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EDITORIAL

James D. Watson 88—the discovery of the double helix was an iconic event in structural chemistry

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Abstract The ingenuity of James D. Watson and Francis Crick, the convergence of the advances in X-ray crystallography, the accumulated knowledge of structural chemistry, and the breakthroughs in chemical methods of analysis led to the discovery of the double helix structure of DNA. The discovery catapulted Watson to a career that helped DNA and the applications of the knowledge about its structure triumph in biomedical sciences. Watson's eighty-eighth birthday is an occasion to have a look at his path to success, his personality, and assess his legacy.

Keywords James D. Watson · Double helix · Francis Crick · DNA · Human Genome Project

It is structure that we look for whenever we try to understand anything.
Linus Pauling (1950)

Introduction

The discovery of the double-helix structure of DNA in 1953 was a seminal event in the history of science and a great achievement for structural chemistry [1]. The discoverers, Francis Crick (1916–2004) and James D. Watson (1928–), *suggested* a structure; they did not say they had determined it. It took another two decades of painstaking research when Crick and Watson's proposal received hard experimental evidence.

It happens often, when a scientist makes an important discovery in his or her youth, a less remarkable career follows. In contrast, Crick and Watson remained at the top of science for the next half century. This alone would warrant a closer examination of their activities. In this Editorial, I am going to have a closer look at the lessons Watson's personality and career might offer.

I have been interested in twentieth-century scientists and their discoveries and this has included a fascination with James D. Watson. We met for the first time when my wife Magdi (short for Magdolna) and I visited him in 2000 in his office at the Cold Spring Harbor Laboratory (CSHL). I was recording our conversation and I had an uneasy feeling that everything appeared superficial in our exchange when we had already passed half an hour of the planned one-hour taping. Then, suddenly, things changed and the exchange became meaningful and exciting. We could not stretch much the planned one-hour meeting because we had to start for the airport—it was the last day of our visit in the United States. Watson took us to the train station and made us promise that we would return for a more substantial visit. I had learned enough about him to know that he would not say such things out of politeness.

Later in the same year Watson and his wife Elizabeth—Liz—visited us in Budapest. Their brief stay included sightseeing, lunch in a Hungarian restaurant, sampling of ice-cream, dinner in our home followed by a meeting, still in our home, with leading Hungarian intellectuals—just as Watson had requested.

We next met in 2002 when Magdi and I spent three months at CSHL as the Watsons' guests. The purpose of

Dedication This Editorial is dedicated to the great scientific partnership of Francis Crick and James D. Watson on the occasion of Francis Crick's birth centennial and Watson's 88th birthday.

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Photo 1 Double Helix—sculpture by Bror Marklund in front of the Biomedical Center of Uppsala University (© 1997 Istvan Hargittai)

the stay was to facilitate my work on my semi-autobiographical book, *Our Lives* [2]. During the subsequent years, we had brief meetings, such as in 2003 during the fiftieth-anniversary celebration of the discovery of the double helix in Cambridge, UK; in 2004 during our visit with Matthew Meselson in Woods Hole, MA; and other occasions. When in the spring of 2007, I was working on my small book, *The DNA Doctor* [3], based on previous conversations with Watson, I experienced some hesitancy in our interactions. When I asked him to give me permission to quote from among his statements in other publications, he declined. Moreover, he did not do this himself but asked one of his associates to call me and tell me about this. This associate was embarrassed conveying Watson's message. Watson's decision, however, was consistent in that he preferred using his material in his own books as he had told me.

Watson's *Avoid Boring People* appeared later in 2007 [4]. As he was preparing for launching the book, he gave an interview to a journalist, who had worked before at CSHL. They spent several hours together. During the interview, Watson made disparaging comments about Africans. When these statements appeared in print, the reactions were devastating for Watson. The CSHL reacted by attempting to dissociate itself from him. When Watson later told me about this experience, he repeatedly used the word "sordid" in characterizing the reaction from CSHL. As I was reading about Watson's humiliation, I wrote him a letter expressing my friendship.

The next time we met was in the spring of 2008 during another of our visits in the United States. This was the first time Magdi and I had been in their Manhattan home. It was then that I fully understood that his ordeal was heavier than I had suspected and it was not over yet. A few days later, Watson asked me to be present at an interview arranged for him by the publicist who had been hired for him. This turned out to be a depressing experience. I knew that CSHL had retired him from his position and the circumstances of the interview with an apparently ignorant journalist were such as if even his independent thinking had also been taken away from Watson.

In contrast, our next meetings in the spring of 2010 and in the fall of 2014, both in their Manhattan home, were uplifting. My impression was that Watson was recovering from his ordeal.

It is possible to view Watson's life in a consistent way, which I attempt below by breaking it into eight periods.

Preparation, 1928–1951

Watson was born April 6, 1928, into a non-practicing Christian family with mostly Irish and Scottish roots. He left his mother's Catholic faith by the age of twelve. The family lived in a not very well-to-do neighborhood of the south side of Chicago. The parents were determined to get a good education for their two children—Watson had a sister, Elizabeth. Watson in his succinct style referred to this as growing up in a quasi-Jewish atmosphere where books were more important than material goods.

Watson went to schools that were not especially remarkable and he breezed through them at an accelerated pace. Although no child prodigy, he was successful in quiz programs on television. He graduated from high school at the age of fifteen and enrolled at the University of Chicago under its maverick president Robert Hutchins who placed the Great Books in the focus of instruction. This broad-based education proved beneficial to Watson. He was more ambitious than most of his peers. When he found a subject that interested him, he was keener to learn about it than anybody else. He did not mind seeing others that were more talented than he was; on the contrary, he sought out their company. He learned from others if there was something to learn, and imitated others when he found people worthy of imitation.

Photo 2 James D. Watson with a double helix model in his left hand in June 1953 at Cold Spring Harbor Laboratory (photo by and courtesy of Karl Maramorosch)

He read Erwin Schrödinger's *What Is Life?* and this book more than anything contributed to Watson's transformation from a bird-watcher zoologist into a geneticist. He completed his undergraduate college education by the age of nineteen and began looking for a graduate school. The big-name schools were not kind to him, perhaps because they could not see anything remarkable about him—eagerness can hardly come through in written applications. He ended up at Indiana University in Bloomington in 1947, but Indiana at that time was probably the best place for his further development. It could offer him top graduate education in modern biology. It had the recent Nobel laureate Hermann J. Muller and two future Nobel laureates—three if including Watson—in the same department. This department provided Watson a diverse international environment with a strong European flavor. Watson had a compressed youth because his and Crick's seminal discovery catapulted him early into the big league of science and world fame. His maturity followed more slowly.

Photo 3 James D. Watson in 2000 in the Hargittais' home in Budapest (photo by I. Hargittai)

Double helix—the discovery, 1951–1954

Upon having earned his doctorate, Watson left for Denmark for postdoctoral studies. He was not lucky with his first assignment so he moved to another laboratory, but the project there did not go well either. In the spring of 1951, he attended a meeting in Naples where he listened to Maurice Wilkins talking about the X-ray work on DNA at King's College in London. Watson glimpsed at Wilkins's photograph of an X-ray diffraction pattern, and decided to work on the structure of DNA in Britain.

This was not a decision taken lightly. The funding agency for Watson's postdoctoral fellowship opposed his move, yet Watson was undeterred even when he lost the support that was supposed to sustain him. At this point, he hardly knew anything about X-ray crystallography, let alone its application to biological macromolecules. This was the time when some giants of science were struggling with solving the structure of proteins at the edge of feasibility.

In hindsight, Watson's decision was a sign of genius, but his ignorance must have contributed to making it. Of course, he was not ignorant in many aspects of his subsequent research and it could not be ascribed to ignorance either that he recognized the importance of uncovering the structure of DNA beyond the importance of DNA, the

substance. However, he was not clear about the possibilities and limitations of structural chemistry at the time and in particular about those of X-ray crystallography. A certain amount of ignorance is useful when a scientist embarks on an ambitious project. Rita Levi-Montalcini might have had Jim Watson in mind when she stressed in her autobiography the importance of underestimating the "difficulties, which cause one to tackle problems that other, more critical and acute persons instead opt to avoid" [5].

Once Watson had decided on his project, he had to choose the venue for it, and he ended up in the best place for his purpose, in the Cavendish Laboratory in Cambridge. The change from the periphery of science in Denmark (periphery, that is, in molecular biology and not in Niels Bohr's physics) to a world center was to Watson's liking. No sooner had he arrived than he teamed up with Francis Crick, who had a background in physics, was full of ideas, and had been engaged in an unexciting project. They formed one of the most remarkable partnerships in the history of science.

In April of 1952 in Oxford, Watson—as a proxy—presented the results from the experiments of Hershey and Chase of the CSHL. These results reinforced Avery et al.'s findings that DNA was the substance of heredity. Also in 1952, the biochemist Erwin Chargaff visited the Cavendish Laboratory, and told Watson and Crick about his seminal experiments. The essence of Chargaff's discoveries had direct relevance to them: DNA was organism-specific, but the DNA bases adenine (a purine) and thymine (a pyrimidine) occurred in roughly equal amounts as did the bases guanine (a purine) and cytosine (a pyrimidine) in all DNAs, regardless from which organisms they had been extracted.

Scientists congregated in Cambridge, and were anxious to share their latest findings with the researchers there, as if seeking their approval. It was another fortunate circumstance that Linus Pauling had sent his son, Peter, there, and he became friendly with Watson and Crick. The young Pauling was happy to carry the news from his father about progress at Caltech to his new friends. Then, Watson and Crick received a roommate at the Cavendish in the person of the American chemist, Jerry Donohue, who put them on the right track about the preferred chemical forms of the bases in DNA. Watson hardly knew any chemistry at the time of the double helix discovery, but he was always ready to learn what he needed to know.

Watson and Crick did not do experiments, but had access to Rosalind Franklin's diffraction pattern. When Wilkins shared Franklin's observations with Watson, he did so as part of his angry revenge against her rather than in an altruistic move for the sake of advancing science. Wilkins considered Franklin an intruder into his research turf and resented her style. Then, through Max Perutz, Watson and Crick had access to the laboratory report with Franklin's discussion of her experiments. There has been much effort to demonstrate that there was nothing wrong with having communicated Franklin's data to Watson and Crick, but it has been questionable at least whether it was "legal" or not [6]. Nobody has ever suggested that the way Watson went about it was "moral."

In addition to Franklin and her student Raymond G. Gosling's X-ray patterns, Watson and Crick utilized Pauling's approach of relying on all available structural chemistry in their quest for the DNA structure. This was, of course, perfectly legitimate and constituted a brilliant example of how the next discovery builds on previous discoveries about which it utilizes published data and techniques. What Watson and Crick needed to do was "only" to put together all the relevant information after they had done the most crucial act by having posed the right question.

Watson and Crick's paper in April 1953 [1] was barely longer than one page in *Nature* and it stressed that its authors merely *suggested* a structure. However, it had important novel features. One was that it consisted of two helical chains, each coiling around the same axis, but having opposite direction, and thus complementing each other. The other novel feature was the manner in which the two helices were held together through hydrogen bonds between the purine and pyrimidine bases. The bases were joined in pairs, a single base from one helix paired with a single base from the other helix. The two bases in a pair lay side by side, and the complementary pair of a purine base was always a pyrimidine and vice versa. A majestically simple sketch illustrated the report. The structure was consistent with all the information available by then: X-ray crystallography, model building, and chemical analysis of DNA.

Watson and Crick's approach to research was very efficient, but unusual at that time. It was using other people's measurements, techniques, experimental results, and conclusions. Science works this way. Isaac Newton explained that he saw farther than his predecessors, because he stood on the shoulders of others. This is what Watson and Crick did, except that Franklin was their contemporary and they failed to inform her that they had stepped onto her shoulder. In any case, Watson and Crick did not want to let themselves get bogged down with details.

Watson and Crick's working style appeared unorthodox to many. They seemed sloppy, did not seem hard working, and appeared as if they had plenty of free time for entertainment. At times they behaved as if they were underemployed—not the usual image of the mad scientist who lives for his work day and night. Furthermore, they seemed too interested in scientific gossip and not enough in learning from the scientific literature. However, there is no definition of what constitutes the most efficient approach to research, and the unconventional features of Watson's and Crick's approach turned out to be an excellent way to attack the problem they were working on.

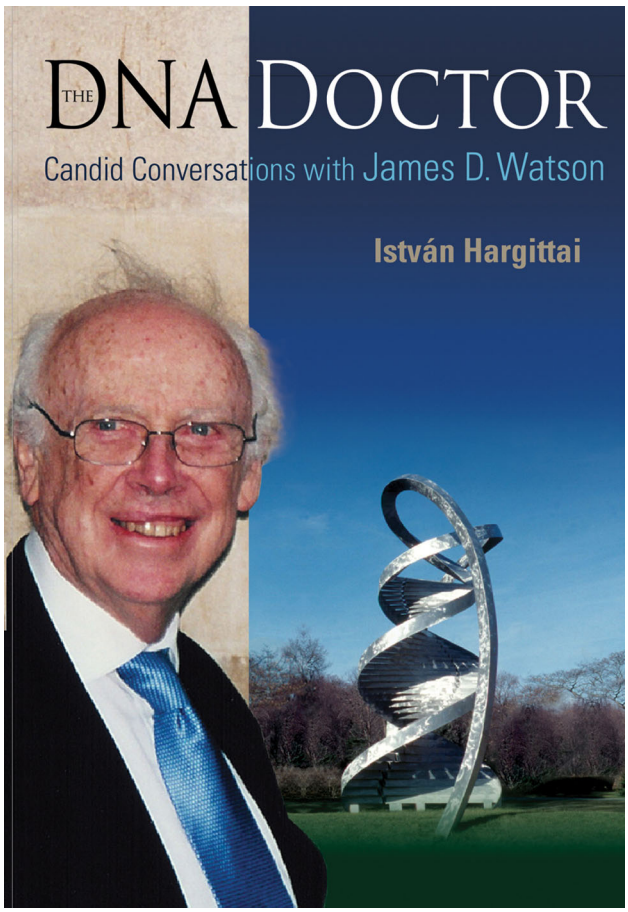

Photo 4 James D. Watson's portrait of 2003 in Cambridge by Magdolna Hargittai on a book cover [3]

Max Delbrück formulated his idea about the usefulness of limited sloppiness, according to which if one is very sloppy that is bad, but thriving for too much rigor might hinder advances. Crick formulated his idea about the advantages of listening to gossip because the grapevine might bring in crucial information that had not yet reached the degree of perfection that would fit publishing it. Finally, hard work and hard thinking do not necessarily appear the same on the surface while the latter may not be less needed in research than carrying out yet another experiment or computation. Not all environments in the world would have so easily tolerated Watson and Crick's way of doing science as the Cavendish Laboratory.

Transition, 1954–1962

During the period from 1954 to 1962, Watson was seeking his role for the rest of his life. It was a transition between the great discovery and Watson's becoming an impresario of science. He first tried to emulate his and Crick's big success in research, but it did not work. He was a good researcher, but unremarkable if compared with his early achievement. He distinguished himself as a professor at Harvard University, but just being a Harvard professor did not satisfy him (while for most it would be a dream position). He did not seem comfortable in a situation, in which however distinguished he could be, there were others around him similarly distinguished. He built up an excellent laboratory at Harvard and attracted to it first-rate scientists, among them Walter Gilbert, a theoretical physicist and future Nobel laureate for his biological discoveries.

Watson was increasingly recognized for the 1953 discovery by such road posts as the Lasker Award and membership of the US National Academy of Sciences. In 1962, Watson, along with Francis Crick and Maurice Wilkins received the Nobel Prize for the double helix. By then Franklin had died. Had she lived, it is not at all certain that she might have been included in the award (a three-person limit in any category of the Nobel Prize is rigorously observed). In the early 1960s, her contribution to the double-helix discovery was not yet recognized to the extent that it has since.

At this time, Watson embarked on textbook writing that would result in his exceptional *Molecular Biology of the Gene* [7]. It was a first both for its subject and for its unusual, creative style.

The Double Helix—the book, 1962–1968

The book *The Double Helix* [8] was long in the making, and the story of its publication is symptomatic of Watson and of the environment in which he operated. It appeared in 1968, following clashes with fellow discoverers and with the Harvard authorities for his unconstrained and subjective style. The book became a success and a defining contribution to twentieth-century literature on science. His negative portrayal of the late Rosalind Franklin sparked a re-evaluation of her contribution to the double-helix story and led to its enhanced recognition. The end of this period brought Watson a long-awaited marriage and his initial appointment to the Cold Spring Harbor Laboratory (CSHL).

Cold Spring Harbor Laboratory, 1968–

Initially, Watson was CSHL's part-time director, but in 1976, he left Harvard and became full-time director of CSHL. He transformed CSHL from a dilapidated and impoverished laboratory to an institution of world leadership in biological and cancer research. Ever since Watson's dedication to it, the CSHL has enjoyed the fruits of his exceptional fund-raising abilities.

Photo 5 James D Watson lecturing on June 15, 2010, at Moscow State University. Courtesy of MASTER-MULTIMEDIA Ltd. © 2010 Felix O. Kasparinsky

Watson reshaped not only CSHL's scientific profile but also its physical appearance to universal satisfaction. In this, his architectural historian wife, Elizabeth L. Watson, proved to be a creative and dedicated partner. Simultaneously with his taking command of CSHL, Watson was one of the leaders in molecular biology whose importance had been reinforced by the fast emerging biotechnology. Watson contributed to the movement of scientists that publicly faced the potential hazards of genetic engineering. This movement led to the memorable Asilomar meeting in 1975 that discussed the scientific safety and ethical ramifications of biotechnology. Subsequently, he was instrumental in calming the runaway hostile sentiments by some segments of the public toward genetic engineering. In 1988, Watson stepped onto the national scene in a major way for his next undertaking.

Human Genome Project (HGP), 1988–1992

The HGP became central to Watson's thinking and efforts from the mid-1980s. It is an oversimplification to ascribe the roots of the Human Genome Project to the discovery of the double helix, but it is easy to do so because the structure has such an easily perceived and beautiful appearance. Other factors, most notably the cracking of the genetic code by Marshall Nirenberg and others as well as Frederick Sanger's (and to a smaller extent, Walter Gilbert's) works in creating the techniques for sequencing complex biological macromolecules, played decisive roles in this.

From the mid-1980s, increasingly loud voices called for deciphering the human genome, pointing to the potential benefits in biomedicine. When the project became a national program in the United States, Watson assumed its administrative leadership in 1988, which proved crucial for the success of the HGP. It was characteristic for Watson's anticipatory thinking and innovative approach that from the start, he had a percentage of the budget of the HGP assigned to the study of societal and ethical issues related to the project. Although Watson was forced out of the HGP leadership in 1992, he has remained a staunch supporter.

Elder Statesman, 1992–2007

For the next decade and a half, Watson continued in a somewhat reduced role at both the CSHL and nationally. In 1993, he resigned from his directorship of the CSHL and became its president, thus removing himself from the day-to-day running of the Laboratory. There was no doubt, however, that he could get involved in micromanaging at any point at the CSHL, and he often did. His dominating presence prevented other strong personalities to consider a

leading position at the CSHL. But the Laboratory has thrived. At some point, Watson even felt the presidency superfluous for him and he became chancellor, continuing fundraising and being a major presence but without administrative duties. He had book writing projects of recording everything in minute detail about his own life. This was to change along with everything else in his life in October 2007.

Exit and Twilight, 2007–

In October 2007, there was the scandal that I have already referred to in the Introduction and that had been in the making for many years if considering Watson's recklessness in making politically-not-correct statements. This time, however, he overstepped an important boundary and appeared as if he were a racist, which he definitely was not. Watson underwent the most critical period of his life. He appeared to be no longer master of his fate, and not even of his thoughts. This state continued for several long months. Lately, the situation has slowly consolidated, but Watson's fierce independence seems to be gone for good. In time, Watson has resumed his fundraising activities for CSHL.

Assessment and legacy

Any student of Watson's life may seek to answer a plethora of questions. Here is a sampler, but no attempt raising all possible questions, let alone answering them all. It will be the task of a future biography.

- What does it mean that Watson is a genius (something few would doubt)?
- How could someone, not obviously a great scientist, rise to the top in science?
- How could Watson stay at the top in science for half a century?
- What explains his tremendous authority in spite of his lack of oratorical abilities and in spite of his lack of many positive human qualities?
- What is the explanation for the tremendous popularity of the double helix?
- Did Watson "make DNA" or did DNA make Watson?
- How did it happen that Watson has become identified not just with the double helix, but also with DNA itself?
- What kind of role model does Watson represent?
- What will his legacy be and how far will his influence extend into the future?

The closing sentence of Watson and Crick's seminal paper about the double helix has become a celebrated quotation in the scientific literature: "It has not escaped our notice that the specific pairing [of the bases] we have postulated immediately suggests a possible copying mechanism for the genetic material" [1]. Today, this is commonplace whereas in 1953, it was revolutionary. The double helix structure of DNA came within a decade after the discovery that DNA was the genetic material. When Oswald Avery and his two associates first pronounced it in 1944, few people noticed it and it impacted yet fewer. When, in 1952, Alfred Hershey and Martha Chase showed the same, its acceptance was enthusiastic and broad.

The discovery of the double helix structure of DNA opened a new era in science with a direct route to the Human Genome Project four decades later, and its beneficial consequences in human medicine we cannot yet fully fathom. For years, Watson had doubts about the structure. Only in the early 1970s did reliable crystal structure determinations of DNA, finally, confirm Watson and Crick's original suggestion. It was only then that Watson, finally, had his first good night's sleep about the double helix.

The 1953 discovery catapulted the twenty-five year old Watson to the pinnacle of twentieth-century science. He was an ambitious young man who himself wondered in retrospect about how could it happen to him to "go beyond [his] ability and come out on top" [9]. He had doubts about whether he was bright enough, whether he would at all be able to solve a problem, and whether he would ever have original ideas. He was much sooner a genius than a great scientist, and what happened to him was the fortunate confluence of many factors of being at the right place at the right time, and above all, of being the right person for his self-ordained task.

It certainly was not sheer luck, because it was his decision about what to do and where to continue his career when he faced branching points. Circumstances, too, favored what he decided doing. Watson was very lucky, but he worked hard at finding his luck. He always had the right mentors; supporters; partners; ultimately, the right wife; the right venues for remaking a research place into his own image; and most of all, the right shoulders to stand on in order to look farther. Peter Medawar, the great immunologist, remarked, "Lucky or not, Watson was a highly privileged young man" [10]. It was less his background at home than the environments he eventually sought out for himself that made him privileged.

Watson and Crick never explicitly acknowledged that Watson had had access to Franklin's data, not even in the April 1953 *Nature* paper, and this omission was as much a breach of ethics as snatching the information itself. Watson ignored—whether knowingly or just because he did not care—many minor and not so minor societal conventions. Some of this was on purpose. Legend has it that he was so absent-minded that he often forgot to tie his shoelaces, but

Photo 6 James D. Watson with Istvan Hargittai in 2010 in the Watsons' home in Manhattan, New York (photo by and courtesy of Magdolna Hargittai)

it has been observed, when arriving at a party, just before entering the house, Watson untied his shoelaces.

His idiosyncrasies might have made Watson unwanted company, but the opposite happened; they enhanced his popularity. So did many of his manners that went against accepted norms. He mumbled in his lectures, often speaking to the blackboard rather than to the audience, and in a voice hardly audible, yet his audiences eagerly awaited and attended his talks. He was a poor dresser, but was sought out to attend gatherings. He was clumsy and awkward with girls, but the Cambridge ladies threw themselves into helping him find dates and girlfriends.

For six decades, Watson basked in success and it was not a casual relationship, because he thought a great deal about how to succeed in science. He wanted success and he thought about the Nobel Prize already early in his career. Fame was a driving force for him; he set up rules that assured success, and he practiced them. Watson summarized his prescriptions in over a hundred rules in his book *Avoid Boring People*, and that title was one of his favorite rules [4]. The near-obsession has remained with him and on a recent, June 2010, visit to Russia, he enumerated his rules to his eager Russian audience. The students of Moscow State University took his advice very seriously.

When I used to lecture about Watson in my course on the great discoveries in the twentieth century, I told my students that if Watson opened the door to our auditorium and looked for a place to sit down, he would single out the person in the audience whom he would find most interesting. At this moment, usually there was a little commotion; my students looked around as if assessing themselves and their peers, and sometimes one of them shifted in his seat as if making room for Watson (it was invariably a he rather than a she).

It is a Watson maxim that if you are the smartest person in the room, you are not in the right room. Watson and Crick were roommates at the Cavendish Laboratory in Cambridge and Watson felt comfortable about it. They fortunately complemented each other. Their contributions blended to such a degree that when Crick had to decide about the topic of his long overdue dissertation, he better thought of choosing something from protein structural work rather than the discovery of the double helix where it proved impossible to disentangle their contributions. Watson and Crick were very different not only as human beings but even more so as researchers. For example whereas both were curious and ambitious, Crick's curiosity was stronger than Crick's ambitions whereas Watson's ambitions were stronger than Watson's curiosity. Crick was a great scientist willing to attack even risky problems if he was sufficiently curious about them. Watson was a great scientist whose ignorance contributed to his decision

to study the structure of DNA—he was not fully cognizant of the then possibilities of X-ray crystallography and even of the state of analyzing biologically important macromolecular structures. He was, however, fully aware of the importance of elucidating the structure of the substance of heredity. His going for it against all odds was a stroke of genius.

Watson's keys to success are comprised of a broad domain of traits. They included the ability to distinguish between the important and the unimportant, and he always found time for relaxation. He economized with his time, but when he was doing something that he judged truly needed doing, he spent his time on it liberally. He was very patient when he was cutting out his paper models of the bases for his model as he was on the verge of the discovery of base-pairing in DNA. He paid meticulous attention to the minutest details in writing his textbooks. He devoted a lot of time to the back-and-forth exchanges with his colleagues and friends as he was preparing the publication of his book *The Double Helix*. He paid the most careful attention to all aspects of the planning of new constructions and renovating old buildings at Cold Spring Harbor Laboratory.

It is equally noteworthy what he did *not* do. There are scientists who once they find a fertile area of research, exploit it to the fullest; once they establish a new methodology, apply it to whatever it may be applicable. Others may feel in retrospect that they had moved away too quickly after they had made a discovery. For Watson, it was never a problem to determine when his work would become repetitious without, however, under-utilizing the potentials of an area. After the discovery of the double helix, but only after having made sure that everybody saw its biological implications, he moved on. His negative experience with the study of the structure of RNA and with the quest for the messenger RNA strengthened his determination that instead of trying to top his previous feat in research, he should be seeking his success elsewhere.

He became immensely successful in his new avocations, directing science and authoring books. His next success, his textbooks, covered new grounds and were innovative not only for their contents but for their style as well. His account of the double helix discovery showed the process of scientific research in a way that nobody before him had been capable of or dared. Cold Spring Harbor Laboratory did not merely become singularly successful, including its Watson Graduate School; it has also become Watson's shrine. However, only time will show whether it will become a lasting success after Watson is gone. He had generated hostility at CSHL due to his methods of enticing success through competition between members of the same group, between groups of the same laboratory, and so on. On occasion, it seemed to his associates that nothing was too sacred to him for the sake of success.

Watson was seldom a player in politics at the national level, but there were exceptions. When President Nixon declared his "War against Cancer," Watson pointed out the futility of the project. He showed that they could spend the money more wisely if they first reached a basic understanding as to the causes of the different cases and the mechanism of actions. He acquired a prominent role in the Human Genome Project between 1988 and 1992, a brief period, but crucial as it was the start of the project. Otherwise, he was seldom involved in politics. His public appearances made headlines for some shocking, but inconsequential statements like the one that fat women have better sex lives than slim women do. Mostly, he was restrained as one who knew what he could say publicly and where to draw the line to keep his views private, with due consideration for his fundraising role for the Cold Spring Harbor Laboratory. This restraint was absent in his 2007 debacle. Due to his age, the scandal could have signified the closing of his career and would have made a sad ending.

Watson, however, was not done yet: he persevered. He managed a comeback. The former whiz-kid, now an octogenarian, has lately been active again, traveling, giving talks, and raising funds—for CSHL. James D. Watson is still going strong. He continues shaping his legacy, which he sees primarily in his books and in CSHL. His image building has long focused on making him identified with DNA. He knows that the fame of an individual based on scientific discoveries is fragile. His haunting experience in 2007 reinforced the necessity of a stronger basis for his legacy than an institution. Sydney Brenner, one of the architects of modern molecular biology, stated: "Worrier or Warrior, Jim has been the guardian of DNA for the past 50 years" [11]. Watson's legacy may be dependent on his success in having become identified with DNA, not just its structure, but also the substance. Nobody could ever destroy DNA—it is eternal.

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