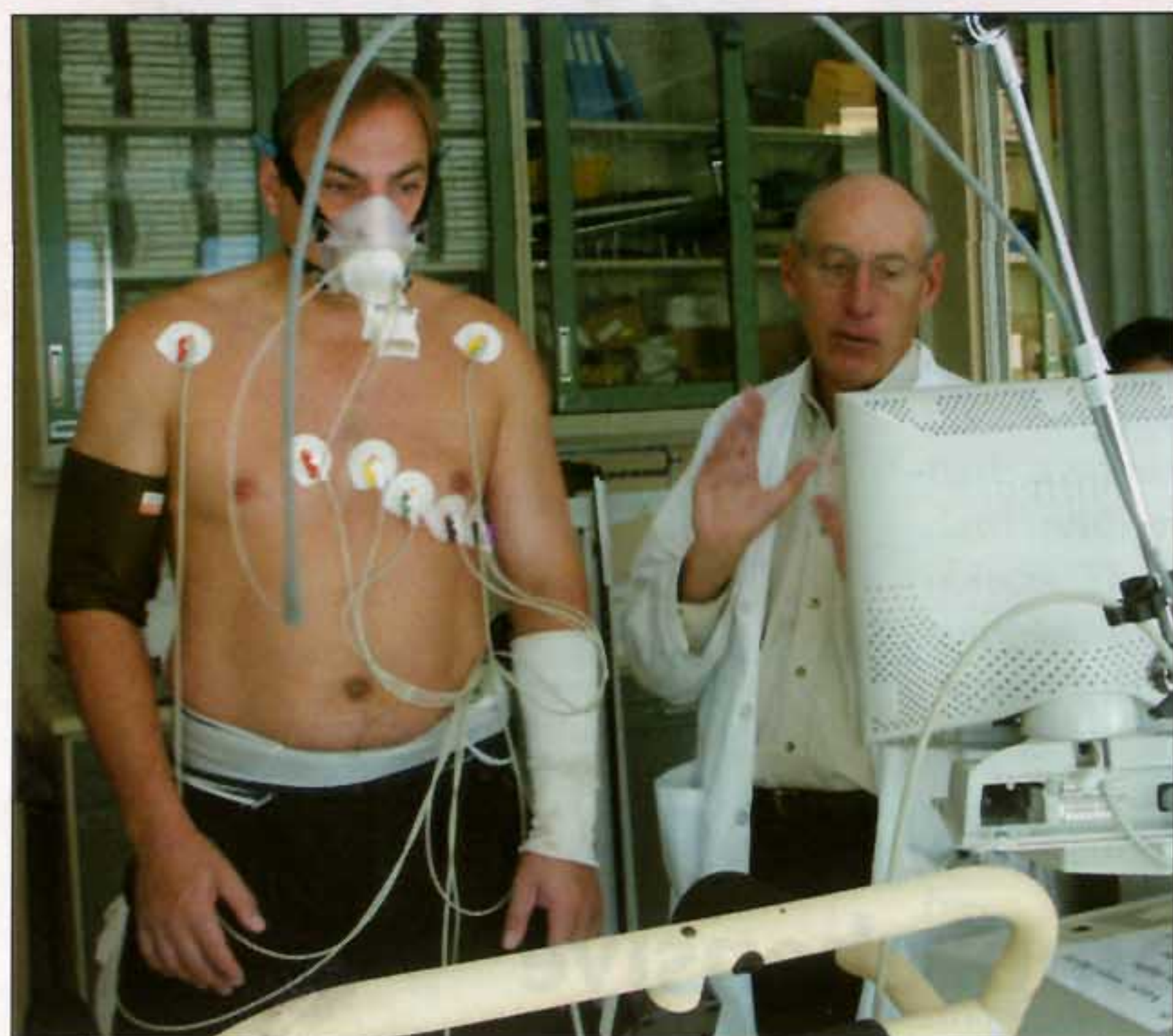


### Expired Gas Analysis with Exercise Capacity is Proven as Best Predictor of Cardiovascular Death

*Editor's Note: The following is an excerpt from an interview with Dr. Victor Froelicher regarding his research on exercise testing with expired gas analysis. While Dr. Froelicher is prohibited by law from endorsing any product, he shared input on his use of this technology.*

For nearly 30 years, dating back to research conducted in the Air Force at the School of Aerospace Medicine, Dr. Victor Froelicher, Director, ECG and Exercise Testing Laboratory has recognized the value of expired gas analysis in conjunction with exercise testing to identify coronary artery disease. At that time, the process was laborious and cumbersome, utilizing a Tissot, a volume displacing device to assess the volume of exhaled air in pilots and astronauts. Since the inception of PC-based techniques and gas analyzers for pulmonary function diagnostic technology, Froelicher has continued to espouse the economic and predictive value of instantaneous expired gas analysis and exercise testing.

"The important measurement for predicting cardiovascular death is exercise capacity, over and over again. It is more powerful and independent than all the other risk factors," Froelicher explains. His belief is based on decades of research and data—compiled at several Veterans Affairs (VA) Hospitals affiliated with major medical schools—that have been used to develop scores that predict which patient(s) can have a detrimental outcome such as heart attack or death.



Dr. Froelicher reviews real-time test data while the patient performs an exercise test with exhaled gas analysis.

While Dr. Froelicher recognizes the advent of newer, non-invasive tests for cardiac disease, he and a panel of experts have published several articles recommending the continued use of exercise capacity when screening patients for heart disease. The latest, "Exercise Capacity and Mortality Among Men Referred for Exercise Testing," (The New England Journal of Medicine, Volume 346, Number 11, March 14, 2002) is the result of recording treadmill tests on 6,213 middle-aged men over a ten year period. While the men were divided into two groups—those with a history of heart disease and healthy men—the study pointed Dr. Froelicher and his colleagues to the same conclusion: "Exercise capacity is a more powerful predictor of mortality among men than other established risk factors for cardiovascular disease."<sup>1</sup>

**Reference:** 1. Myers, J. et al, Exercise Capacity and Mortality Among Men Referred for Exercise Testing. New England Journal of Medicine 2002;346:793-801.

A graduate of the University of Pittsburgh Medical School in 1967, Victor F. Froelicher obtained his internship and internal medicine training at Wilford Hall U.S. Air Force Medical Center. He then pursued his fellowship in cardiology at the University of Alabama at Birmingham with T.J. Reeves. While at the U.S. Air Force School of Aerospace Medicine, Dr. Froelicher published numerous works related to exercise physiology and early screening for coronary artery disease in healthy aviators. His angiographic and follow-up studies of aviators were critical to the understanding of silent ischemia and the application of Bayesian statistics and predictive modeling to diagnostic tests. After eleven years of service in the U.S. Air Force, he left as a Lt. Colonel and joined the faculty at the University of California at San Diego. At UCSD he was the principal investigator of a randomized trial of cardiac rehabilitation called PERFEXT. In 1980, he was a co-founding editor for the Journal of Cardiopulmonary Rehabilitation. From 1984 to 1992, Dr. Froelicher was Chief of Cardiology at the Long Beach Veterans Affairs Medical Center and Assistant Chief at the University of California, Irvine. At the Long Beach VA, he performed the largest outcomes study of coronary artery disease in the VA. He was the co-principal investigator of a Veterans Affairs cooperative multicenter study of exercise testing and angiography called QUEXTA. In addition to writing several textbooks, Dr. Froelicher has participated in developing exercise testing guidelines for numerous organizations including the American College of Cardiology, American Heart Association and the American College of Sports Medicine. His last books were the 4th Edition of Exercise and the Heart and "Handbook of Ambulatory Care Cardiology." Also, he has co-authored over 200 papers, serves on numerous editorial boards and reviews for all of the major medical journals. In 1995, he was chosen for the "Best Doctors in the U.S." book and in 1997 was chosen as a best doctor in the "Pacific Region" and Silicon Valley. He is cardiologist to the Stanford athletes and participates in the Stanford Sports medicine program. He has co-authored a software program for exercise testing and cardiology information management and an educational web page which can be found at [www.cardiology.org](http://www.cardiology.org).

For more information visit [www.schillerch](http://www.schillerch) or call (786) 845-0620.

"We are also finding a correlation between each MET (metabolic equivalent) increase in a patient's exercise capacity with a 10% improvement in survival and a five percent decline in health-care costs. That is very important," adds Froelicher. While he doesn't discount the value of additional tests, and believes important data can be extracted from them, Froelicher cautions, "For preliminary testing, you don't want to start out with your most expensive test."

#### Reliable Equipment Leads to Reliable Test Data

A key component to Froelicher's research is his equipment. With each treadmill test, the patient is hooked up to Schiller's CardioVit CS-200 Ergo-Spiro for a breath-by-breath analysis of exhaled oxygen and carbon dioxide. The system offers simultaneous presentation of ECG and spirometry flow curves while enabling the clinician to compare all parameters. "We've used this technology and it is clearly reliable," states Froelicher. In fact, Froelicher brought a 12-year old Schiller Ergo Spirometry system to Palo Alto from the VA's Long Beach facility that outperforms newer models from different manufacturers.

Other than reliability, Froelicher believes this form of technology allows for the interface with existing systems and networks. Schiller's Ergo Spirometry is a PC-based system that connects right to the VA's existing network without any involvement from the IT Department. Over the course of years, Schiller has kept an open ear to end-users' suggestions.

#### VA Palo Alto Health Care System

The VA Palo Alto Health Care System is one of the largest VA facilities in the nation, home to three inpatient divisions and six community based clinics. The Palo Alto Division boasts one of the most sophisticated tertiary care centers in the Veterans Health Administration (VHA). Affiliation with the Stanford University School of Medicine has helped make the VA Palo Alto Health Care System a leader in research with an annual budget of approximately \$44 million. Nearly 1,300 students of various disciplines receive training each year through the health systems' affiliations with Stanford and numerous other colleges and universities.



Dr. Froelicher conducts a stress test at the VA Palo Alto Division.