Tell us about your early days

I was born and raised by the Mediterranean Sea, in the beautiful town of Chania in Crete, Greece. I went to school and lived in Chania until I moved to Heraklion, Crete for my medical degree studies at the University of Crete. After Medical School, I went to Thessaloniki in the north of Greece for a 12-month rural medical service, which was a mandatory requirement for Greek medical graduates at the time. To further develop my clinical and research skills, I relocated to the USA in 2002.

When did you decide to become a scientist? Were there any people who influenced your decision?

My father, Spyros Lionakis, a professor of horticulture in Greece, introduced the “bug” for science to me. Since childhood, he instilled in me the concept of intellectual curiosity. I recall being excited when he would take me to his laboratory and show me experiments that his lab members had set up to interrogate different conditions that influence growth and crop productivity of subtropical plants. My decision to pursue a career as a scientist was finalized during Medical School and was due, at large, to a wonderful professor I had, George Samonis. He had spent several years at The University of Texas MD Anderson Cancer Center in Houston, Texas where he performed both clinical Infectious Diseases training and research training under the guidance of Gerald Bodey, a legend in the field of academic Infectious Diseases. Based on his experiences abroad before returning to Greece, he was the one who urged me to pursue an academic career abroad, he was the one who introduced me to Dimitrios Kontoyiannis whose laboratory I joined after Medical School, and he was the one who gave me the opportunity to get involved in my first experiments in mice that were colonized with Candida albicans following administration of antibiotics. It is quite interesting how life comes back full-circle sometimes; over 15 years after that initial exposure to the research concept that antibiotic-induced microbiome perturbations result in enhanced mucosal Candida colonization, we now study how antibiotics affect mucosal host-Candida interactions in mice and humans at the microbiomic and immunological levels in my own laboratory.

What was your first position after university?

Right after completing university and the rural clinical service in Greece, I was fortunate to join the laboratory of Dimitrios Kontoyiannis at the Department of Infectious Diseases, Infection Control and Employee Health at The University of Texas MD Anderson Cancer Center in Houston, Texas as a post-doctoral research fellow. I spent 2 years in Dimitrios’ laboratory and that experience propelled my academic career. I was involved in the implementation of a variety of clinical and basic research projects pertaining to fungal microbiology and pathogenesis, mechanisms of antifungal resistance, and mechanisms of antifungal activity of antimicrobial agents against the
opportunistic molds *Aspergillus, Mucorales* and *Fusarium*, both *in vitro* and *in vivo* in mouse and Drosohila models of infection. This fellowship further solidified my strong interest in a career path of a physici-an-scientist and gave me the opportunity to enhance my clinical and bench research skills and to publish a significant number of scientific manuscripts. More importantly, I was fortunate to have Dimitrios as a mentor and to have the opportunity to learn so much from him. Even now, more than 10 years after leaving his laboratory, Dimitrios is a valued mentor and friend from whom I seek advice, guidance and inspiration.

**Where did you perform your internship/residency and what field of specialization did you choose?**

I performed my Internal Medicine Residency at Baylor College of Medicine in Houston, Texas (2004 – 2007). I was fortunate to train in a rigorous clinical and academic environment with great teachers, most memorable of which was Robert Graham at Ben Taub Hospital. Residency training at Baylor comprised a unique compilation of different hospital settings that allowed for exposure to a myriad of diverse pathologies. Since studying Microbiology and Immunology in Medical School, I was fascinated by the host-pathogen interface and I knew that I would pursue a career in Infectious Diseases. During my residency training at Baylor, the significant exposure to patients with multiple infectious diseases further reinforced my strong interest in that specialization. I love Infectious Diseases because it is an intellectually gratifying sub-specialty that is not confined to one organ or system but instead requires integration of knowledge from all disciplines across Internal Medicine. After residency, I moved to the National Institute of Allergy and Infectious Diseases (NIAID) at the National Institutes of Health (NIH) for my Infectious Diseases fellowship (2007 – 2012), to take advantage of the exceptional environment for integration of basic, translational and clinical research. In addition, I was attracted to the outstanding NIH immunology faculty and the opportunity to extend my knowledge of fungal pathogenesis to the host immune response, which is poorly understood. After a year of intense clinical training in Infectious Diseases during which I had the privilege to have Jack Bennett, a legend in the field of Medical Mycology and Infectious Diseases, as one of my attendings, I began research training on the role of leukocyte chemotactic factors in antifungal immunity at the Laboratory of Molecular Immunology (LMI) under the mentorship of Philip Murphy, a world-renowned immunologist.

**When and where did you start your own lab?**

In 2010, during the research years of my Infectious Diseases fellowship at LMI, I was recruited as an Assistant Clinical Investigator in the Transition Program in Clinical Research (TPCR) of the NIAID, which is the intramural counterpart of obtaining a K award outside the NIH. The TPCR, which is meant to foster the development of an independent clinical research program, was a non-tenure track transition point between fellowship and a Tenure-Track Investigator position, in which I was recruited in 2012. Therefore, I started my own laboratory in the summer of 2012 within LCID at the NIAID, building on the foundation of a valuable translational research experience during the NIAID TPCR between 2010 and 2012.

**What is your position at your institution?**

I am a Clinical Tenure-Track Investigator within The Laboratory of Clinical Infectious Diseases (LCID) at the Intramural Research program of the NIAID at the NIH, and Chief of the Fungal Pathogene-sis Unit. I spend most of my time between my laboratory and coordinating the clinical care and clinical research studies of patients with mucosal and systemic fungal disease that are enrolled in my laboratory’s Institutional Review Board (IRB)-approved clinical research protocols at the NIAID. I also attend the NIAID Infectious Diseases Consultation Service and I participate in the education and mentoring of the NIAID Infectious Diseases and Allergy/Immunology clinical fellows.

**What are your research interests? What areas or topics does your lab currently focus on?**

Human fungal infections are typically opportunistic and primarily affect patients with acquired immunodeficiency (e.g., HIV infection or modern medical interventions such as cancer chemotherapy and transplantation) or inborn errors of immunity. Among fungal infections, mucosal and systemic candidiasis and invasive aspergillosis are the primary focus of attention in my laboratory. Systemic candidiasis is the most common deep-seated fungal infection in the developed world and a leading cause of nosocomial bloodstream infection in the USA. Invasive aspergillosis is the most common systemic fungal infection in recipients of allogeneic hematopoetic stem cell transplantation. Despite the availability of potent antifungal drugs with good *in vitro* and preclinical activity against *Candida* and *Aspergillus*, clinical outcomes of infected patients are often poor leading to significant morbidity and unacceptably high mortality rates. Therefore, adjunctive immune-based therapies are highly desirable, yet their development and success depends on improving our understanding of the cellular and molecular basis of human antifungal immunity.

Research in my lab applies an integrated bench-to-bedside approach, which aims to 1) define the cellular and molecular factors that regulate the immune response against mucosal and invasive fungal infections in clinically relevant animal models and to 2) better understand the genetic and immune defects that underlie inherited and acquired susceptibility to mucosal and invasive fungal disease in humans. Our goal is to develop a detailed mechanistic understanding of the molecular and cellular basis of mammalian innate and adaptive immune responses against *Candida* and *Aspergillus* with an aim to devise novel strategies to enhance the diag-nosis, improve risk stratification and
prognostication, and augment or supplement the current antifungal drug treatment against candidiasis and aspergillosis. To this end, we utilize in vitro cell culture systems, clinically relevant mouse models of mucosal and invasive fungal infections, and clinical samples from targeted cohorts of patients with inherited or acquired susceptibility to mucosal and invasive fungal disease to study host-fungal interactions by using a variety of immunological, biological, and imaging approaches.

Who were your mentors?

Besides George Samonis and Dimitrios Kontoyiannis who introduced me to academic medicine and had a tremendous impact on my early professional steps, Phil Murphy is undoubtedly the research mentor who has marked and catalyzed my academic development. I cannot think of a more rigorous, logical and brilliant scientist than Phil and there are no words to express my gratitude for what he has wholeheartedly done to foster my growth as an independent scientist. In the recent years as a Tenure-Track Investigator, I have also critically benefited from the mentorship of Steve Holland, my Branch Chief, whom I consider an exemplary physician-scientist as he performs clinical medicine and research with aplomb and equally superb quality.

Do you have partners that are important for your research projects?

To succeed in science, it is essential to partner with outstanding researchers outside of the direct area of expertise of the laboratory in order to enhance the caliber of the research questions that can be answered. In that regard, my laboratory collaborates with Phil Murphy and Steve Holland as well as June Kwon-Chung, my laboratory neighbor and an instrumental resource for us. Other NIH partners important for our research include Amy Hsu in our human genetics studies, Julie Segre in our microbiome studies and Yasmine Belkaid in our mucosal immunology studies. My laboratory has long-standing rewarding interactions with Mihai Netea at Radboud University Nijmegen Medical Center in the Netherlands and with John Perfect and Melissa Johnson at Duke University that have allowed us to translate our basic mouse immunological findings at the population genetics level in humans. Jean Lim at Icahn School of Medicine at Mount Sinai is a dear friend and a collaborator since the time we were both post-doctoral research fellows at Phil Murphy’s laboratory at LMI.

What do you like most about your work as a physician?

Two features of working as a physician make it extremely rewarding and enjoyable for me. Firstly, practicing medicine is

Figure 1. About Michail Lionakis. Dr. Lionakis received his medical degree and graduate education at University of Crete, Greece. In 2002, he moved to the US to work as a Postdoc research fellow at M.D. Anderson Cancer Center, Texas, in the lab of Dimitrios Kontoyiannis, and as an Internal Medicine Resident at Baylor College of Medicine (2004-7) to develop his clinical skills. He then moved to Bethesda, Maryland, to join the National Institutes of Allergy & Infectious Diseases (NIAID), first as an Infectious Diseases Clinical Fellow (2007-10) and Assistant Clinical Investigator at the Laboratory of Molecular Immunology (2010-2), then as a Chief of Fungal Pathogenesis Unit at the Laboratory of Clinical Infectious Diseases (since 2012). Dr. Lionakis’ main research interests throughout his career have been host-fungal interactions and mechanisms of innate and acquired antifungal immunity and fungal pathogenesis, in particular mucosal and systemic candidiasis and invasive aspergillosis. He has authored >60 papers and book chapters in the field. In addition to his research activities, Dr. Lionakis is an attending physician at NIAID. He has received multiple honors and awards including ICAAC American Society of Microbiology Award for Outstanding Research (2003), Henry D. McIntosh Award for Outstanding Resident in Medicine (2007), George McCracken Infectious Disease Fellow Award (2010) and IDWeek Investigator Award (2015).
stimulating and challenging and provides sustainable intellectual growth. It requires ongoing review and synthesis of the literature to keep up with novel, fast-moving and complex medical knowledge. Secondly, working as a physician is a calling that comes with unparalleled humility and nobility and provides the opportunity to directly impact on patients’ lives.

How can one successfully combine working in the clinic with heading a research lab?

It is a challenge to combine a career as a clinician and a scientist, but all in all a rewarding one. Although there is no magic recipe for succeeding as a physician-scientist, essential features include hard work, focusing on developing a translational research program that draws experimental questions from the clinic and brings them to the bench and back to the bedside, partnering with outstanding collaborators and attracting talented trainees.

What do you think you would do if you were not an MD or a scientist?

I would not like to do something other than being a physician-scientist. It is not easy to make the right choice on such an important professional matter at the age of 16 in high school. I am glad and fortunate that my decision back then to go to Medical School was right on target.

What do you do for fun?

I love spending relaxing time with my wife Olga and our friends at home or at our favorite restaurants. I enjoy traveling around the world. We do that with every opportunity we get. I like watching and participating in sports, particularly basketball and swimming. I also like going to the movies, dancing and listening to good Greek and international music.