event
MBG 311 A Pilot phase 3, International, Multicenter, Open-label, Dual-Injection, Myocardial Imaging and Safety of MIBG in suspected Ischemic Disease

09/01/05-08/31/08 Contractual Grant SCIOS-37663
[Site PI: Jagat Narula]
Scios Nova Inc *ADHERE Registry*

08/17/04–10/31/05 Contractual Grant RSA-030162, Fujisawa HealthCare
Direct Cost 227,042 ($19,010/patient×10)
[Site PI: Jagat Narula]
A Phase 2, Dose Escalation Evaluation of Pharmacokinetic and Hemodynamic Effects of Carperitide in Heart Failure Subjects

09/01/05–12/31/05 Contractual Grant, TP-37257, Titan Healthcare
[Site PI: Jagat Narula]
Direct Cost $44,829.00 ($8,336/patient×5)
A Multi-Center, Randomized, Double Blind, Placebo-Controlled Study of DITPA in patients with NYHA Class III and IV Congestive Heart Failure who have low Serum T3 Levels

12/01/00–12/21/01 Contractual Grant, Theseus Biotechnology
[PI: Jagat Narula]
Direct Cost $5,450/patient×15 patients
Phase II Noninvasive Detection of Myocardial Apoptosis in Cardiac Allograft Rejection with Tc-99m-Labeled Annexin-V

03/01/01–12/31/02 Contractual Grant, Theseus Biotechnology
[PI: Jagat Narula]
Direct Cost $5,400/patient×10 patients
Noninvasive Detection of Myocardial Apoptosis in Acute Myocardial Infarction with Tc-99m-Labeled Annexin-V

03/01/00–02/28/03 Investigator-Initiated Grant, DuPont Pharmaceuticals
Direct Cost $2,44,000
[PI: Jagat Narula]
Development of Targeting Strategies for the Detection of Unstable Atherosclerotic Plaques

02/01/02–06/30/03 DFI4510, Sanofi-Synthelabo
[Site PI: Jagat Narula]
Direct Cost $7,132 per patient×20 Patien*ts*
A Randomized, Double Blind, Multicenter, Placebo Controlled Study of the SR121463B as Aquauretic Vasopressin V2 Receptor Inhibitor Trial in Congestive Heart Failure

10/01/02– Contractual Grant, Novartis Pharmaceuticals
[Site PI: Jagat Narula]
Direct Cost $83,000
Comparison of C0 and C2 Cyclosporin Levels for Prediction Of Calcneurin Inhibitor-Induced Renal Toxicity and Cardiac Allograft Rejection

07/01/02–6/30/03 Drexel University, Synergy Grant Award
(PI: Jagat Narula from Medicine)
(Co-PI: Ryszard M. Lec From Bioengineering)

Direct Cost $20,000
Exploiting palpography for the detection of atherosclerotic plaques vulnerable to rupture

07/01/03–06/30/04 Drexel University, Synergy Grant Award
(PI: Jagat Narula from Medicine)
(Co-PI: Som Tyagi From Biophysics)
Direct Cost $20,000
Nanoimaging for noninvasive detection of vulnerable plaques

07/01/01–06/30/03 Drexel University, State Tobacco Funds
(Co-PIs: Mani Vannan & Jagat Narula)
Direct Cost $47,000
Ultrasound-based targeting of unstable plaques

07/01/97–06/30/00 Allegheny Health, Education and Research Foundation (PI: Jagat Narula)
Direct Annual Cost $162,500, Unrestricted
Center for Molecular Cardiology

09/01/98–06/30/99 Commonwealth of Pennsylvania State Grant
(Co-PI: Jagat Narula; PI: Susan Brozena)
Direct Annual Cost $125,000
Stress Signaling and Apoptosis Interruptus in Heart Failure

05/01/98–04/30/99 Novartis Industrial Grant (PI: Jagat Narula)
Direct Cost $10,000
Potential Reversal of Apoptosis after LVAD Placement

11/01/99–04/30/00 Parke-Davis 1025-012 (PI: Jagat Narula)
Direct Cost $11,750 per patient
A Randomized, Double Blind, Multicenter, Placebo Controlled Study of the IV YM087 (CI1025) on Cardiopulmonary Hemodynamics in Patients with Class III-IV Heart Failure

12/01/99–11/30/01 (PI: Jagat Narula)
Theseus Biotechnology
Direct Cost $5,450/patient×31 patients
Phase I Noninvasive Detection of Myocardial Apoptosis in Cardiac Allograft Rejection with Tc-99m-Labeled Annexin-V

12/01/00–06/30/01 Award #156-00-222 (PI: Jagat Narula)
Otsuka America Pharmaceutical,
Direct Cost $13,000 per patient
VICTOR: Multicenter Randomized, Double Blind, Placebo Controlled Parallel Group, Efficacy and Safety Study to Evaluate Effects of Tolvapton (OPC-41061) when Compared to Frusemide in Patients with Heart Failure

12/01/00–06/30/01 Award #156-00-222 (PI: Jagat Narula)
Otsuka America Pharmaceutical
Direct Cost $3,500 per patient
VITAL: Multicenter Randomized, Double Blind, Placebo Controlled Parallel Group, Efficacy and Safety Study to Evaluate Effects of Tolvapton (OPC-41061) on the Chronic Outcomes in Patients with Congestive Heart Failure

12/01/00–12/30/01 Award #IE3-99-02-035 (PI: Jagat Narula)
Searle Pharmaceutical
Direct Cost $4,100 per patient
EPHESUS: Multicenter Randomized, Double Blind, Placebo-Controlled Parallel Group, Efficacy and Safety Study to Evaluate Effects of Eplerenone in Patients with Heart Failure After Acute Myocardial Infarction

07/01/00–06/30/02 Drexel University, Synergy Grant Award
(PI: Jagat Narula from Medicine and Co-PI: Steven Wrenn from Bioengineering)
Fluorescence Imaging of Unstable Atherosclerotic Plaques

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U.S. Patent Awards/Applications:

US Patent #5780052; *European* Patent 96912764.6-2114
Awarded: Composition and methods useful for inhibiting cell death and for delivering an agent into a cell
Co-Inventors: Ban-An Khaw, Vladimir Torchilin, Imran Vural

US Patent Application #60/039,111; Awarded
Signal enhancement of dispecific antibody-polymer probe for immunoassay use; *Co-Inventor:* Ban-An Khaw

US Patent Application; Filed Feb 21, 2001
Characterization of microbial deposition and immune response at basement membranes and methods relating thereto
Co-Inventors: E. William Rosenberg, Patricia Noah,
Robert B. Skinner, Jr., Timothy D. Mandrell

US Patent Application; Filed Jun 12, 2002
Intracellular Delivery of Therapeutic and imaging agents to stressed and apoptotic cells using annexin V as targeting vector
Co-Inventors: Francis Blankenberg, H. W. Strauss, John Tait

ACORD 42/2016 en relació amb el punt 10 de l'ordre del dia de la sessió del Consell de Govern de data 10 de maig de 2016: Nomenament de doctors Honoris Causa de la Facultat de Medicina.

Vist l'acord de la Junta de la Facultat de Medicina de data 15 de març de 2016 pel qual se sol·licita al Consell de Govern el nomenament del doctor Jagat Narula, com a doctor honoris causa de la UAB.

Atès que la Normativa que regula el procediment per a l'atorgament del títol de doctor Honoris Causa aprovada pel Consell de Govern en data 26 de maig de 2004 en el seu article 5.2 estableix que el Consell de Govern podrà atorgar un nomenament cada dos anys a la Facultat de Ciències, la Facultat de Filosofia i Lletres i a la Facultat de Medicina, i un nomenament cada quatre anys a cadascun dels centres restants.

Atès que la proposta de la Facultat de Medicina compleix els requisits exigits a la normativa abans esmentada.

Vista la conformitat del Gabinet Jurídic.

Per tot això, a la vista de les consideracions anteriors, a proposta de la Facultat de Medicina, el Consell de Govern ha adoptat els següents

ACORDS

Primer.-Nomenar el doctor Jagat Narula, doctor honoris causa de la UAB.

Segon.-Encarregar a la secretària general i al vicerector de Relacions Institucionals i de Campus l'execució i el seguiment d'aquest acord.

Tercer.-Comunicar el present acord a la Facultat de Medicina.

Bellaterra (Cerdanyola del Vallès), 10 de maig de 2016