

Internal medicine and biomedicine in Poland: views from the inside and outside

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Daniel P. Potaczek, MD, PhD Daniel P. Potaczek graduated (2002) and obtained his PhD degree for the work on the genetic variability of the high-affinity IgE receptor (2007) from the Jagiellonian University Medical College, Kraków, Poland; he pursued his career at the Atopy (Allergy) Research Center of the Juntendo University School of Medicine, Tokyo, Japan, and then at the Department of Pediatric Pneumology, Allergy and Neonatology, Hannover Medical School, Hannover, Germany (working on the genetics and genomics of IgE receptors and their effects on serum IgE regulation, and on the role of *ORMDL* genes in the development of childhood asthma); his research interests include also the role of IL-6 pathway genetic polymorphisms in aortic stenosis, the effects of iron metabolism on the risk of thrombosis, and the diagnostics of monogenetic hemostatic or cardiovascular disorders (John Paul II Hospital, Kraków); at the Institute of Laboratory Medicine and Pathobiochemistry, Molecular Diagnostics, Philipp University of Marburg, Germany, he works on the development of novel anti-sense approach-based therapeutics as well as on the role of environmental factors (viruses, bacteria, and parasites), epigenetic modifications, and other mechanisms in the susceptibility to allergy and related disorders.

As a medical doctor, I had started my carrier in the field of internal medicine, but subsequently I spent most of my professional life working as a biomedical researcher. Moreover, a huge majority of my scientific activities have taken place abroad. Still, I have always been closely collaborating with renowned Polish researchers. In addition, my scientific work involved not only pure laboratory investigations but was often connected to clinical studies of different types. Finally, as part of my quite recent work, I have been involved in establishing some genetic assays for single-gene disorders as well as for analysis and interpretation of genetic testing results. Thus, although my perspective is rather subjective and has mostly foreign and not strictly clinical character, I am still providing some of my thoughts on internal medicine, as shortly outlined below.

Internal medicine and its role now and in the nearest future

Internal medicine is for me a hub connecting other branches of medicine, and (apart from pediatrics in the case of children) it is the only branch that offers so called holistic approach to patients and their health or disease. Of course, nowadays, internal medicine is also subdivided into several sub-branches, some of which, such as for example cardiology, have in fact become independent clinical areas. The process of deeper and deeper specialization is now a clear trend due to an exponentially progressing development of novel diagnostic and therapeutic options. Interestingly, not only divergence but also surprising convergence between different medical subspecialties can be seen, such as for example in the case of percutaneous coronary interventions, which are mastered by cardiothoracic surgeons, interventional cardiologists, interventional radiologists, and possibly other specialists.

Strict specialization in medicine is reflected by (or reflects) similar processes in biomedical sciences, where investigators typically focus these

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days on very narrow thematic and methodological aspects. Therefore, successful research requires collaboration among specialists in various areas within one team or between independent teams in a form of consortia. Furthermore, at least in my opinion, the most interesting research is conducted on the border of 2 or more different disciplines (ie, where 2 or more disciplines overlap), such as for example, from a field of internal medicine, allergy and thrombosis, allergy and atherosclerosis, and allergy and cancer.^{1,2} This, however, requires some coordination between specialists from various research areas. In university hospitals, where it all looks quite similar to science, it is internal medicine (and sometimes, depending on the geographic location, diagnostics) that plays the role of such a coordinator. With increasing specialization and an increasing number of medical branches, the importance of the coordinating role of internal medicine will be also increasing.

On the other hand, there are some areas of internal medicine that are (still) not, and some of them will probably never be, fully independent of the original discipline. It is in my opinion another role of internal medicine to host the areas linked to one or several already defined branches but not yet (if ever) sharply separated from them or clearly defined. One such example, although probably not the best, could be hemostasis and thrombosis, which is partly covered by hematology, angiology, cardiology, neurology, clinical genetics, and some other specializations.

Remarkable examples of recent developments in Polish internal medicine It is believed that Polish biomedical sciences and clinical medicine are not really innovative. It is not for me to judge, but I can clearly see many examples suggesting that even if this was true some time ago, things are now changing for better. I would like to shortly describe 2 Polish initiatives/centers, selected based on my own experience.

The first one is the John Paul II Hospital in Kraków, headed by Dr. Anna Prokop-Staszecka. It is a very modern institution that in addition to top-level stationary and ambulatory care with advanced diagnostics of different types, offers also health education to patients. The knowledge is provided not only to patients but also to health care specialists (continuing education). Finally, the hospital is strongly involved in scientific, especially translational, research activities. Of importance, it is not a university hospital per se, although it hosts some academic units as well. Thanks to local and international financing, the John Paul II Hospital in Kraków is constantly developing. To give just one but a very prominent example, the Center for Modern Laboratory Diagnostics, headed by Prof. Anetta Undas, was founded as part of the hospital. It establishes and then offers novel laboratory diagnostic modalities to patients, not really available or hardly accessible elsewhere in Poland.³ This is especially true in the case of coagulation and hemostasis

disorders. Sometimes, when the testing is not available in the center, the results are obtained through collaborating units abroad.^{4,5}

Another remarkable example comes from Łódź, where, based on European funds, Professor Marek L. Kowalski established the Healthy Ageing Research Centre with a mission "(...) to support and advance healthy ageing through biomedical research, education and collaborative partnership at European, national and local levels."⁶ This large international initiative is designed to conduct translational research aiming at improving the health status of the elderly, who constitute an increasingly numerous age group due to population aging in Europe, including Poland.

Future development of Polish biomedicine It is not for me to decide on how Polish biomedicine should develop. I can only make some suggestions based on my recent experiences. However, it is clear to me that further progress in Polish biomedicine could be achieved only through the development of domestic (Polish) novel diagnostic and therapeutic strategies. It does not have to be something completely new but at least a new practical application of the already existing approaches. I will try to give 2 examples on how I think this could work.

The concept of applying antisense (preventing certain mRNAs to be translated) molecules as therapeutics is not new but still makes it possible to develop novel highly specific drugs with a chance of entering the market, such as for example mipomersen approved by the Food and Drug Administration as a complementary treatment for patients with homozygous familial hypercholesterolemia.^{7,8} However, a successful antisense drug does not have to be developed by a big company, at least at the beginning. Sometimes, a group of motivated researchers and a relatively small spin-off might be enough.⁸

A concept of liquid biopsies, a methodology using molecules (eg, cell-free DNA or exosomal RNA) or cells circulating in blood, was developed to be used predominantly but not solely for the diagnostics of cancer.¹⁰ It is rather new but even here some further developments could be made. For instance, benefits from targeting RNA sequestered by blood platelets¹¹ or implementation of not only genetic but also epigenetic analyses of plasma DNA¹² have recently been reported.

Conclusions To summarize, I believe there is not only a lot of space but also a deep need for the presence and further development of internal medicine now and in the future. Paradoxically, in times of narrow specialization, internal medicine can either coordinate other branches of medicine or comprehensively cover the areas partly overlapping with several of them at once but not forming separate disciplines (yet). In my view, this is where a substantial recent progress in Polish internal medicine has occurred. Further development of biomedicine in Poland should go through

translational research aiming at the development of new diagnostic or therapeutic modalities.

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