Sir Harold Ridley, Kt, MD, FRCS, FRS (Figure 1), the inventor of the intraocular lens (IOL)\(^1\)\(^{-16}\) and one of the founders of the modern subspecialty of cataract and refractive surgery, passed away on May 25, 2001, just 6 weeks before his 95th birthday, in a hospital near his wife, Elisabeth, and his retirement cottage in Stapleford, Wiltshire (near Salisbury), Southwestern England.

Most obituaries are crafted to provide a brief biographical sketch of an individual, to list his or her accomplishments and honors, and to express gratitude to the deceased. In this memorial to Sir Harold as well as another obituary covering different facts of his life published in the American Journal of Ophthalmology,\(^1\) we have chosen a diverse course. Our purpose here is not only to honor him, but also to discuss the hard time he encountered in gaining acceptance of the IOL itself as well as to highlight his non–IOL-related accomplishments, the latter not being well known to ophthalmologists and the general public.

One of us (D.J.A.) first met Sir Harold in 1985, having been referred to him by 2 of his English colleagues, the late John Pearce, MD, and D. Peter Choyce, MD. That meeting was the beginning of a 2-decade-long close personal friendship with Sir Harold. At the first sighting of him in the train station at Salisbury, it appeared that he was at low ebb physically and especially psychologically. Having retired to a lovely rural setting, the Ridleys lived in modest comfort. However, he still recognized that many of his colleagues and peers frequently treated him and his IOL with severe skepticism and indeed sometimes scorn. This was the reason that Pearce and Choyce had called his attention to some IOL-related research results we and our coworkers had just published.\(^1\)^\(^{14}\)^\(^{15}\) They believed Sir Harold would be very appreciative of them because these writings had helped verify several of his concepts regarding the rationale, safety, and efficacy of his invention—and indeed he was!

As late as 1985 when I first met him, almost 4 decades after his initial IOL implantation on November 29, 1949, acceptance of the concept of an implantable plastic “foreign body” in the eye was far from universal, especially among some members of the medical establishment. The latter included some of the most illustrious professors at some of the world’s greatest universities, including his homeland in England as well as in the United States. Not only did this criticism wear him down, but also he related that one extremely worrying matter was the fear of a charge of malpractice being brought against him, against which he probably would have had little defense in those early days of the still-experimental operation. That partially explains why very little was heard from him during the period from the mid-1940s until the early 1950s, as his surgical research proceeded in secrecy.

Acceptance of the IOL was very slow in coming. Several observations conveyed to me in recent interviews with many of Ridley’s contemporaries have convinced me that Sir Harold provided us a gift that in many ways actually transcended the IOL itself. Details regarding these have been published in an obituary elsewhere.\(^1\) In short, his invention of the IOL was not merely the introduction of a piece of refined plastic, etc, but it was influential in 2 other ways.
First, it jarred and disrupted the apparent long-standing dogma that one “should never put a foreign body into the delicate tissues of the eye” (seemingly trite now, but a major issue in the mid-20th century and before). Ridley had forced a huge paradigm shift and a major rethinking of principles. This probably explains at least in part why Ridley received such disproportionate criticism, sometimes bordering on invective, that continued during the past half century.1

Second, Ridley helped pioneer the general use and worldwide dissemination of permanent implantable intraocular prosthetics or biodevices, in short, artificial “tissues or organs” designed to remain permanently in a delicate tissue or organ of the body. This is taken for granted today but was a “bombshell” then. The strife that ensued was, in a limited way within his subspecialty, not unlike that occurring today on a national and international level with respect to stem cell and cloning research. His invention helped propel not only ophthalmology but, indeed, general medicine into a new era. It helped generate a new subspecialty that we now term biomedical engineering, which has grown rapidly during the past 2 decades. He himself was probably not aware of this more universal significance of his invention, but we believe history will show that the introduction of these broad concepts and innovations were as important as the basic visual rehabilitative benefits of the IOL itself.

NON–IOL-RELATED CONTRIBUTIONS

A detailed biography and several short works about Ridley have already been published.1–13 Just before his death, Ridley requested that, in lieu of a classic obituary or biography, we mention a few of his non–IOL-related activities.

It will surprise many readers that Sir Harold Ridley did pioneering work in several other fields of ophthalmology besides the IOL. Significant research and teaching, aids, medical and surgical treatments and techniques, and biodevices in routine use today—now usually taken for granted—were either invented or first applied by Ridley. The credit he deserves for these non–IOL-related contributions has in many instances faded. These are, however, of sufficient significance that they deserve this documentation, not just because they are of historic value but also because some have a continuing practical usefulness today.

One means of looking at his non–IOL-related accomplishments is to ask the question: What might this man’s legacy have been if he had not invented the IOL, but had otherwise completed his professional life as it unfolded? In our opinion, if one sets aside the IOL from his list of professional accomplishments, what emerges is surprising. A glimpse of Ridley’s other discoveries in ophthalmology reveals an array of important innovations that reflect an interest and expertise in almost all components and tissues of the eye. Some of these taken alone would have ensured a solid legacy.

Almost all of his innovative activities, including the invention of the IOL, occurred between about 1945 and about 1955. It is ironic that if this chain of other non-IOL research endeavors had not been thrust into the background by the widespread publicity given to the IOL, his acceptance by the academic medical establishment at that time would almost surely have been immediate and highly positive. Why? Because almost without exception the non–IOL-related issues offered solid, noncontroversial, and clinically relevant advances in clinical ophthalmology that would not have required the above-mentioned paradigm shift. Without the IOL there is no doubt that his career would have been far less controversial and stressful. The evolution of the non-IOL discoveries he made would have been easy for all to accept, and some of them taken alone might represent a lifetime of productive work for most of us. However, the legacy gained from his non–IOL-related inventions would probably have been “short-term”—during his lifetime. Each of these represented baseline discoveries of concepts and techniques that he made by using the rudimentary gadgetry and technology available to him at that time. Therefore, this work has been built upon, improved, and superseded many times through the years, and at first glance the essence of his original work is hardly visible today. In sharp contrast, the IOL led to a revolution that shoved most of his other discoveries into the background. A 5-decade-long period of turmoil ensued that caused a degree of controversy unprecedented in our specialty. However, as is often the case with things of value, the lack of acceptance of the IOL by many during much of Ridley’s lifetime was followed, as the history was written, by the permanent positive reorganization that he clearly deserves.

Removing the cloak of the IOL discloses the following partial listing of several documented ideas that originated with Ridley. These are ideas and innovations that have not yet been systematically categorized and submitted to the public. Most are by now long forgotten or previously unpublished. These ideas can be classified into 3 categories: (1) clinical (medical/surgical) applications; (2) pioneering attempts at application of the newly emerging post–World War II technology, termed electronics at that time and termed high tech today; and (3) nonscientific innovations, not intended by Ridley himself, leading to an unintentional but radical shift in the realm of medical economics.

CLINICAL (MEDICAL/SURGICAL) APPLICATIONS

1. Ridley performed definitive characterization of onchocerciasis (river
blindness). This is one of the most common causes of blindness in the world. Ridley’s studies were based on work carried out during his wartime service in Ghana, West Africa, in 1943. He gathered sufficient facilities to perform histopathological analysis of the microorganisms (Figure 2). This work resulted in the presentation of his classic monograph, “Ocular Onchocerciasis,” in 1945. He himself painted a figure showing fundus changes in this disease, now universally called the Ridley fundus. This work helped establish a basis for later treatment of this disease, including today’s ongoing World Health Organization–sponsored treatments.

2. Ridley applied various multivitamin therapies to patients in tropical countries. He treated nutritional amblyopia in released World War II prisoners. These efforts represent, in an indirect way, a forerunner of today’s use of “multivitamins” for several eye diseases, eg, macular degeneration.

He also developed a keen interest in treating patients (especially children) with beta carotene to combat keratomalacia (xerophthalmia). He applied this treatment on a small scale (but with great success) during his wartime period in Ghana. He did not publish results regarding this condition, but he spoke of it often and emphasized it in his private writings.

Although he has received almost no credit for these efforts, they have no doubt been influential in helping attain today’s huge public health successes achieved by administration of beta carotene to affected populations. His accomplishments in this field were a source of great pride to him. In some discussions he would speak of these efforts with much more enthusiasm than the IOL.

3. While treating ocular leprosy in Ghana in 1941, a disease commonly regarded as incurable, Ridley performed what he believed may have been the first successful penetrating keratoplasty on a leper (cited by Apple and Sims5). Unfortunately, he did not publish this, but his claim is probably correct, since, to our knowledge, there are no earlier published reports in the literature.

He pioneered clinical research in local (nonenucleation) treatment of uveal malignant melanoma. Figure 3 shows an example of an irradiated choroidal neoplasm.

He was an early pioneer (with D. Peter Choyce, MD) in keratorefractive surgery, especially intrastromal corneal implants. He also helped design one of the first keratoprosthetic biodevices (Figure 4). To our knowledge, he did not attempt phakic IOLs.

**ELECTRONIC (HIGH-TECH) OPHTHALMOLOGY**

Just as he derived IOL material biocompatibility data from World War II experiences when polymethylmethacrylate fragments from shattered cockpit canopies became embedded in the eyes of injured pilots, Ridley was keen to apply the new electronics technology that emerged during and after that war to ophthalmology and the visual sciences. As he had done with the IOL in collaboration with Rayner Intraocular Lenses, Ltd, Hove, England, Sir Harold also developed close relationships with other members of the corporate sector to accomplish these applications, in particular the Marconi Wireless Electronic Company, London, England, and the Pye Electronics Company, Cambridge, England, both leaders in the field at that time.

It is likely that very few of us who prepare medical, surgical, diagnostic, or teaching videos or PowerPoint presentations today realize that Sir Harold laid some of the groundwork for these techniques.

Ridley was the first to televise eye operations, in both black-and-white and color. Documented in 1950, this of course opened the floodgates to our almost universal...
use of videos in research and teaching presentations, as well as the establishment of “film festivals” that are now popular and useful components of many of our meetings and conferences, both large and small.

Ridley was the first to use the nascent technology of the late 1940s to image intraocular tissues on a monitor in both black-and-white and color in 1950 (Figure 5). The fundus shown in Figure 5C is the first such televised intraocular image ever recorded. It is an image of the eye of his operating room nurse (“theatre sister”) Doreen Ogg, shot in Cambridge in September 1949, just 2 months before his initial implantation operation on November 29, 1949. This represented the forerunner of such applications as televised videoconferencing and videodiagnosis. Telepathology has also been applied to ophthalmic pathology.25

Barly Masters, MD, a leading authority in this field, has confirmed that Sir Harold’s work was instrumental in directly establishing the basic principles of modern confocal microscopy and scanning laser ophthalmoscopy, a very important clinical and research tool.26-29

MEDICAL ECONOMICS

Last but not least, and largely unbeknownst to him, Sir Harold’s influence also spread into the realm of business and finance. The IOL was one of the first inventions that led to a product manufactured in the corporate private sector that became a marketable device that was distributed and sold worldwide. The huge market for such products helped stimulate the very large medical-industrial complex that exists today. This had a strong influence in adding a business component to our subspecialty in addition to the classic clinical and scientific components that our forerunners had experienced. Ridley himself would have been bewildered, for example, had he been informed that his cataract-IOL operation became the number one surgical cost to the US Medicare system in all of medicine. Perhaps he would have been even more surprised to learn that the Nd:YAG laser secondary posterior capsulotomy treatment for posterior capsule opacification (secondary cataract) was the second highest cost.30

CONCLUSIONS

Each one of the selected items listed here would constitute a discovery or innovation of a lifetime for most of us. Taken in their summation (even without the IOL!), these provide a very significant contribution to ophthalmology and the visual sciences. After the mid 1950s, Sir Harold’s production of other innovations slowed because he was clearly preoccupied with the IOL. It dominated his thoughts, not only scien-
tically, but also in relation to the immense stress during this entire period. As we have entered the 21st century, Sir Harold's legacy is ensured. In our opinion, he ranks with many of ophthalmology's greats, such as Albrecht von Graefe, Ernst Fuchs, and others, as one of the most influential ophthalmologists in history. All of us are indeed happy that Sir Harold lived long enough to see the fruits of his efforts and receive the long list of honors that he deserved.

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REFERENCES


Correction

In the Clinical Sciences article by Graf and Roesen titled “Ocular Malingering: A Surprising Visual Acuity Test,” published in the June issue of the ARCHIVES (2002;120:756-760), an error occurred in the “Introduction” on page 756. In the right-hand column, first paragraph, the sentence beginning on line 8 should have read as follows: “The probability of a maximum number of correct responses (k) out of 32 optotypes with 4 possible alternative answers can be determined by the distribution function of the binomial formula: If k = 1, P = .001; if k = 2, P = .007; and if k = 3, P = .03.”