

MEMORIAM
Dr. Judah Folkman
1933 – 2008

"I spent a memorable year with Judah Folkman in his Boston laboratory in 1973/1974. Unforgettable to this day were his enthusiasm; his eagerness to learn from others as well as to communicate his own ideas on angiogenesis as an integral role in the progression and metastasis of tumors; his unusual concern for his patients; and his generosity towards students and co-workers. His sudden unexpected death was a blow to me and many others, and a grievous loss to the fields of cancer treatment and research to which he had contributed so much."

ROBERT AUERBACH
UNIVERSITY OF WISCONSIN, MADISON, WI

"Dr. Folkman was the kindest person that I knew. He would listen to everyone who wanted to speak with him from a medical student to a Nobel Prize winner. He would make the person feel comfortable and engage them in deep communication. Without a doubt after speaking with him one would leave with a clearer vision of the topic of the day. That is a skill that is innate and cannot be learned nor taught."

KEVIN CAMPHAUSEN
NATIONAL CANCER INSTITUTE, BETHESDA, MD

"Dr. Judah Folkman was a unique scientific mentor for me. Nearly 20 years ago, I listened to the first lecture on tumor angiogenesis and antiangiogenic therapy given by Dr. Folkman in a symposium in Stockholm. While I was quite sleepy to listen to most other lectures, my never suddenly became excited and I woke up when Dr. Folkman was talking about angiogenesis. His lecture was so unusually inspiring and memorable and contained so many humorous jokes that I still remember that particular lecture today. For example, Dr. Folkman said "if a post doc could resolve this problem, his salary will be doubled". At the end of the lecture, he usually said "before listening to your lecture I was confused and after listening to your lecture I am still confused, but at a higher level". After listening to that lecture, I immediately decided to work on tumor angiogenesis in his lab (not due to double salary). I was thinking who could resist not working in this exciting field. However, the word "angiogenesis" was not popular at that time and many scientists could not even pronounce it appropriately. At the beginning of 90s, I joined Dr. Folkman lab. I quickly found that his lab was not well funded and very few people believed his concept. NIH rejected his grant application for identifying angiogenesis inhibitors and pharmaceutical companies withdrew their support. Working in Dr. Folkman's lab, I had not only learnt angiogenesis research, but learnt the way of novel thinking and the way to approaching unusual medical problems. This has affected my entire research career. Using his abundant clinical knowledge and experience as a background, he always asked some unusual questions such as "why does a big tumor suppress a small tumor growth?", "why do tumor cells remain dormant in the body for months and years?", and "what happens to their DNA when apoptotic cells are eaten by their neighbor cells?" He usually taught me by saying that doing research is like playing chess. There are many ways to go. One has to find the smartest way to do research. Due to the space limit, I can only list a few examples how great and enjoyable to work with Dr. Folkman. If someone asks me "what field of research would you like to choose if I would go through my Ph.D and post doc training once again", I would certainly spell out the word angiogenesis. If that person asks me "whom I would like to choose as a supervisor, I would say Dr. Judah Folkman. For me, Dr. Folkman is still alive and his scientific spirit will stay with us for generations."

YIHAI CAO
KAROLINSKA INSTITUTET, MTC, STOCKHOLM, SWEDEN

"Judah Folkman was an individual like none other. He was too busy to eat and seldom took a vacation but always had time to stop and chat with an excited student or patient who needed hope. In addition to his innate brilliance, he had three characteristics that set him apart: his genuine and unbridled curiosity, his perseverance and his ability to synthesize information. I joined Judah's Laboratory for Surgical Research right out of my postdoctoral fellowship and have remained associated with him all of my professional life. I consider myself truly blessed to have known him and been mentored by him."

PAT D'AMORE

HARVARD MEDICAL SCHOOL AND SCHEPENS EYE RESEARCH INSTITUTE, BOSTON, MA

"Judah Folkman was one of the most creative scientists that I have ever known, an exceptionally wise and caring physician, and an outstanding teacher. As a result of his scientific creativity, he often stirred up controversy, because it often takes decades to determine whether highly original ideas are correct. He was more often right than wrong, but he had to overcome a great deal of opposition to his ideas. He did so with characteristic kindness to his critics, and he poked gentle fun at NIH or Journal reviewers who had zinged him in the past. Judah was at the very least a co-founder of the field of angiogenesis and certainly the founder of the field of anti-angiogenesis as an approach to cancer therapy. Very few, if any other investigators can make such a broad claim in any field of science today. He has literally thousands of scientific children. He was also a persuasive speaker and for many years the leading spokesman for the fields of angiogenesis and anti-angiogenesis. Judah was also an exceedingly wise and compassionate doctor who was 110% devoted to his work, yet generous with his time. Literally hundreds of patients with hopeless cancers sought his advice. He was helpful to them all, doing what he could to steer them to clinical trials, experimental drugs or just to talk to them in a kindly way. Finally, he was an outstanding teacher, consistently one of the most popular with medical students, and he received many awards for teaching. In sum, Judah Folkman was a giant as a scientist, physician and teacher. He is sorely missed."

HAROLD DVORAK

BETH ISRAEL DEACONESS MEDICAL CENTER, BOSTON, MA

"Even though I did not have the opportunity and the honor of working directly with Dr. Folkman, I learned a great deal from him through our interactions at various meetings over the last twenty years. There were several important principles that I learned from Dr. Folkman which I wish to elaborate on. The first was that Dr. Folkman remained humble despite all of his wonderful contributions and the world-wide respect he commanded. He prepared for each individual lecture with hand written notes and used these notes to guide him through his lectures. His lectures were always elegant, thoughtful, and inspirational. Despite his stature, he was never too big to answer questions no matter how trivial they were. A second lesson I learned from Dr. Folkman was the fact that he took the time to respond to each and every patient that contacted him. As you can imagine, he received numerous patient inquiries over the years in regards to appropriate treatments. In fact some of these inquiries sparked an interest in the mind of Dr. Folkman which led to advances in the field. He took the time to respond to each and every individual which required a tremendous time commitment on his part. However, as always, his primary interest was in translating basic science toward improving the lives of patients. I learned from Dr. Folkman that no matter how busy you are you must always find the time to respond to questions of patients as we must realize how important it is to support not only their medical needs of patients but also the emotional needs. Lastly, Dr. Folkman taught me the value of translating simple observations into clinical practice. His seminal paper in the New England Journal of Medicine in 1991 demonstrating that microvessel density correlated with poor patient outcome in patients with breast cancer demonstrated that pure biologic insight is much more important than complex molecular or biochemical expertise. He recognized the importance of molecular biology as a tool to interrogate biology but never missed the fact that biology dictates patient outcome. Dr. Folkman's vision, persistence, elegance and mentorship will be missed by colleagues, patients, and trainees. Current and future investigators are encouraged to pursue science and clinically relevant studies with the same vigor and enthusiasm of Dr. Folkman himself."

LEE M. ELLIS

UNIVERSITY OF TEXAS M.D. ANDERSON CANCER CENTER, HOUSTON, TX

"I first met Judah Folkman in 1986 at a cancer symposium in Oakland CA, where I spoke about my then new genetically engineered mouse model of cancer (RIP-Tag2) and Judah spoke about tumor angiogenesis. Our intersection there seeded a dialog and then collaboration and in turn an enduring friendship that has flourished over the years. The first milestone was our discovery (reported in Nature in 1989) that angiogenesis was activated as a discrete pre-malignant event in that model of pancreatic islet cell carcinogenesis; a second was our synthesis of the "angiogenic switch" concept in a perspective published in Cell (1996). Judah was an inspiring presence in both. Our interactions in the late 1980's and through the 1990's were sustained not only by late night and Sunday morning phone conversations (and no time was a bad time for Judah — he was always ready to discuss results and ideas and possibilities) but also by a series of inter-group meetings, where Judah and his key lab members would spend a day in a half in my lab's conference room at UCSF in San Francisco, or vice versa in his at Children's Hospital in Boston. These joint group meetings were remarkable for the electric atmosphere, for the data presented and the stimulating discussions, and so much for Judah's amazing presence, always so positive, so enthusiastic, and so bubbling over with new ideas and extrapolations, some insightful, and some far-fetched, but always stimulating. I admired and even envied his boundless curiosity and his biological intuition, and all his knowledge of human biology and disease, and yet I prided myself in providing a balance of critical counterpoint, anchored in the possibility of testing mechanistic hypotheses in increasingly convincing ways using the tools of molecular genetics. And thus my career was deeply touched and inspired, both by our collaborative successes as well as the lessons of those that never reached fruition, and evermore so by the special experience of knowing this remarkable man."

DOUGLAS HANAHAN

HELEN DILLER FAMILY COMPREHENSIVE CANCER CENTER, UCSF, SAN FRANCISCO, CA

"Dr. Folkman's brilliance was in paying attention to the novel and not so obvious. My first memory of him is that of a gentle, kind professor descending from a podium amidst applause of world renowned scientists and stopping to speak to a medical student. He stopped and listened to an excited medical student tell his "explanation" of the puzzling phenomenon he had just presented. He paid attention; he believed that fresh nonconformist thinking of new scientists was what led to new discoveries and innovative directions. He was very impatient with narrow thinking that would lead to statements like "... but that cannot be so because ...". He looked at science with fresh eyes; he looked for new explanations of old phenomena and unorthodox connections between previously unrelated fields. Most of us who worked with him would be able to recount numerous occasions where a quiet student would whisper a hesitant thought and Dr. Folkman would extend it to explain a puzzling clinical phenomenon. He was a crusader for new ideas, and persevered until they were published and established. Many scientists owe him their beginnings. We all remember the first encounter where everything we suggested was listened to, supported and explored. Many moved from afar to be close to that sustenance."

GIANNOULA KLEMENT

CHILDREN'S HOSPITAL BOSTON AND DANA-FARBER CANCER INSTITUTE, BOSTON, MA

"Judah Folkman was simply an amazing man - brilliant, thoughtful, generous. I remember hearing him speak at the Whitehead Symposium in 1996 and it changed my life forever. I will always cherish having worked with him, and for introducing me to this wonderful field of angiogenesis."

CALVIN KUO

STANFORD UNIVERSITY SCHOOL OF MEDICINE, STANFORD, CA

"When I received my doctoral degree in 1974 from MIT, I was disillusioned with research. All my colleagues were going into the petrochemical and chemical industries. I got jobs there too. I still remember an engineer at Exxon telling me that if I could help increase the yield of oil by .1 percent that would be worth billions of dollars and he said "wouldn't that be wonderful?" But I didn't want to do that. I had a dream that I might someday use my engineering skills to improve people's health. I applied for lots of jobs and was lucky enough to receive 20 job offers, but I only thought one might fulfill that dream. That was with Dr. Folkman. I remember writing Dr. Folkman and him calling me, and my visit in 1974 to Children's Hospital. He asked if I'd help isolate the first angiogenesis inhibitor. That job changed my life. Not only did I help isolate that angiogenesis inhibitor, but also we were able to develop principles that would lead to new controlled release medications that would affect millions of people. Dr. Folkman was the greatest role model a young scientist could have. He was a fantastic mentor, a superb role model, one of nicest human being I've ever met, and a truly great man."

ROBERT LANGER
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MA

"Dr. Folkman was an inspiration for me early on in my training. As a surgical resident, after reading his papers on tumor angiogenesis, I knew that I wanted to pursue a career in science and clinical medicine focused on cancer and the role of the tumor vasculature. As my career progressed, I had the privilege of meeting Dr. Folkman and then interacting with him on several projects over the years. I considered him a great mentor and colleague. He was unselfish with his time and his ideas and a true champion for the development of novel treatments for patients suffering from cancer. I will miss his energy, enthusiasm and intellect. The field of angiogenesis research has lost its most passionate leader."

STEVEN K. LIBUTTI
NATIONAL CANCER INSTITUTE, BETHESDA, MD

"Judah Folkman did more for cancer research than anyone I know, not least because of his support of innovation and young scientists, to say nothing of his own scientific genius. He was my mentor while I was a postdoctoral fellow in Children's Hospital Boston and Harvard Medical School, and I could not have asked for a more inspiring, thought-provoking, and above all, a kind and wonderful colleague and friend. The many rewarding discussions we had will be greatly missed. His positive attitude, his wonderful and witty sense of humor and his optimism towards life and towards solving complex scientific problems were the unique markers of his leadership. Dr. Folkman inspired me to believe that the greatest opportunities come disguised as unsolvable problems. He challenged me to follow up every risky unconventional idea, and to welcome the opportunity to continue in pursuit of the idea even when an experiment did not work the way I predicted it would. This relentless search for the answers is my guiding principle in running my own laboratory today. He lived his life exactly as he wanted. He did what he loved most and he died in the best way a man can. It was just too early for those of us left behind. My colleagues in the vascular biology program in Boston, cancer researchers around the world, and scientists everywhere are bereft of a great spirit and a giant in his field."

RONIT SATCHI-FAINARO
SACKLER SCHOOL OF MEDICINE, TEL AVIV UNIVERSITY, TEL AVIV, ISRAEL

"I had the honor and privilege to work with Dr. Folkman for the past 27 years. The impact of his life on me is beyond what I can express. He was a great scientific pioneer and a true leader. He was a very kind person."

YUEN SHING
HARVARD MEDICAL SCHOOL AND CHILDREN'S HOSPITAL, BOSTON, MA

"I came in contact with Dr. Folkman's ideas when I was setting up my first lab at the Beth Israel Hospital in Boston. What made the most impact was the obvious passion he had for science and the everyday desire to ask how we can translate new science advances into the clinical practice. In that he was, and still is, far ahead of his time."

MICHAEL SIMONS

DARTMOUTH MEDICAL SCHOOL, ANGIOGENESIS RESEARCH CENTER, HANOVER, NH

"Dr. Folkman was a great spokesperson for cancer research. He very effectively communicated the promise and hurdles of cancer drug discovery to the public. He was ever optimistic that we would be successful in impacting therapeutically on malignant diseases. Personally, I will miss his 'voice' which gently and effectively motivated all of us to continue our efforts in drug discovery even though the journey is long and challenging."

BEVERLY TEICHER

ONCOLOGY RESEARCH, GENZYME CORPORATION, FRAMINGHAM, MA

"Dr. Folkman leaves behind a legacy of years of well documented scientific discoveries and achievements. However, his greatest attribute was his ability to mentor and inspire those outside of his own laboratory. This was clearly the case for me. I met Dr. Folkman in 1992 and he has had a tremendous influence on my laboratory's research direction ever since. His ability to stimulate basic science hypotheses from clinical observations was exceptional."

WILLIAM DOUGLAS FIGG, SR.

**MEDICAL ONCOLOGY BRANCH, CENTER FOR CANCER RESEARCH, NATIONAL CANCER INSTITUTE,
BETHESDA, MD**

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An Integrative Approach from Science to Medicine

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