

Computational Signal Detection Laboratories (CSD Labs) offers clinically validated eMurmur that automates detection of heart defects by assisting physicians in performing auscultation.

□ THERE IS A SIGNIFICANT UNMET CLINICAL NEED TO STANDARDIZE AUSCULTATION.

Heart auscultation (Latin verb *auscultare* meaning “to listen”) with a stethoscope is the 200-year-old “standard” examination method worldwide for the screening of heart defects in patients of all ages for the purpose of identifying abnormal heart sounds (“murmurs”). ● Auscultation is often referred to as an *art*, since a correct diagnosis can be challenging for various reasons and is exclusively dependent on the medical professional’s qualifications. The “technology” has not changed since the stethoscope was invented in France in 1816. ● “Unfortunately, accurate interpretation of heart sounds by primary care providers is fraught with error, leading to missed diagnosis of disease and/or excessive costs associated with evaluation of normal variants. Thus, automated heart sound analysis, also known as computer-assisted auscultation (CAA), has the potential to become a cost-effective screening and diagnostic tool...” (Source: Aetna Inc., 2013 Clinical Policy Bulletin, “Acoustic Heart Sound Recording and Computer Analysis.”)

□ CSD LABS HAS DEVELOPED eMURMUR, WORLD’S MOST PERCEPTIVE HEART MURMUR DETECTOR FOR OBJECTIVE AND HIGHLY ACCURATE IDENTIFICATION OF “PATHOLOGICAL” VERSUS “INNOCENT” HEART MURMURS.

eMurmur is a clinically tested software platform for the objective detection of heart murmurs that analyzes and classifies heart sounds acquired via an electronic stethoscope. The eMurmur platform is comprised of an app that runs on a mobile device and is powered by SADIE, a Machine Intelligence Signal Analysis/Diagnosis Engine. Via Bluetooth® or audio cable, the app pairs with any commercially available electronic stethoscope or other appropriate recording device, and receives and sends the acquired heart sounds to the server for analysis. After a few seconds, the results are displayed to the health care professional on his/her mobile device where he/she can review, compare, consult, or add his/her own findings in an efficient and standardized way. ● This novel way of standardized documentation of auscultation findings can be utilized by medical professionals performing auscultation in their daily routine right at their patient’s side. ● Moreover, eMurmur offers medical professionals the capacity to retrieve a PDF report containing all of the above results, and enables integration into electronic patient files and hospital information systems. Other unique benefits include e-consultation via the eMurmur web portal (i.e., remote case reviewing by medical experts); and heart sound-monitoring by comparing current with previous auscultation data, including recordings and all findings.

□ A CLINICAL STUDY OF eMURMUR CITES ITS “REAL-WORLD’ ROBUSTNESS.” Heart sounds are sophisticated and complex biological signals that become even more complex to analyze because they are usually concealed by a lot of noise and other sounds (breathing, moving, crying, etc). Therefore, the commonly used signal analysis methods generally do not suffice in producing a diagnosis-supporting result that is continuously robust enough to be used by medical professionals in their daily work. ● Now, results of a pilot study (“Computerized Automatic Diagnosis of Innocent and Pathologic Murmurs...”) of 106 patients at Children’s Hospital of Eastern Ontario, published in the peer-reviewed medical journal *Congenital Heart Disease* have confirmed “the high quality and ‘real-world’ robustness of the Machine Intelligence Engine (SADIE) in the assessment of...murmur”

CONTACTS & KEY INFORMATION

Headquarters	CSD Labs LLC Nikolaiplatz 4, 8020 Graz, Austria office@CSDlabs.com
Website	www.CSDlabs.com
Investors	Angel investors, plus several government grants
Industry	Medical Software for Clinical Decision Support
Sector	Cardiology, eHealth
Proprietary Platform	Computer assisted auscultation (CAA)-based eMurmur , a medical decision support software platform for fully automated heart murmur classification, powered by SADIE , the world’s most accurate heart Signal Analysis/Diagnosis Engine.
A Few Examples of Numerous Stakeholder Benefits	Patients: Improved diagnosis; earlier murmur protection; more certainty, less stress. Medical Professionals: Objective heart sound analysis; validated diagnosis output with meaningful physiological parameters; efficient electronic documentation; e-consultation for expert review; more time for asymptomatic patients. Private Insurers/Health Care Providers: Cost savings (\$US millions), shorter hospital stays, reduced risk, transparency through standardized electronic documentation, reduced variability, patient flow management.
Regulatory Status	eMurmur is a class II medical device; FDA and CE clearance in USA and Europe in 2017.

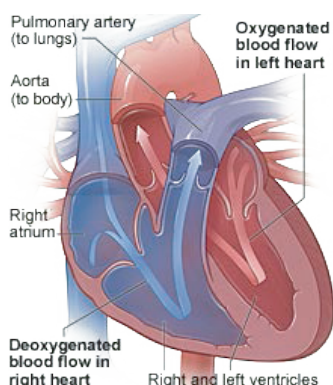
LEADERSHIP TEAM

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Chief Executive Officer and Founder
- Andreas Reinisch**
Chief Technology Officer and Co-Founder
- Michael Farrell**
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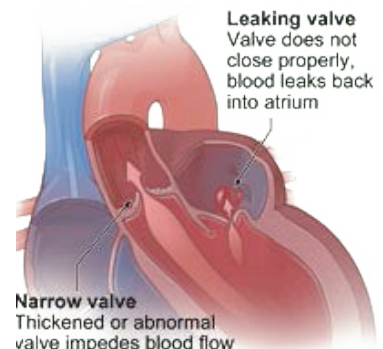
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FROM STETHOSCOPE TO COMPUTER-ASSISTED AUSCULTATION (CAA): eMURMUR HAS REINVENTED THE 200-YEAR-OLD WAY OF IDENTIFYING PATHOLOGICAL HEART MURMURS



Each heartbeat results in characteristic audible heart sounds that may be detected on the chest by means of a stethoscope. These sounds are mainly the result of valve activity and the associated turbulent blood flow. But depending on the patient’s age, different heart conditions can arise causing these characteristic heart sounds to deviate from the normal physiological sounds. These abnormal heart sounds are called **heart murmurs**. Analysis of heart sounds, called **auscultation**, requires acute hearing and much experience on the part of the examining physician. **eMurmur** is a **computer-assisted auscultation (CAA)** platform designed to **standardize analysis, classification and electronic documentation** of heart sounds and murmurs.



NOTE: eMurmur is awaiting approval for sale.