

Advanced Echocardiography Fellowship Program
Affiliation: Sir Mortimer B. Davis–Jewish General Hospital,
McGill University

Number of Positions: Maximum 3

Fellowship Director:

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Introduction:

The Jewish General Hospital (JGH) Cardiology Division and McGill University offer a Fellowship Program for cardiologists who desire to obtain Level 3 training in echocardiography (echo). The JGH is a McGill University affiliated teaching hospital with a large and active Cardiology Division and a nationally recognized echo lab. The echo lab has extensive experience in providing basic as well as advanced echo training, having provided dedicated echo fellowships to over 50 cardiologists nationwide since 1991. Echocardiography combines the technical challenges of image acquisition with accurate image interpretation. This necessitates an understanding of the physical principles of sound transmission, as well as of fluid dynamics. Using advanced echocardiography equipment, one acquires high quality images, both static, as well as moving in 2D/3D images in order to visualize heart's structure and function, and applies Doppler principles to assess heart valve and chamber function. To maximize clinical usefulness, it is critical that the echo be interpreted in the context of a thorough understanding of cardiovascular physiology and how it relates to disease processes. Our program at the JGH will accept exceptional cardiologists who have a strong interest in attaining these goals and requirements.

Requirements:

- 1) Completion or anticipated completion of a clinical core cardiology residency program (Royal College or equivalent)
- 2) Complete CV submission
- 3) Three reference letters
- 4) All candidates will be interviewed by the Fellowship Director and will be presented to the echocardiography faculty for consideration.
- 5) Application is via the McGill PostGraduate Office (Minerva system) and accredited through the McGill Cardiology Training Program and its Program Director(s).

Program Description:

During the 12-month echocardiography fellowship, the candidate will fulfill the CCS/CSE/ASE requirements for echocardiography. For Level 3 certification, the trainee will be required to perform at least 300 two-dimensional/Doppler studies. The imaging skills of the candidate will be evaluated early during the fellowship to determine if additional dedicated scanning time is needed, usually to be performed in the first 2 months of the fellowship. In addition, a minimum of 450 studies should be interpreted with the attending cardiologist and reported using the JGH echo lab database. The complexity of studies which fellows are expected to interpret accurately and completely, as well as gradual independence will be increased as their experience increases. The Fellow will be phased in over this first 2 months into stress echocardiography with a minimum requirement of 100 studies performed and interpreted, and transesophageal echocardiography with a minimum of 150 studies performed and interpreted. From statistics derived over the past several years, the numbers and case variety far exceeds those minimum standards set out by Canadian and American guidelines. The Fellow will interpret on average 1500-2000 transthoracic studies, 150-200 stress and dobutamine/dipyridamole studies, and 150-200 transesophageal studies. The program will allow the Fellow to sit for the National Board of Echocardiography examination, should he/she choose. It is clear from the above, that this large exposure will allow for the Fellow to amass the experience to function independently as an expert echocardiographer following completion of his/her training.

The technical aspects of echocardiographic image acquisition and measurements will be taught by experienced sonographers in the lab and the interpretation of studies will be supervised by experienced echocardiographers. The Fellow will be encouraged to use supplementary educational resources, including extensive teaching files, and will be assigned reading from standardized texts. Teaching will incorporate both technical as well as cognitive skills required to perform and interpret echocardiograms. Fellows will participate in regular Echo and Cardiac Imaging Rounds, which are held weekly and will regularly present on both basic as well as cutting edge topics in echocardiography.

Once assured of adequate technical skills, the Fellow will be phased into the interpreter's role. This entails reading and interpreting echocardiograms performed by sonographers, formulating a report, and reviewing the study and the report with the attending echocardiographer. In addition, the trainee will then commence taking on-call duty (home call) in echocardiography, covering one weekend and 6 week-night calls per month, supervised by an attending echocardiographer. The fellow may be called upon, in times of extreme need, to perform a night or weekend General Cardiology resident level call at the JGH. This is expected to be very rare and all efforts will be made to minimize its occurrence.

The JGH serves as one of the primary teaching sites in echocardiography for the McGill University Core Cardiology Program, and frequently has PGY 4-6 Residents rotating through the Laboratory. The echocardiography Fellow will interact with these cardiology residents and will assume a role as an educator by reviewing their studies and teaching them basic and eventually advanced concepts. Recent Fellows in echocardiography have contributed tremendously through their daily interactions and specific lectures to the clinical cardiology residents and the Cardiology Division staff, and have taught as well at the Medical School during the small group physiology sessions.

Faculty:

Igal A. Sebag, MD, FRCPC, FACC, FASE

Fellowship/Teaching Director,

Director of Echocardiography and Non-Invasive Cardiology,

Echo Fellowships: Jewish General Hospital and Massachusetts General Hospital

Specialties: Three-dimensional echocardiography, Two-dimensional speckle-tracking imaging (strain), Echocardiographic predictors of chemotherapy-induced cardiotoxicity

Founding and Director, The Annual JGH/McGill Scientific Symposium in Cardiovascular Imaging

Previous Member, Guidelines and Standards Committee, American Society of Echocardiography

Writing Committees: (1) Expert Consensus for Multi-Modality Imaging Evaluation of Adult

Patients During and After Cancer Therapy (2014), (2) Expert Consensus for Multi-Modality

Imaging Evaluation of Cardiovascular Complications of Radiotherapy in Adults (2013),

American Society of Echocardiography

Lawrence Rudski, MD, FRCPC, FACC, FASE

Director, Division of Cardiology

Echo Fellowship: Massachusetts General Hospital

Specialties: Echocardiographic evaluation and (patho)physiology of the right ventricle, pulmonary hypertension

Member (and previous co-chair), Guidelines and Standards Committee, American Society of Echocardiography

Writing Committees: (1) Chair, Expert Consensus Document on Echocardiographic Evaluation of the Right Ventricle (2010), (2) Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults (2015), American Society of Echocardiography

Jonathan Afilalo, MD, MSc, FACC, FRCPC

Echo Fellowship: Massachusetts General Hospital

Other Fellowship: Cardiac MRI, Beth Israel-Deaconess Medical Center

Specialties/Academic interests: Cardiovascular outcomes in older adults, Incremental value of imaging for risk prediction before cardiac surgery, Guidelines for the echocardiographic assessment of the right heart

Associate Member, Departments of Epidemiology and Experimental Medicine

Co-Director of Research, McGill Cardiology Training Program

Annabel Chen-Tournoux, MD

Echo Fellowship: Massachusetts General Hospital

Specialties/Interests: Echocardiographic indices of myocardial function and how they complement biomarkers in cardiovascular disease prevention and management of obesity and metabolic syndrome and heart failure.

Co-Program Director, McGill Core Cardiology Training Program

Regina Husa, MD, FRCPC

Echo Fellowship: Jewish General Hospital

Other Training: Masters in Education, Harvard Medical School

Specialty: Education in Medicine

Director of Accreditation, Postgraduate Office, McGill Medical School

Vartan Mardigyan, MD, FRCPC

Fellowship: Electrophysiology, The McGill University Health Centre

Caroline Michel, MD, FRCPC

Echo Fellowship: Jewish General Hospital

Specialty: Echocardiographic indices in heart failure

Director, Heart Function Clinic, JGH

Judith Therrien, MD, FRCPC

Fellowship Director in Adult Congenital Heart Disease,

Echo Fellowship: Jewish General Hospital

Other Fellowships: Adult Congenital Heart Disease (Royal Brompton), London, and UHN

Toronto General Hospital

Specialty: Adult Congenital Heart Disease

Regular author in the chapter on Congenital Heart Disease, Braunwald's Heart Disease

Previous Chair, Canadian Guidelines on the Management of Adults with Congenital heart Disease

Ann Walling, MD, FRCPC

Echo Fellowship: University of Texas, San Antonio

Specialty: Stress echocardiography

Marie-Josée Blais, RDCS

Chief Sonographer, Non-invasive Cardiology - JGH

Facilities:

The JGH Echocardiography Laboratory is comprised of 8 full-time GFT Level 3 Echocardiographers, as well as 6 cardiac sonographers. The laboratory is currently situated within the Division of Cardiology and currently encompasses 6 rooms: 4 transthoracic rooms, 1 stress/(transthoracic) room (treadmill and supine bike) and 1 transesophageal/(transthoracic) room. Following the opening of a new Critical Care Facility (Pavilion K) set for January 2016, there will be a total of 9 rooms. The lab is equipped with 5 GE E9s, 1 Philips and 1 GE S6, three of which are equipped with real-time 3-dimensional capabilities. For the highly motivated Fellow, an opportunity for exposure to intra-operative TEE is possible through cooperation with the Department of Anaesthesia. Echocardiograms are interpreted both on-line with the patient still in the room, permitting the highest level of quality control, as well as off-line for most portable studies. A custom database program contains the echo records of over 100,000 studies. A library of echo reference books, as well as files of landmark articles are available for consultation. An Echo reading room with 5 viewing/reporting stations, as well as a dedicated EchoPac PC research station are available. In addition, a Fellow's room, complete with workstations is available.

Research:

The echo lab at the JGH maintains an active research program. A number of recent Fellows have completed projects which have been presented at national and international meetings and which have been published in peer-reviewed journals. The JGH is officially recognized as the Center for Pulmonary Vascular Diseases for the Montreal Region and much of Quebec and accordingly there are research activities involving pulmonary hypertension and right-sided heart function. Studies also focus on valvular heart disease, congenital heart disease, LV remodeling and issues of quality in echo such as compliance with guidelines and appropriate use of echocardiography. The above projects incorporate database research, as well as research using cutting edge technologies such as 3-D echo, and imaging of small animals. Fellows are expected and strongly encouraged to participate in a project in their area of interest, and if feasible to initiate a project that can be completed within their Fellowship. The Fellow will be encouraged to submit original research for presentation at scientific congresses and to attend these meetings, with financial assistance from the echo lab. Planned echo meetings will provide Fellows with ample opportunity to present to a wide audience.

Role of the Echocardiography Fellow:

During the twelve months of training, the trainee should acquire the following skill sets:

- understand cardiovascular anatomy, hemodynamics and the physical principles and instrumentation of ultrasound
- understand indications for transthoracic echocardiography (TTE) as per published guidelines.
- understand the limitations of TTE
- understand the echocardiographic appearance of cardiac structures including cardiac chambers, valves, pericardium, and major blood vessels
- learn to correlate echocardiographic features with findings from other investigations, e.g. cardiac catheterization, surgical and autopsy observations, as well as how to utilize the information provided by the echo study in clinical decision-making, including surgical indications, prognostic information, and guidance of medical therapy.

- learn the indications, contraindications, strengths and weaknesses for transesophageal echocardiography.
learn about the safe use of conscious sedation agents including their complications and treatment of complications.
learn to perform esophageal intubation of the TEE probe and to perform a comprehensive transesophageal examination to address the conditions listed below.
- learn the indications for different stress echo modalities as well as strengths/weaknesses vis a vis other imaging modalities.
learn how to perform exercise, dobutamine and dipyridamole stress echo, including recognition of complications, and their management.
learn to interpret the hemodynamic effects on the heart of exercise in the setting of valvular heart diseases including mitral and aortic regurgitation and mitral stenosis.
- learn to perform and interpret transthoracic M-mode, two-dimensional, pulsed Doppler, Continuous Wave Doppler, tissue Doppler, and Colour Flow studies in adult patients referred to an echocardiographic lab. Advanced tissue Doppler for the purposes of dyssynchrony analysis and cardiac resynchronization, as well as an introduction to strain rate imaging will also be taught.
- learn to interpret neonatal echos using an segmental approach and recognize and quantify structural abnormalities, including congenital cardiac conditions and neonatal conditions such as PDA.
- learn the indications, contraindications and precautions regarding the performance of contrast studies, using both agitated saline, as well as echo contrast agents.

This should include the following cardiac conditions:

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| I | left and right ventricular dysfunction – segmental and global, including systolic and diastolic dysfunction, including the assessment of dyssynchrony |
| II | valvular heart disease including the assessment and quantitation of stenosis and regurgitation of all four cardiac valves |
| III | pericardial disease including pericardial effusion, assessment of constrictive pericarditis (and its distinction from restrictive cardiomyopathy), cardiac tamponade, and the use of echocardiography to guide pericardiocentesis |
| VI | selected congenital heart disease such as atrial septal defect, ventricular septal defect, Tetralogy of Fallot and Ebstein’s Anomaly |
| V | assessment of the aorta and its major branches to diagnose and evaluate dissection, intramural hematoma, aneurysm and atheromata |
| VI | pulmonary hypertension – including Doppler estimation of right ventricular and pulmonary artery pressures |

In addition, the Fellow will learn management skills necessary to participate in and direct a modern echo lab. These include equipment evaluation and troubleshooting, screening of echocardiographic studies to prioritize for urgency, time management, interactions with para-professionals including sonographers, receptionists, clerical workers etc. Data management and reporting skills are also essential attributes that will be taught.

Evaluation:

The Fellows will be evaluated on a regular basis by all echocardiographers in the echo lab as well as the sonographer staff. In addition to this, the Fellows will initially be given bi-weekly or

monthly written tests commensurate with their level of training in order to evaluate their evolving knowledge base. They will be given echocardiographic cases to interpret. As well, more theoretical exams focusing on physical principles, echocardiographic definitions and criteria for a variety of normal and pathological findings will be given. Verbal feedback will be given initially monthly, with written feedback a minimum of four times per year. Written evaluations using the standard McGill evaluation format as well as CanMeds format as applicable will be made.

Fellows will be encouraged to feedback to the program director about all issues that concern him/her and that impact on learning. A McGill Resident Feedback form will given to the Fellow to submit to the Fellowship Director, who will consider the comments and make changes to the Fellowship program as needed to best suit the needs of the Fellow. In addition, the Fellow will complete a report at the end of the Fellowship, to be submitted to the Cardiology Program Director for McGill University.

Conclusion:

Echocardiography has become an integral imaging modality in the diagnosis and management of a wide variety of conditions involving the heart, and touching on broad disease categories that the Internist has to treat. The challenge, however, is how to balance the need for this skill with the necessity to ensure that the test is performed and reported to the highest standard. Accordingly, the JGH had designed a program built on a close interaction between a nationally recognized echo lab and Cardiology Division staffed with superb clinicians. This will enable the successful candidate to learn the state-of-art technical skills and, as importantly, the appropriate utilization and clinical application of the wealth of information obtained from the echocardiographic examination.

Table 1, Echocardiography Training Objectives and Strategies

Roles	Objectives	Strategies
Medical Expert	<ul style="list-style-type: none"> • Understand cardiovascular anatomy, hemodynamics and the physical principles and instrumentation of ultra sound including 2D, Doppler, harmonics, and mechanisms and identification of artifacts • Learn to perform and interpret (in the clinical context) transthoracic M Mode, two-dimensional, pulse Doppler, continuous wave, and tissue Doppler and Colour Flow studies on patients with common cardiovascular illnesses • Understands the indications, contraindications, strengths and weaknesses of both transthoracic and transesophageal echocardiography • learn about the safe use of conscious sedation agents including their complications and treatment of complications. • learn to perform esophageal intubation of the TEE probe and to perform a comprehensive transesophageal examination to address the conditions listed below. • learn how to perform exercise, dobutamine and dipyridamole stress echo, including recognition of complications, and their management. • learn to interpret the hemodynamic effects on the heart of exercise in the setting of valvular heart diseases including mitral and aortic regurgitation and mitral stenosis. • Know the echocardiographic appearance of cardiac structures including cardiac chambers, valves and major blood vessels • Learn to correlate echocardiographic features with findings from other investigations including hemodynamic studies and surgical/pathological correlation • learn to interpret neonatal echos using an segmental approach and recognize and quantify structural abnormalities, including congenital 	<ul style="list-style-type: none"> • Understand the basic principles and instrumentation of ultra sound and Doppler • Become familiar with both normal and abnormal echocardiographic appearance of cardiac structures on transthoracic and transesophageal echo • Acquire the knowledge base for the basic Doppler equations used in echocardiography • Know the two-dimensional and Doppler features of left ventricular systolic and diastolic dysfunction, right ventricular dysfunction, cardiomyopathies, pulmonary hypertension, valvular regurgitations, stenosis, prosthetic heart valves, pericardial disease, intracardiac mass and thrombus and simple congenital heart disease in adults and neonates. • Know the appropriate response on the left and right ventricles to stress, as well as the hemodynamic effects of stress on valvular heart disease • The above will be accomplished by direct supervision with a senior sonographer and staff cardiologist using heart models as well as standard echocardiographic texts and educational audio-visual resources

	cardiac conditions and neonatal conditions such as PDA.	
Communicator	<ul style="list-style-type: none"> •Develop a good patient relationship during the examination with appropriate attention to comfort and personal privacy •Interpret from the requisition the relevant questions to be answered by the echocardiographic examination •Develop a report of all salient echocardiographic features •Communicate the results of the examination to the patient when appropriate, as well as to the referring physician 	<ul style="list-style-type: none"> •Work closely with echocardiographic technologists in order to acquire appropriate skills to perform the examination in an effective and compassionate fashion •Read examination with staff cardiologists to learn how to interpret and report effectively •Prepare sample/practice reports of echocardiographic studies
Collaborator	<ul style="list-style-type: none"> •Work closely with the staff in the echocardiographic department including technologists, assisting in the preparation, performance of the study, and discharge from the echo Lab •Work with the staff cardiologists in an effective and professional manner •Work with other physicians and allied health care professionals when performing echocardiographic examinations 	<ul style="list-style-type: none"> •Spend adequate amount of time with staff cardiologists as well as sonographers •Perform echocardiographic studies in the Intensive Care Unit, CSU and the CCU

Manager	<ul style="list-style-type: none"> •Utilizes the echocardiographic equipment and time in an efficient manner •Respects and adheres to both the laboratory schedule and the patients needs for a timely examination •Understands the indications and contraindications for cardiac echo 	<ul style="list-style-type: none"> •Works closely with the sonographer to screen the booking schedule and triage/select appropriate cases
Health Advocate	<ul style="list-style-type: none"> •Understand the role of echocardiography in diagnosing cardiovascular disease •Use the information from echocardiography to help patients modify cardiac risk factors •Use echocardiography to help patients understand their cardiovascular illness 	<ul style="list-style-type: none"> •Utilize the information from echocardiographic studies in combination with the information obtained from the patients to promote cardiovascular health
Scholar	<ul style="list-style-type: none"> •Understand knowledge gaps in technical and interpret skills in echocardiography •Critically evaluates the literature on topics related to echocardiography •Assist in the teaching of more junior housestaff in the technical and interpretive skills of echocardiography •Participate in rounds and presentations of echocardiographic topics 	<ul style="list-style-type: none"> •Read the appropriate literature provided •Refer to the standard textbooks of cardiology and electrocardiography •Attend Cardiology Grand Rounds •Attend city wide echocardiography rounds • Prepare/present in-depth echo presentation/journal clubs dealing with appropriate topic for level of training • Review/utilize multimedia resources including teaching case banks and electronic textbooks to supplement printed materials
Professional	<ul style="list-style-type: none"> •Interact with patients coming to the Echocardiography Laboratory with integrity, honesty and compassion •Work with other physicians and allied healthcare professionals in a appropriate and professional manner 	<ul style="list-style-type: none"> •Use senior staff cardiologists as mentors •Spend an appropriate amount of time in the echocardiography laboratory in order to develop the appropriate professional skills

**Table 2, Echocardiography Trainee Objective Specific Evaluation
Echocardiography Laboratory**

Fellow _____

Date of Rotation _____ Supervisor _____

Roles	Objectives	Not Met	Met	Met with Distinction	Comments
Medical Expert	<ul style="list-style-type: none"> • Understand cardiovascular anatomy, hemodynamics and the physical principles and instrumentation of ultra sound • Understands the indications, contraindications, strengths and weaknesses of both transthoracic and transesophageal echocardiography • Performs esophageal intubation of TEE probe in appropriate manner • Performs complete TEE examination • Know the echocardiographic appearance of cardiac structures including cardiac chambers, valves and major blood vessels • Learn to correlate echocardiographic features with findings from other investigations including hemodynamics and surgical specimens • Learn to perform and interpret transthoracic M Mode, two-dimensional, pulse Doppler, continuous wave Doppler and Colour Flow studies on patients with common cardiovascular illnesses • knows the indications for different stress echo modalities as well as strengths/weaknesses vis a 				

	<p>vis other imaging modalities.</p> <ul style="list-style-type: none"> •knows how to perform exercise, dobutamine and dipyridamole stress echo, including recognition of complications, and their management. •knows how to interpret the hemodynamic effects on the heart of exercise in the setting of valvular heart diseases including mitral and aortic regurgitation and mitral stenosis. 				
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Communicator	<ul style="list-style-type: none"> •Develop a good patient relationship during the examination with appropriate attention to comfort •Interpret from the requisition the relevant questions to be answered by the echocardiographic examination •Develop a report of all salient echocardiographic features •Communicate the results of the examination to the patient and the referring physician 	Not Met	Met	Met with Distinction	Comments
Collaborator	<ul style="list-style-type: none"> •Work closely with the staff in the echocardiographic department including technologists •Work with the staff cardiologists in an effective and professional manner •Work with other physicians and allied health care professionals when performing echocardiographic examinations 				
Manager	<ul style="list-style-type: none"> •Utilizes the echocardiographic 				

	<p>equipment and time in an efficient manner</p> <ul style="list-style-type: none"> •Respects and adheres to both the laboratory schedule and the patients needs for a timely examination •Understands the indications and contraindications for cardiac echo 				
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Health Advocate	<ul style="list-style-type: none"> •Understand the role of echocardiography in diagnosing cardiovascular disease •Use the information from echocardiography to help patients modify cardiac risk factors •Use echocardiography to help patients understand their cardiovascular illness 	Not Met	Met	Met with Distinction	Comments
Scholar	<ul style="list-style-type: none"> •Understand knowledge gaps in technical and interpret skills in echocardiography •Critically the literature on topics related to echocardiography •Assist in the teaching of more junior housestaff in the technical and interpretive skills of echocardiography •Participate in rounds and presentations of echocardiographic topics 				
Professional	<ul style="list-style-type: none"> •Interact with patients coming to the Echocardiography Laboratory with integrity, honesty and compassion •Work with other physicians and allied healthcare professionals in a appropriate and professional manner 				

Were the objectives discussed at the beginning of the rotation?

Yes No

At the midpoint of the rotation?
Were the objectives successfully completed?

Yes No
Yes No

Comments:

Strengths:

Areas for Improvement:

SIGNATURES:

_____ Date _____
Trainee/Resident

_____ Date _____
Evaluator