

# LET'S START WITH

**W**e talk with **Prof. Witold Rużyłło, MD, PhD**, a pioneer of advanced cardiological techniques in Poland, about ongoing progress in interventional cardiology, creating a system for early identification of those at risk of heart disease, and the role of prevention.

**Academia: What does it take it become an interventional cardiologist?**

Prof. Witold Rużyłło: Above all, you need spatial imagination, or the ability to translate what you see on a screen into the anatomy of the human body. In addition, you must not be afraid, you need to have the courage to use new methods that are devised in this field every few years. You also need to keep a touch of madness in you and you need to be intellectually restless. You can't choose a middle path, you have to find your passion and follow it. I started my professional activity back when interventional cardiology was still in its infancy. After completing my studies, I joined Prof. Edmund Żera's team. He bought the first equipment for cineangiography in Poland. That was exactly when I discovered I could argue for what I believed was right and I wasn't afraid of novelties. Of course, you need to constantly have it in your mind that you must do no harm, because every procedure carries risks. Even so, I have pioneered many procedures. For example, I performed the first percutaneous transthoracic myocardial biopsy in Poland in 1972, based on what I'd read in the literature, and then a transluminal endomyocardial biopsy, using a biptome brought from Japan.

**To the layman, the heart is a very complex organ. Many of its elements can be damaged. Are there any fragments that fail especially frequently?**

The most important disease is coronary atherosclerosis. It is caused by certain genetic factors linked to high levels of cholesterol (hypercholesterolemia) and may therefore manifest itself at a relatively early age. There are two types of cholesterol in the blood: high-density lipoproteins (HDLs), called the "good" cholesterol, and low-density lipoproteins (LDL), or the "bad" cholesterol. What matters is the HDL/LDL ratio. A large amount of HDL prevents the early development of atherosclerosis and, by the same token, coronary heart disease. Risk factors for developing coronary heart disease include not only high cholesterol but also diabetes, obesity, lack of physical activity, and smoking.

This is because nicotine affects the coronary arteries, eventually taking away their ability to dilate.

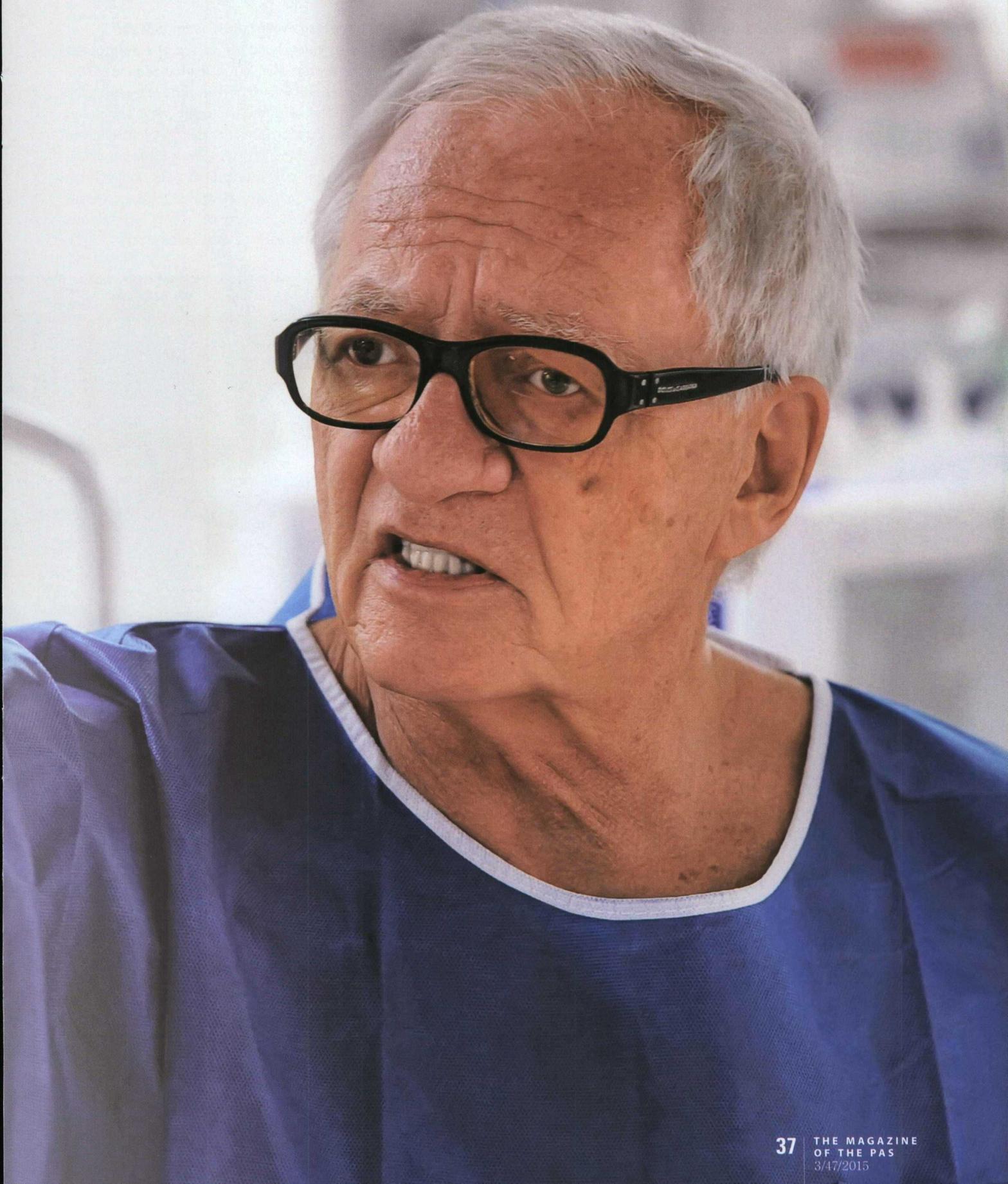
There are many acquired heart diseases, too. At one time, we often performed procedures to dilate the mitral valve, damaged by rheumatic diseases. Rheumatic diseases are currently rare; the most frequent acquired heart defect is now age-related calcification of the aortic valve, through which blood is pumped from the left ventricle to peripheral arteries. Critical aortic valve stenosis can cause damage to the left ventricle, possibly even sudden cardiac death, when blood cannot reach the coronary arteries. We usually operate on aortic valve stenosis in older patients who suffer from many other conditions, such as chronic obstructive pulmonary disease and renal failure, or have a long history of arterial hypertension, obesity, and diabetes. We describe such people as high-risk surgical patients, for whom it's very important to be able to perform minimally invasive procedures.

Congenital heart defects are another group of diseases, usually treated in infants or before birth, when the baby is still in the womb. For example, dilatation of the aortic valve can be performed even in a fetus. That means that cardiologists treat patients from the fetal stage to old age. Interventional procedures are common in patients with abnormal blood leaks inside and outside the heart. Most people treated in hospitals are over 65, but we also treat octogenarians, who leave hospitals with smiles on their faces and can look forward to another potential 15 or 20 years of life. A few years ago, no one thought that would be possible.

Even so, there is still the problem of the choice of method. Advancements in medical technology give us a wide range of therapeutic options, but we must always adjust treatment to each patient individually. In some cases, choosing not to intervene is less risky than performing a procedure.

**You are a great supporter of treatment methods that eliminate the need to open the chest, which means interventional cardiology. What does it deal with?**

# THE HEART



In 1967, the Argentinian cardiac surgeon René Favaloro performed the first coronary artery bypass surgery at the Cleveland Clinic. A young cardiologist named Andreas Grüntzig wondered whether bypass surgery could be replaced by the expansion of the damaged artery, and performed such a procedure in 1977. That was how interventional cardiology was born. The following years witnessed the performance of more procedures, starting from the correction of patent ductus arteriosus. This is a congenital heart defect in which the opening between the aorta and the pulmonary artery fails to close shortly after birth. The first pulmonary valvuloplasty, or the dilatation of the congenital narrowing of the pulmonary valve, was performed in 1982. Two years later, I performed the same procedure at the Institute of Cardiology in Anin.

#### Could you describe this procedure?

We introduce a guiding catheter into the aorta, then into the ostium of the right and left coronary artery. We can get there through the radial artery or the femoral artery. After that, we need to introduce another catheter and a balloon. When the balloon reaches the narrowing, it is inflated to a pressure of 12–14 atmospheres, thus compressing the atherosclerotic plaque. Such procedures were performed for several years, but the dilated site tended to renarrow, so we came to the conclusion that it was necessary to insert a “scaffolding” to hold the repaired vessel open. And so stents, or tiny mesh tubes, were developed. We have the same balloon-tipped catheter, which we use to insert the stent. When the balloon is inflated, it expands the stent, allowing it to lock in place. Restenosis turned out to be less frequent after such procedures, but nevertheless still occurred. Back in the 1990s, we started to use stents coated with anti-proliferative substances. That turned out to reduce restenosis to a significant degree. In recent years, biodegradable stents have been developed that disappear after several years.

Another major milestone in interventional cardiology came with the employment of angioplasty in the treatment of acute coronary syndromes. Today’s fatality rate for heart attacks does not exceed 4%, if the patient reaches us in time. Before the introduction of angioplasty, that rate was as high as 30%.

There are over 150 invasive cardiology centers in Poland, 148 of which are on duty round the clock. It is very important that patients reach such centers early enough. So I say clearly: if anyone feels a pain in their chest, they should call an ambulance. They will have an ECG, which will allow the doctors to check if a heart attack has occurred. If so and if the patient reaches one of our centers within two hours from the onset of pain, the blocked coronary artery can be opened and there will be no significant after-effects. Catheterization should be performed within 30 minutes of a patient’s

arrival at the hospital. Time is extremely important, because even if we succeed in opening the blocked vessel, but do so after several hours, the heart attack will have caused damage to the heart.

#### What about treatment options for valves?

We can treat nearly all the valves: the pulmonary valve, the aortic valve, and the bicuspid valve (the one between the left atrium and the left ventricle). We are still left with the tricuspid valve, which lies between the right atrium and the right ventricle, but we are getting there. Aortic valves are treated surgically. In high-risk surgical patients, we perform interventional procedures and introduce valves through the femoral artery or, if it is too narrow, through a carotid artery, a subclavian artery.

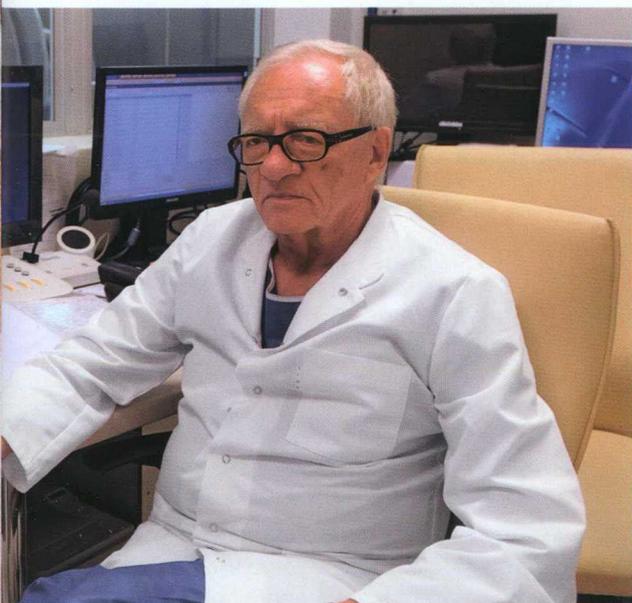


As I said, mitral regurgitation and aortic valve stenosis in older patients pose a growing problem. Blood from the lungs enters the heart, passing through the left atrium to the left ventricle, which contracts to push blood into the aorta. If the left ventricle enlarges as a result of many years of arterial hypertension or a heart attack and its contractility becomes impaired, especially that of the muscles and tendinous chords involved in the work of the valve, and if the mitral valve annulus dilates, there are several possible ways of repairing the leaky valve. Currently, the most popular method involves the placement of a clip: the left atrium is accessed through a puncture made in the interatrial septum and a clip is placed. We also try to narrow the mitral annulus, without injuring the leaflets, only by reducing the ostium of the valve, which is dilated in patients with functional regurgitation. The valve itself is not ill. It simply does not close properly, because the annulus dilates due to the enlargement of the left ventricle.

**You are making things sound so simple. How do you make sure that you guide the catheter correctly?**

That's a good question! We monitor the procedure using X-ray visualization. Such images can be captured from different sides. We access the blood vessels through a puncture in an artery or vein, we insert a cannula (a catheter), and everything we need through the catheter. Even very wide instruments can be pushed through veins without any problems, but arteries are less easily stretched.

In aortic valve implantation, it is important that the procedure is monitored using transesophageal echocardiography. We insert a thin tube into the patient's esophagus and we can see everything in 3D. We can see images of the heart and the vessels



on X-ray screens. In addition, we have transesophageal echocardiography, a blood pressure monitor, and ECG. If everything goes well, we need about an hour to implant a valve, without opening the chest, and the patient wakes up with a pressure dressing on his thigh.

We have talked about the aortic valve, but it is also possible to perform procedures to treat pulmonary valve insufficiency caused by a congenital defect. Such surgeries are often performed in childhood and involve using a conduit, or a fragment of the pulmonary artery with a valve taken from a corpse. It lasts for more than a decade, but it ultimately calcifies, because it is after all a foreign body, so reoperations are necessary. Currently, we offer such patients the implantation of a pulmonary valve into the calcified conduit through the femoral vein. We performed this procedure for the first time on 18 December 2008. So far, we have performed 67 procedures of transcatheter pulmonary valve implantation.

**You are working miracles.**

That is what interventional cardiology is like. Someone might say that if we are implanting stents using a balloon under the pressure of 18 atmospheres, we might cause a perforation! So far, this has happened only once, during the implantation of a pulmonary valve. Fortunately, no surgical intervention was necessary.

We are aware of our responsibility. All operations must be well thought out. Importantly, all members of the cardiac team, which means cardiac surgeons and cardiologists, must work together. We respect one another. Such collaboration and good will are the key to success. I can say with satisfaction that I have worked in many places in the world and I have always experienced that.

Relations between teams working in two different places are extremely important. The atmosphere must be pleasant, even friendly, but that must occur spontaneously, not because university officials or the director of an institute demand it. When I start doing something, I know that others are watching. We are partners and this is what makes advancements in medicine possible. We already have hybrid operating rooms.

**How many people are involved in one procedure?**

Implanting a stent and a pulmonary valve is done in one stage, sometimes in two stages. Such a procedure requires two doctors and a scrub nurse. We perform procedures under general anesthesia, so the patient is intubated, and there is additionally an anesthesiologist and an anesthesiologist assistant in the room. Some aortic valve implantation procedures are not performed under general anesthesia, if the patient is in good overall condition and the procedure is expected to be quick. In the case of the pulmonary valve, however, general anesthesia means greater comfort for very ill young people with congenital defects who have often undergone many surgeries. Meanwhile, other procedures, aside from the implantation of valves or the repair of insufficiency, for example the closure of defects, may be done without general anesthesia.

**Immense changes have taken place throughout your professional career. What will happen in the future?**

The scale of changes has been virtually unimaginable. When I look back, I can see that very clearly. As for the future, prevention is especially sorely needed. That requires adequate legal measures – a new Public Health Act has just been signed in Poland! If we know that someone has a genetic predisposition for heart disease or suffered a minor heart attack, we must not allow further damage to the heart. Such patients must have periodic examinations every year or every two years. Coronary computed tomography angiography, or CCTA, is enough, there is no need to hospitalize such patients.

*"In interventional cardiology, you must not be afraid, you need to have the courage to use new methods that are devised in this field every few years. You also need to keep a touch of madness in you and you need to be intellectually restless," Prof. Rużyłło tells us*

I believe that CCTA and MRI, done to assess damage to the heart, are promising methods, because they allow non-invasive and outpatient assessment of patients with coronary heart disease. All necessary examinations take 4-5 hours in a specialized center.

**How can we look after our hearts, to avoid ever having to meet you in the operating room?**

You are slim, probably physically active, you live a healthy lifestyle, you jog or take walks...

**I ride a bike and I swim.**

Physical activity is crucial. Also, you need to know if anyone in your family has a history of heart problems and a heart attack. You need to test your cholesterol

levels. You need to enjoy your life, live it to the full. Weight is also important, because those more susceptible to developing diabetes are usually obese. Those at risk should undergo regular examinations: ECG and echocardiography, which show the condition of the heart. In addition, in an aging population, more or less 10% of the population around 65 may experience irregular heartbeat such as atrial fibrillation. In this case, a Holter monitor proves useful, because atrial fibrillation can cause embolisms in the brain. Properly diagnosed fibrillation requires immediate treatment with anticoagulants and we can use transesophageal echocardiography to see if there are any blood clots. Ablation may be used to treat patients with atrial fibrillation. That is also a new field in cardiology.

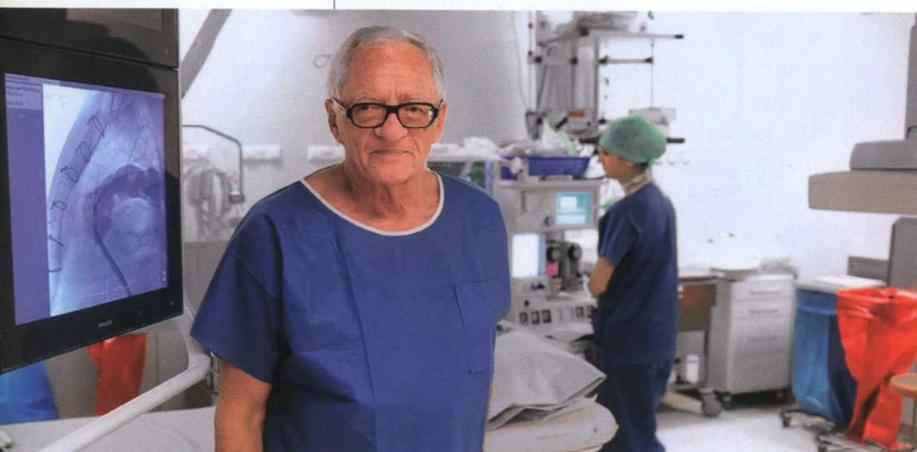
**Is it also being done in Poland?**

Yes, we pioneered this method in Anin. After accessing the heart through a vein and passing through the atrial septum, we apply high temperature at the source of arrhythmia. More and more patients in Poland are treated using this method, but this is still not enough. If a blood clot breaks away from the atrium, it may reach the brain and cause a stroke. In Poland, 70,000 strokes are reported every year, with 30,000 patients dying within a month after the stroke. In many cases, it is enough to close the left atrial appendage and the patient won't have to take anticoagulants. We must remember that many people can't take such medications due to coexisting bleeding, which often occurs in older patients with atrial fibrillation. That has been one of our successes in recent years.

**You performed procedures in Texas when you were 32 years old. Do today's 30-year-olds stand a chance of operating together with famous doctors like you?**

I am very enthusiastic about young people. I believe that working with young people and supporting their development is very important for the development of science. A scientific supervisor must create a friendly atmosphere for young people and I believe I have succeeded in doing that. A group of prominent cardiologists has developed around me. I have always supported them, also after they finished their studies. Without their help, I probably wouldn't have gotten to where I am now. A partnership-based relationship is important. In the past, a professor was a prominent figure and no one dared to speak in his presence. I want relations based on different principles. My students here in Anin can feel our support and satisfaction with their work here. I am indeed very pleased to see them bettering themselves.

INTERVIEW BY ANNA ZAWADZKA  
IN COLLABORATION WITH AGNIESZKA KLOCH  
PHOTOS BY JAKUB OSTAŁOWSKI



**Prof. Witold Rużyłło** has pioneered modern interventional cardiology methods in Poland. He was the first in Poland to perform diagnostic procedures (coronary angiography and myocardial biopsy) and interventional cardiology procedures (the closure of patent ductus arteriosus and coronary angioplasty). He also used pioneering therapeutic procedures to treat congenital and acquired heart defects in Poland (1984-1987), culminating in the first percutaneous pulmonary valve implantation in Poland in 2008. He worked at the Texas Heart Institute and at Texas Children's Hospital at Baylor College of Medicine in Houston in 1970-1971, and has been a visiting professor at many medical universities. In the years 1981-2009, Prof. Rużyłło served as head of the Coronary Disease Department and the Independent Hemodynamics Laboratory. In 2006-2015, he was director of the Cardinal Stefan Wyszyński Institute of Cardiology in Anin. He has authored 587 publications and 10 textbooks, including *Diagnostyka hemodynamiczna serca* [Hemodynamic Cardiodiagnostics], *Wady serca* [Heart Defects], and *Kardiologia interwencyjna* [Interventional Cardiology], and numerous chapters in other textbooks (his citation count = 11,210 and h-index = 40). Editor-in-chief of the Polish interventional cardiology journal *Postępy w Kardiologii Interwencyjnej*. He has served as president of the Polish Cardiac Society (PTK) and a member of the board of the European Society of Cardiology. He became a corresponding member of the Polish Academy of Sciences (PAS) in 2004 and served as member of the PAS Presidium from 2007 to 2011. He was a member of the medical sciences section at Poland's Central Commission for Academic Titles and Degrees in 2003-2013. He was a member of the Programme Council of the National Program for the Prevention and Treatment of Cardiovascular Diseases POLKARD in 2003-2009.