

## The Continuous Progress in the Fight Against Cancer

Adrian P. Hunis\*

Over the course of my career as a physician-scientist, the field of oncology has undergone a remarkable technology, the reality for a cancer patient has changed dramatically. Now, almost every patient with cancer has a real hope of getting healthier. This note is in anticipation of the next wave of innovations will get us to the point that will not only provide hope but help all patients so that they can return to "life as they knew it" before their diagnosis.

During the medical training given earlier, most patients with cancer were treated with surgery, radiotherapy, and/or chemotherapy. These treatments helped some, but most patients with metastatic cancer did not have curative options. The landscape of cancer care has changed drastically over the past three decades through the knowledge generated by scientific and technological innovations. For instance, sequencing of the human genome led to the revolution of molecularly targeted therapeutics, which has transformed treatment for many patients. As one example, basic and clinical research starting from the identification of the KRAS gene all the way to the recent FDA approval of the KRAS-targeted therapeutic Sotorasib for certain patients with lung cancer highlights how research-driven advances can improve patient outcomes. Another great example is the development of immunotherapeutic, which was propelled by basic research in immunology, and has now become a standard treatment for many adult and pediatric patients with formerly lethal cancers. Because of these exciting advances, oncology is one of the most promising areas of medical research where current trainees can truly help people from disease back to health. Of course, there is a substantial amount of work that is left to be done.

In the future, the new wave of scientific and technological innovations will accelerate progress in cancer prevention, detection, diagnosis, and treatment. A greater understanding of the tumor

Member Emeritus of the American, Association of Clinical Oncology (ASCO), Member Emeritus of European Society of Medical Oncology (ESMO), School of Medicine, Universidad de Buenos Aires (UBA), Argentina

\*Corresponding Author: Adrian P. Hunis, Member Emeritus of the American, Association of Clinical Oncology (ASCO), Member Emeritus of European Society of Medical Oncology (ESMO), School of Medicine, Universidad de Buenos Aires (UBA), Argentina.

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microenvironment and ways to modify it will help in developing better strategies to treat cancers. Identifying more sophisticated approaches to delivering cytotoxic agents such as radioactive compounds specifically to tumors will enhance our ability to eliminate cancer cells. An emerging class of therapeutics that holds immense potential is protein degraders called PROTACS that can selectively destroy cancer-causing proteins.

Physicians must also fundamentally change how clinical research is conducted. Currently, only five percent of adult cancer patients participate in clinical trials and participation is especially low among racial and ethnic minorities. There is a need of cultural change so that in the future every patient is offered and has access to a clinical trial. That is the only way by which the true potential of precision medicine can be reached and answer some of our most elusive questions such as the causes of cancer treatment resistance. It would be critical also to integrate very early-phase (Phase 0) clinical studies prior to large-scale traditional clinical trials where low doses of potential therapeutics are administered to patients to determine whether such treatments may have the desired effect. These data could really help cancer scientists personalize treatments for patients and drive progress in precision cancer medicine.

In parallel to the investigations into cancer biology, there must be a strong focus on studying the "macroenvironment" where an individual lives, the individual's lifestyle and behavior. For instance, it is now realized that obesity is a major risk factor for many cancer types; while several hypotheses have been proposed, such as the role of chronic inflammation, the gut microbiome, or hormonal imbalance, the exact mechanism by which obesity leads to cancer is not well understood. Concerted efforts are needed to improve public health measures that can reduce cancer risks especially among segments of the population that experience a disproportionate burden of cancer. Over the past year and a half, the cancer research community, like every other community around the world, has had to face the COVID-19 [Coronavirus Disease 2019] pandemic, a challenge unlike any that has been faced before. Cancer screening and treatment have been disrupted, most cancer research projects have been halted at least temporarily, and many cancer researchers have turned their attention to fighting COVID-19. However, the pandemic has also uncovered new opportunities, such as the potential of mRNA vaccines and telemedicine that can have long-term positive impacts on clinical research and delivery of care.

Our past investment in medical research has led to modern medicine, leading to better outcomes for many diseases including cancer. It is vital that funding should be given to meritorious research to encourage the next generation of scientists to get involved in cancer research. This will also require sustainable funding that is higher than the current rate. It is imperative that everyone should work together with all stakeholders, so that medical research continues to be a national priority. Increased investment is urgently needed for all to fulfill the global mission of preventing and curing all types of cancers and bring more hope to the patients.