

CURRICULUM VITAE

NAME

Ralph William Metcalfe, Professor metcalfe@uh.edu
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EDUCATION

B.S.	Mathematics	University of Washington	1968
M.S.	Mathematics	M.I.T.	1970
Ph.D.	Applied Mathematics	M.I.T.	1973

Thesis Title: *Spectral Methods for Boundary Value Problems in Fluid Mechanics*

Thesis Supervisor: Professor Steven A. Orszag.

PROFESSIONAL EXPERIENCE

1973 - 1978	Research Scientist, Flow Research Company
1978 - 1987	Senior Research Scientist, Flow Research Company
1987 - 1998	Professor, Mechanical Engineering, University of Houston
1999 - Present	Professor, Mechanical Engineering & Mathematics, University of Houston
2003 – 2010	Deputy Director, Biomedical Engineering Program, University of Houston
2006 – Present	Professor, Mechanical Engineering, Biomedical Engineering & Mathematics University of Houston

SUPERVISION OF RESEARCH

STUDENTS CURRENTLY BEING SUPERVISED

Aishwarya Mantha	PhD Candidate
Mircea Ionescu	PhD Candidate
David Bass	MS Candidate
Pranab Jha	PhD Candidate
Mani Prakash	MS Candidate
Ethan Pedneau	Honors Thesis Candidate
Haripriya Sudararaju	PhD Candidate

SERVICE

Member of NIH Study Sections on Cardiovascular Devices, Jun 14, Oct 25, 2004; Feb 17, Jun 27, Oct 24, 2005; Mar 6, June 18, Oct 30, 2006 Feb 25, Jun 24, Oct 14, 2007; Feb 11, 2008, Oct 19, Nov 6 [ARRA] 2009, Feb 22, Jun 21, Oct 25 2010, Feb 21, Jun 20 2011

Chair of NIH Study Sections on Cardiovascular Devices, Jun 23, 2008, Oct 20, 2008; Mar 2, Jun 15, 2009

Member of NIH Study Section on Blood Systems Biology Collaborations [R01], Jan 20, 2010.

Member of NIH Study Section on Respiratory Integrative Biology and Translational Research, February 21-22, 2006. Bethesda, Maryland.

PUBLICATIONS

INVITED PAPERS

METCALFE, RALPH W. 2011 Computational Fluid Dynamics: From Cerebral Aneurysms to Reactive Hyperemia? **2011 World Congress on Mathematical Modeling and Computational Simulation of Cardiovascular and Cardiopulmonary Dynamics**, Williamsburg, VA May 31 – June 3.

METCALFE, RALPH W. 2003 Computational Fluid Dynamics – A Tool for Assessing Aneurysm Risk? **Proceedings of the Neuroradiology Education and Research Symposium at the 41st Annual Meeting of the American Society of Neuroradiology**, Washington D.C. April 26 – May 2. 10 pp. 43-47.

METCALFE, RALPH W. 2003 The Promise of Computational Fluid Dynamics as a Tool for Delineating Therapeutic Options in the Treatment of Cerebrovascular Aneurysms, *American Journal of Neuroradiology* **24 (4)**: 553-554. (Invited Commentary)

METCALFE, RALPH W. 1999 Drag Reduction for Flow Past a Cylinder Using Active Control, at: **Differential Equations and Their Applications: International Symposium dedicated to J. L. Lions**, University of Houston, October 7-9.

METCALFE, RALPH W. 1999 Multi-Phase Flows: Paradoxes and Computational Challenges: **30th AIAA Fluid Dynamics Conference**, Norfolk, VA. 28 June - 1 July. Paper No. AIAA 99-3692.

METCALFE, RALPH W., ANDERS NORDLANDER, JIWEN HE, ROLAND GLOWINSKI. 1998 Drag Reduction for Flow Past a Cylinder Using Active Control, **XXXI National Congress of the Mexican Mathematical Society**, Hermosillo, Mexico. October 11 -17.

TORNBERG, ANNA-KARIN, **RALPH W. METCALFE**, L. RIDGWAY SCOTT, BABAK BAGHERI, 1997 A Fluid Particle Motion Simulation Method, in **Computational Science for the 21st Century**, ed. J. Periaux et al. Wiley-Interscience-Europe, Strasbourg, France.

METCALFE, R. W. 1996 Boundary Layer Flow Control. **ECCOMAS 96**, Paris, France. September 9 -13.

METCALFE, R. W. 1995 The Application of High-Order Finite Element Methods to the Numerical Simulation of Flows Around Bodies. **International Conference on Spectral and High Order Methods**, Houston, Texas. June 5-9, Wyndham Warwick Hotel.

METCALFE, R. W. 1994 Boundary Layer Control: A Brief Review. **Computational Fluid Dynamics '94, Invited Lectures of the Second European CFD Conference**, Stuttgart, Germany. ed. Ing. S. Wagner. Chichester, England:John Wiley & Sons. pp. 52-60.

RILEY, J. J., M. GAD-EL-HAK, **R. W. METCALFE**, 1988 Compliant Coatings. **Annual Reviews of Fluid Mechanics** **20**:393-419, ed. J. Lumley and M. Van Dyke. Palo Alto: Annual Reviews, Inc.

REFEREED PUBLICATIONS

BUDOFF, M., N. AHMADI, ... **R. METCALFE**, ...M. NAGHAVI. 2010 Digital (Fingertip) Thermal Monitoring of Vascular Function: A Novel Non-invasive Non-imaging Test to Improve Traditional Cardiovascular Risk Assessment and Monitoring of Response to Treatments, In *Asymptomatic Atherosclerosis*, ed. M. Naghavi, New York: Springer. pp. 247-263.

KAKADIARIS, I. , M. VAVURANAKIS, S. O'MALLEY, **R METCALFE**, C. HARTLEY, E. FALK, M NAGHAVI. 2010 Vasa Vasorum Imaging: A New Window to the Detection of Vulnerable Atherosclerotic Plaques, In *Asymptomatic Atherosclerosis*, ed. M. Naghavi, New York: Springer. pp. 507-516.

IONESCU, M., R. METCALFE, D. CODY, M. VALDIVIA Y ALVARADO, J. HIPP, G. BENNDORF. 2010 Resolution Limits of Multi Slice-Computed Tomography (MS-CT), C-arm-CT and Flat Panel-CT (FP-CT) compared to MicroCT for Visualization of a Small Metallic Stent, In Press, *Academic Radiology* July 2011.

AKHTAR, M, S KLEIS, **R METCALFE**, M NAGHAVI. 2010 Sensitivity of Digital Thermal Monitoring Parameters to Reactive Hyperemia, *J. Biomechanical Engineering*, **132(5)**: 14 Pages.

BENNDORF G, M IONESCU, M VALDIVIA Y ALVARADO, A BIONDI, J HIPP, **R METCALFE**. 2010 Anomalous hemodynamic effects of a self-expanding intracranial stent: comparing in-vitro and ex-vivo models using ultra-high resolution MicroCT based CFD, *J. Biomechanics*, **43(4)**: 740-748.

MCQUILKIN, G, D. PANTHAGANI, **R. METCALFE** ,...C. HARTLEY. 2009 Digital Thermal Monitoring (DTM) of Vascular Reactivity Closely Correlates with Doppler Flow Velocity, *31st Annual International Conference of the IEEE EMBS*, Minneapolis, MN, September 2 , pp. 1100-1103.

KHALIL, H, **R. METCALFE**, S. KLEIS, E. LEE, N. GILBERT, D. KERR, O. FRAZIER, W. COHN. 2009 Flow Visualization Techniques in a Mock Ventricle Supported by a Nonpulsatile Left Ventricular Assist Device, *ASAIO Journal*, **55**: 323-327.

- MANTHA A, G BENNDORF, A HERNANDEZ, **R METCALFE**. 2009 Stability of Pulsatile Blood Flow at the Ostium of Cerebral Aneurysms, *J. Biomechanics*, **42(8)**: 1081-1087.
- BENNDORF G, M IONESCU, MVY ALVARADO, J HIPP, **R. METCALFE**. 2009 Wall Shear Stress in Intracranial Self-Expanding Stents Studied Using Ultra-High-Resolution 3D Reconstruction, *AJNR Am J Neuroradiol*, **30(3)**: 479-486.
- GUL K, N AHMADI,... **R METCALFE**,... M NAGHAVI 2009 Digital thermal monitoring of vascular function: a novel tool to improve cardiovascular risk assessment, *Vascular Medicine*, **14(2)**: 143-148.
- KHALIL, H, D KERR, M. FRANCHEK, **R. METCALFE**, R BENKOWSKI, W. COHN, E. TUZUN, B. RADOVANCEVIC, O. FRAZIER, K. KADIPASAOGLU 2008 Continuous Flow Total Artificial Heart: Modeling and Feedback Control in a Mock Circulatory System, *ASAIO Journal*, **54**: 249-255.
- KHALIL, H, W. COHN, **R. METCALFE**, O. FRAZIER, 2008 Preload Sensitivity of the Jarvik 2000 and HeartMate II Left Ventricular Assist Devices, *ASAIO Journal*, **54**: 245-248.
- RADAELLI, A. , L. AUGSBURGER, ..., **R. METCALFE**,... A. FRANGI 2008 Reproducibility of haemodynamical simulations in a subject-specific stented aneurysm model, *Journal of Biomechanics*, **41** (10): 2069-2081.
- KAKADIARIS, I. , S. O'MALLEY, M. VAVURANAKIS, S. CARLIER, **R. METCALFE**, C. HARTLEY, E. FALK, & M. NAGHAVI 2006 Signal processing approaches to risk assessment in Coronary Artery Disease, *IEEE Signal Processing Magazine*, **23** (6): 59-62.
- CARLIER, S., I. KAKADIARIS, N. DIB, M. VAVURANAKIS, C. HARTLEY, **R. METCALFE**, R. MEHRAN, M. NAGHAVI 2006 Vasa vasorum imaging of coronary plaques with intravascular ultrasound and microbubbles, *European Heart Journal*, **26**:625 Suppl. 1
- KAKADIARIS, I.; S. O'MALLEY, M. VAVURANAKIS, S. CARLIER, C. HARTLEY, **R. METCALFE**, R. MEHRAN, M. NAGHAVI, 2006 Intravascular ultrasound-based imaging of vasa vasorum for the detection of vulnerable atherosclerotic plaque, *J. Amer. College Cardiology*, **47** (4):264A, Suppl A.
- MANTHA, A., C. KARMONIK, G. BENNDORF, C. STROTHER, **R. METCALFE** 2006 Hemodynamics in a Cerebral Artery Before and After the Formation of an Aneurysm, *American Journal of Neuroradiology*, **27**:1113-18, May 2006.
- KARMONIK, C., A. MANTHA, C. STROTHER, G. BENNDORF, **R. METCALFE** 2006 Dynamic Pressure at Sites of Virtually Repaired Paraclinoid Aneurysms: A Computational Fluid Dynamics Study, in *Medical Imaging 2006: Physiology, Function, and Structure from Medical Images*, A Manduca & A. Amini eds. SPIE Vol. 6143, 8 pp.
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- YAMROM, B., I. KUNIN, **R. METCALFE** & G. CHERNYKH 2003 Discrete Systems of Controlled Pendulum Type. *Int. J. Eng. Sci.* **41** (3-5): 449-458.
- HE, J. W., R. GLOWINSKI, **R. METCALFE**, J. PERIAUX, 2002 Active control for incompressible viscous fluid flow: application to drag reduction for flow past circular cylinders, in *Computational Methods for Control Applications*, R. Glowinski, H. Kawarada, J. Periaux eds., Gakkotosho Co., Tokyo, pp. 233-292.
- LUNDIN, STAFFAN, **RALPH W. METCALFE**, CRAIG J. HARTLEY, 2002 Effects of Severity and Eccentricity of Carotid Stenosis on Pulsatile Blood Flow, *Proceedings of the 24th Annual International Conference of the Engineering in Medicine & Biology Society and the Annual Fall Meeting of the Biomedical Engineering Society(EMBS-BMES)*, Houston, TX 23-25 October 2002, paper no. 6.1.7-6
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- HE, J. W., R. GLOWINSKI, **R. METCALFE**, A. NORDLANDER & J. PERIAUX 2000 Active Control and Drag Optimization for Flow past a Circular Cylinder, I. Oscillatory Cylinder Rotation. *J. Comp Phys.*,**163**, pp. 83-117.
- HE, J. W., R. GLOWINSKI, **R. METCALFE**, & J. PERIAUX 1998 A Numerical Approach to the Control and Stabilization of Advection-Diffusion Systems: Application to Viscous Drag Reduction, *IJCFD*, Vol. 11, pp. 131 - 156...
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- HUSSAIN, F., **R.W. METCALFE**, W. SCHOPPA, 1995 "Core Dynamics Instability: A new transition mechanism in a mixing layer," in **Developments in Fluid Dynamics and Aerospace Engineering**, (eds. S. M. Deshpande, A. Prabhu, K. R. Sreenivasan & P. R. Viswanath), Interline Publ., India, pp. 42-69.
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- METCALFE, R. W.**, F. HUSSAIN, 1991 Large Scale Structures in Reacting Mixing Layers. In *Nonlinear Dynamics of Structures*, ed. R. Z. Sagdeev et al, pp. 165-186. World Scientific: Singapore.
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- DOMARADZKI, J. A., **R. W. METCALFE**, 1988 Numerical Simulations of Turbulent Heat Transfer in the Presence of Shear *J. Fluid Mech.* **193**: 499-531.
- METCALFE, R. W.**, S. A. ORSZAG, M. E. BRACHET, S. MENON, J. J. RILEY, 1987 Secondary Instability of a Temporally Growing Mixing Layer *J. Fluid Mech.* **184**:207-243.
- DOMARADZKI, J. A., **R. W. METCALFE**, 1987 Stabilization of Laminar Boundary Layers by Compliant Membranes *Physics of Fluids* **30**, 695-705.
- DOMARADZKI, J. A., **R. W. METCALFE**, R. S. ROGALLO, J. J. RILEY, 1987 An Analysis of Subgrid-Scale Eddy Viscosity Using Results from Direct Numerical Simulations. *Physical Review Letters* **58** (6), 547-550.
- METCALFE, R. W.**, A. K. M. F. HUSSAIN, S. MENON, M. HAYAKAWA, 1987 Coherent Structures in a Turbulent Mixing Layer: A Comparison Between Direct Numerical Simulations and Experiments. In *Turbulent Shear Flows*, **5**: 110-123 (ed. by Durst et al.). Berlin: Springer-Verlag
- GIVI, P. W.-H. JOU, **R. W. METCALFE**, 1987 Flame Extinction in a Temporally Developing Mixing Layer. *Symposium (International) Combustion*, 21st, pp. 1251-1261. Pittsburgh: Combustion Institute.

METCALFE, R. W., S. MENON, J. J. RILEY, 1986 The Effect of Coherent Modes on the Evolution of a Turbulent Mixing Layer. In *EUROMECH 199, Proceedings, Direct and Large Eddy Simulation of Turbulence* ed. E. H. Hirschel, pp. 265-270. Wiesbaden: Vieweg.

RILEY, J. J., **R. W. METCALFE, S. A. ORSZAG, 1986** Direct Numerical Simulations of Chemically Reacting Turbulent Mixing Layers *Physics of Fluids* **29**, 406-422.

METCALFE, R. W., C. RUTLAND, J. H. DUNCAN, J. J. RILEY, 1986 Numerical Simulations of Active Stabilization of Laminar Boundary Layers, *AIAA Journal* **24** (9), 1494-1501.

MCMURTRY, P. A., W.-H. JOU, J. J. RILEY, **R. W. METCALFE, 1986** Direct Numerical Simulations of a Reacting Mixing Layer with Chemical Heat Release. *AIAA Journal* **24** (6), 962-970.

BRACHET, M. E., **R. W. METCALFE, S. A. ORSZAG, J. J. RILEY, 1985** Secondary Instability of Free Shear Flows. In *Progress and Supercomputing in Computational Fluid Dynamics; Proceedings of U.S.-Israel Workshop*, ed. E. M. Murman and S. S. Abarbanel, pp. 257-286. Boston: Birkhauser.

METCALFE, R. W., J. J. RILEY, 1982 Calculations of Pressure Statistics in Turbulent-Free Shear Flows by Direct Numerical Simulation. In *Proceedings of Eighth International Conference on Numerical Methods in Fluid Dynamics, Lecture Notes in Physics* ed. E. Krause, pp. 383-389. Berlin: Springer-Verlag.

WEISSMAN, M. A., **R. W. METCALFE, J. J. RILEY, 1981** Nonlinear Internal Wave Interactions. In *Nonlinear Properties of Internal Waves*, ed. B. J. West, pp. 253-266. New York: American Institute of Physics.

RILEY, J. J., **R. W. METCALFE, M. A. WEISSMAN, 1981** Direct Numerical Simulations of Homogeneous Turbulence in Density-Stratified Fluids. In *Nonlinear Properties of Internal Waves*, ed. B. J. West, pp. 79-112. New York: American Institute of Physics.

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RILEY, J. J., R. W. METCALFE, 1980 Direct Numerical Simulations of the Turbulent Wake of An Axisymmetric Body. *Second International Symposium on Turbulent Shear Flows*, ed. Bradbury et al., pp. 78-93. Berlin: Springer-Verlag.

BARRICELLI, N. A., **R. W. METCALFE, 1975** A Note on the Asymmetric Distribution of the Impacts Which Created the Lunar Mare Basins. *The Moon* **12**, 193-199.

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BARRICELLI, N. A., **R. W. METCALFE, 1969** The Lunar Surface and Early History of the Earth's Satellite System. *Icarus* **10** (1), 144-163.

BARRICELLI , N. A., R. W. METCALFE, 1969 A Note on the Loss of Hydrogen and the Supply of Hydrogen to the Earth as a Direct or Indirect Effect of the Solar Wind. *Annali di Geofisica* **XXII**, 105-109.

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PRESENTATIONS / PUBLICATIONS (RECENT)

IONESCU, M., R. METCALFE, D. CODY, M. VALDIVIA Y ALVARADO, J. HIPP, G. BENNDORF 2009 Resolution Limits of Multi Slice-Computed Tomography (MS-CT), C-arm Flat Panel CT, Flat Panel-CT (FP-CT), and MicroCT **American Society of Neuroradiology Annual Meeting**, June. Vancouver, B.C., Canada.

IONESCU M., R. METCALFE, M. LINGAMFELTER, M. VALDIVIA Y ALVARADO, J. HIPP, A. BIONDI, G. BENNDORF 2009 Imaging of Intracranial Stent Deployment Using Ultra-high Resolution MicroCT **American Society of Neuroradiology Annual Meeting**, June. Vancouver, B.C., Canada.

AKHTAR, M., S. KLEIS, R. METCALFE , 2009 New Indicators for Digital Thermal Monitoring – A Measure of Vascular Reactivity. **Biomedical Engineering Society Annual Meeting**, October 7-10. Lawrence Convention Center, Pittsburgh, PA.

IONESCU, M., D. CODY, J. HIPP, M. ALVARADO, R. METCALFE , G. BENNDORF 2009 Imaging of small metallic stents resolution limits of multi-slice-computed tomography (MS-CT), C-arm Flat Panel CT, Flat Panel-CT (FP-CT). *Interventional Neuroradiology*, **15** (Suppl.1): p. 186, P 113.

BENNDORF, G., M. IONESCU, M. LINGAMFELTER, M. ALVARADO, R. METCALFE , J. HIPP, A. BIONDI. 2009 Ultra-high resolution imaging of intracranial stent development. *Interventional Neuroradiology*, **15** (Suppl.1): p. 186, P 112.

IONESCU, M., G. BENNDORF, R. METCALFE. 2009 Hemodynamic Changes in Self-Expanding Intracranial Stents: Open-Cell versus Closed-Cell Design. **Houston Society of Engineering in Medicine and Biology Annual Meeting**, Houston, TX. March.

IONESCU M., R. METCALFE, M. VALDIVIA Y ALVARADO, G. BENNDORF 2008 Resolution Limits of Current Flat Panel-Computed Tomography (FP-CT, DynaCT) for Computational Hemodynamics (CHD) Simulations in Intracranial Stents **American Society of Neuroradiology Annual Meeting**, June. New Orleans, LA.

IONESCU M., R. METCALFE, M. VALDIVIA Y ALVARADO, G. BENNDORF 2008 Magnitude and Distribution of Wall Shear Stress in Self-Expanding Intracranial Stents: Open-Cell (Neuroform Treo) versus Closed-Cell Design (Enterprise). **American Society of Neuroradiology Annual Meeting**, June. New Orleans, LA.

IONESCU, M., R. METCALFE, M. VALDIVIA Y ALVARADO, D. CODY, J. HIPP, G. BENNDORF 2008 Capabilities and Limitations of Current X-ray Computed Tomography Systems:

Multislice-CT, C-arm FD-CT, Flat Panel-CT, and MicroCT for Imaging of Small Metallic Stents. **Society of NeuroInterventional Surgery Annual Meeting**, Lake Tahoe, NV, July.

IONESCU, M., G. BENNDORF, N. EBRAHIMI, R. METCALFE. 2008 Hemodynamic Changes Caused by a Self-expanding Intracranial (Wingspan) Stent. **Houston Society of Engineering in Medicine and Biology Annual Meeting**, Houston, TX. February.

MANTHA, A., A. HERNANDEZ, C. KARMONIK, G. BENNDORF, AND R. METCALFE 2007 *Stability of Pulsatile Flow within a Cerebral Aneurysm*, **Biomedical Engineering Society Annual Meeting**, September 26-29. Renaissance Hollywood Hotel / Los Angeles, CA. (Poster)

IONESCU, M., R. METCALFE, N. EBRAHIMI, AND G. BENNDORF 2007 *Hemodynamic Changes Caused by a Self-Expanding Intracranial (Wingspan) Stent*, **Biomedical Engineering Society Annual Meeting**, September 26-29. Renaissance Hollywood Hotel / Los Angeles, CA. (Poster)

A. HERNANDEZ AND R. METCALFE 2007 *Novel 3-Dimensional Visualization Techniques for Hemodynamic Simulations of Flow in Cerebral Aneurysms*, **Biomedical Engineering Society Annual Meeting**, September 26-29. Renaissance Hollywood Hotel / Los Angeles, CA. (Poster)

IONESCU M., R. METCALFE, N. EBRAHIMI, G. BENNDORF 2007 Flow Velocities and Wall Shear Stress in a Neuroform-Trevo Stent **American Society of Neuroradiology Annual Meeting**, June. Chicago, IL.

KHALIL H., M. FRANCHEK, K. KADIPASAOGLU, R. METCALFE, R. BENKOWSKI, W. COHN, O. FRAZIER, 2006 Feedback control of the continuous flow total artificial heart. *ASAIO Journal*, **52**(2):37A

O'MALLEY, S., M. VAVURANAKIS, R. METCALFE, C. HARTLEY, M. NAGHAVI, & I. KAKADIARIS, 2006 *Intravascular ultrasound-based imaging of vasa vasorum for the detection of vulnerable atherosclerotic plaque*, **Proc. Houston Society for Engineering in Medicine and Biology**, Houston, TX.

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KHALIL H., W. COHN, R. BENKOWSKI, **R. METCALFE**, K. KADIPASAOGLU, & O. FRAZIER OH, 2006 Preload sensitivity of continuous flow ventricular assist devices: Application to the total artificial heart. *ASAIO Journal*, **52**(2):41A.

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METCALFE, R., A. MANTHA, C. KARMONIK, G. BENNDORF, S. AKPEK, S. KLICZNIK, M. MAWAD, & C. STROTHER, 2004 *Origin and Effects of Hemodynamic Stresses on the Morphology of Intracranial Aneurysms, 42nd Annual Meeting, American Society of Neuroradiology*, June 5 - 11. Washington State Convention & Trade Center, Seattle, WA. (Abstract).

BENNDORF , G., C. KARMONIK, S. AKPEK A. MANTHA, **R. METCALFE**, W. NAEINI, R. KLUCZNIK, M. MAWAD, & C. STROTHER, 2004 *Influence of Heart Rate on the Hemodynamic Stresses in Cerebral Aneurysms, 42nd Annual Meeting, American Society of Neuroradiology*, June 5 - 11. Washington State Convention & Trade Center, Seattle, WA. (Abstract).

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