

Perspectives

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ALEXANDER HOLLAENDER: Myth and Mensch

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SCIENCE is not kind to the memories of its former practitioners. We were gently reminded of this brutal fact by the editors of the *Perspectives* section of *GENETICS* after they read the original version of this essay on ALEXANDER HOLLAENDER. While the insiders, those who had known ALEX, those who had been at Oak Ridge, might find our essay amusing and perhaps even enlightening, they are a dying breed. These days, most of the readers of *GENETICS* would have never even heard of HOLLAENDER, and as a consequence, would have no motivation even to try to understand what we wanted to say. Upon reflection, we had to agree with the editors. Mentioning a name as illustrious as BRIDGES draws a blank stare from most of our young colleagues. MORGAN's name recognition is a bit better, but after all, a centimorgan is a unit.

ALEXANDER HOLLAENDER was a radiation biologist. His scientific interest was mutation research. SETLOW (1987) and VON BORSTEL (1987), in their obituaries of HOLLAENDER, described his numerous scientific contributions. The most important of these was that the action spectrum for UV-induced mutation of spores of the ring-worm fungus *Trichophyton mentagrophytes* resembled the absorption spectrum of nucleic acids (EMMONS and HOLLAENDER 1939; HOLLAENDER 1941; HOLLAENDER and EMMONS 1941). Thus, HOLLAENDER realized that genes were made of nucleic acids at a time when most of his contemporaries were sure that they were made of proteins. No, most of their contemporaries did not change their views because of the work by HOLLAENDER and EMMONS, nor the work by KNAPP *et al.* (1939); they either explained it away or ignored it. As KUHN (1962) would have put it, the time was not yet ripe for a scientific revolution. But eventually the paradigm did change. In retrospect, it is clear that HOLLAENDER fired one of the first shots in the molecular biological revolution.

HOLLAENDER's other major scientific contribution is known as the "oxygen effect" (HOLLAENDER *et al.* 1951). Most, perhaps all, of the biological effects of ionizing radiation are dramatically reduced in the ab-

sence of molecular oxygen. In one sense, this contribution was bad news. It meant that the cells in the center of large tumor masses, which are often anoxic, would be resistant to radiation therapy. The good news, however, was that the biological effects of radiation could be modulated to achieve desirable results, a possibility that was not so widely recognized at the time. The oxygen effect was actually an old and forgotten discovery by HOLTHUSEN (1921), which HOLLAENDER realized could be put to practical use. Many people date the beginning of research on DNA repair as 1958 when RUTH HILL discovered radiation-sensitive strains of bacteria. More than 20 years earlier, however, HOLLAENDER and CURTIS (1935) had aired the possibility of a mechanism for the recovery of cells from the effects of ultraviolet radiation, and seven years prior to 1958 HOLLAENDER had been pushing people at Oak Ridge to study organic "radical traps" as a potential way of protecting against the effects of ionizing radiation.

These are solid scientific achievements. However, it is a moral certainty that were HOLLAENDER "just" a scientist, we would not have been invited to write this essay. ALEX achieved greatness as a scientific impresario, as the founder and first director of the Biology Division at Oak Ridge National Laboratory (ORNL). The enormity of this assertion may not sink in immediately, for there have been many great directors of institutions devoted to biological research. But JIM WATSON, for instance, did not become great because he was director of the Cold Spring Harbor Laboratory; WATSON had already achieved greatness before he became director. In our opinion, ALEXANDER HOLLAENDER was a unique example in this regard. Had he been recognized as a great scientist, he might have been offered a professorship at Harvard or Stanford. Had he been recognized as a great organizer of science, he might have been offered the presidency of MIT or Caltech. In any event, he would have found a more likely venue to demonstrate his talents than that God-forsaken hundred square miles bounded by the Clinch River and the Black Oak Ridge.

What was so great about Oak Ridge? In one sense, great means large. In this day of genome projects, biotechnology conglomerates and university megalabs, no one is likely to be impressed by the size of the Biology Division, which was never more than roughly 200 doctoral-level scientists. In the early sixties, however, that was big biology if not Big Science, a phrase coined by the then-director of ORNL, ALVIN WEINBERG. Despite the best laid plans of the Atomic Energy Commission (AEC; the predecessor of the Department of Energy), plans predicated on the assumption that real research would not thrive in a national laboratory not closely associated with a major university, HOLLAENDER reared a Biology Division devoted to basic research that was larger than those at Brookhaven, Argonne and Los Alamos combined. As would be expected in a federal laboratory, there was much programmatic research done by relatively large groups. While even ALEX was unable to ensure that all of the large-scale efforts were of the highest quality, we would not want to denigrate them. Indeed, some, such as the mouse mutation project, were national assets. As would also be expected in an environment dominated by engineers, there was much technical research. This, too, we do not wish to denigrate; indeed, we were involved in some of it ourselves (transmutation of ^{33}P from ^{33}S). But the answer to the question posed at the beginning of this paragraph is that Oak Ridge was a great place to do basic research. HOLLAENDER conjured up this research paradise out of thin air.

In addition to his scientific contributions and presiding over the ORNL Biology Division, HOLLAENDER was famous as an organizer of scientific symposia on a grand scale. His first venture into this field, which was an attempt to mitigate the isolation imposed by the location of Oak Ridge and by its security gates, is described in detail below. But these activities soon expanded beyond the confines of East Tennessee and the North American continent. Organizing symposia became his preferred method of biotechnology transfer to the second and third worlds, and he continued doing it to the end of his life. He personally initiated more than 40 such symposia after his retirement as Director of the Biology Division.

This essay was written at the Basel Institute for Immunology (BII). One of us (C.M.S.) moved there from Oak Ridge when the BII was founded some 25 years ago. The other author (R.C.vB.) has spent two sabbatical years at the BII and is a persistent visitor. NIELS JERNE always claimed that Caltech was the model for the BII. Maybe so, but the BII is far closer to being Oak Ridge Europe than it is to being Caltech East. Some day, perhaps, we shall write an essay on "NIELS JERNE: Myth and Mensch." What is interesting in the present context is how the two directors with polar opposite public images—HOLLAENDER the autocrat and JERNE

the democrat—created such similar institutions. Obviously the Mensch is more important than the Myth.

HOLLAENDER moved to Oak Ridge in 1947 to become Director of the Biology Division of the ORNL. The conditions were right. The AEC was planning a nuclear energy future for the United States, the budget was expanding, and scientific fields were not yet crowded with individuals who had chosen science as a high-salaried occupation (a state of affairs created by Sputnik) rather than as an area of intense interest. From the way the Biology Division came to be structured, a case can be made that HOLLAENDER's vision for biology placed genetics at the core, with the rest of the biological sciences radiating outward. During the decade of the fifties, the Biology Division was unique for the variety of organisms used for genetic experiments. Genetics was needed to carry out the *raison d'être* of the Biology Division, that of determining the fundamental actions of ionizing and nonionizing radiation on cells and organisms and of determining what the findings might imply for human health in the new age of atomic energy. A competent cadre of young scientists was assembled, and the interactions among them created a center of excellence during the 1950s and 1960s. Eventually the Division reached a size of about 180 principal investigators, with postdoctoral fellows and visiting investigators bringing the total to over 200 scientists during HOLLAENDER's heyday. At that time, only the summer gatherings of scientists at Woods Hole were comparable in number, and research on biology at the ORNL lasted all year round.

In one respect, however, conditions were far from ideal. Oak Ridge was far from the lights of any big city, and until the summer of 1952 not only the laboratory but the town itself remained behind locked gates.

How did HOLLAENDER accomplish this in a small town in the foothills of the Cumberland Mountains? To answer that question, we need to consider ALEX the Mensch and ALEX the Myth. These two HOLLAENDERS may overlap, but they do not coincide. Personally, we have a great affection for ALEX the Mensch. Thus, although we have tried hard to avoid it, we may have created a few new myths of our own here.

The allocator of research problems: *Myth:* ALEX assigned to each scientist the research projects he wanted done and told them which experiments to do.

Mensch: The Myth and the Mensch here are exactly 180 degrees out of phase. ALEX's method was simply to hire scientists who wanted to do the sort of research he wanted done. In an approach like that of the immune system, ALEX realized that selection is superior to instruction as a way to achieve a desired result. He hired the best scientists he could in a certain field and gave them complete freedom for research. He encouraged adventurous science by providing equipment, supplies, and a technician for each investigator and placed more than one scientist in each laboratory so that collabora-

tions could flourish. Because universities in the late 1940s and 1950s found it difficult to acquire advanced equipment and supplies and required much teaching, a scientific career at the Biology Division of the ORNL was an opportunity to spend time in a scientific paradise.

No one was exempt from ALEX's badgering for publications. He was always telling each staff member to publish more. One could feel satisfied, with a new paper just appearing in *Nature*, the *Proceedings of the National Academy of Sciences* or *GENETICS*, a manuscript in press in another of these journals, and another in the editorial office, yet ALEX would say, "I know you got some more stuff," and as every investigator knows, he was usually right. He kept everyone on the edge of defensiveness about publications, and all of them kept publishing as much as they could muster. After a while, each staff member became pretty good at it.

The financial wizard: *Myth:* ALEX was a good administrator who attended to business so closely that the Biology Division thrived. He was a penny pincher, so the Division operated efficiently.

Mensch: The first axiom from which ALEX worked was, "They've got lots of money, and we've got to help them spend it wisely." ALEX was the biggest-spending penny pincher east of Texas, at least when he was spending someone else's money.

His first problem was to get the money to make the Biology Division grow. The fuel to keep the Division expanding came from paying scientists about 10% less than the average for ORNL. In the late 1940s and 1950s, the salaries paid young biologists in universities were even less than those paid by ALEX, so he could easily convince individuals about the good deal they were getting. Moreover, the cost of living in East Tennessee was the lowest in the country. The target budget for each division of ORNL was calculated on the average salary per person. Thus, by paying the biologists less, ALEX could hire more young scientists, which in turn justified a still higher budget for the next year. Because salaries consumed about 90% of all funds, the average growth of the Biology Division was close to 10% per year. This simple bootstrap operation worked for about 15 years.

After that, ALEX's skills as a fund-raiser began to show in other ways. He began making deals with the National Institutes of Health and the National Aeronautics and Space Administration to sell the expertise in the Biology Division to solve problems for these agencies. This research was carried out at the Biology Division, despite the strict AEC policy that subcontractors were not allowed to obtain funds from any other federal agency. The AEC and their administrative subclasses were afraid that growth, spending, and vision might get out of their control, and that is precisely what ALEX wanted.

The public relations expert: *Myth:* ALEX relied on ORNL policy and its public relations department to develop a national presence and to give itself visibility.

Mensch: ALEX was convinced that in order to thrive in the Cumberland foothills, he had to make himself visible nationally. He did his best to keep the Biology Division in the minds of biologists everywhere. For example, when he arrived in Oak Ridge, ALEX began a small weekly bulletin for the Biology Division, listing the travels and seminars of the staff members and the names of everyone who visited the laboratory, and each issue listed references that staff members had checked in incoming journals. Since he had built such a superb library, there were many articles to be checked. ALEX sent this little bulletin to friends and acquaintances in hundreds of colleges and universities, who came to welcome each issue. Anyone who requested it could receive the bulletin at no cost. He also sent out yearly lists of the papers published by Biology Division staff, with the offer to send any reprints that might interest the reader.

ALEX wanted everyone to visit Oak Ridge as speaker, adviser and rumor-monger to keep the staff informed about what was going on in cutting-edge science everywhere else. So he publicized the Biology Division both by bringing in many speakers from everywhere and by traveling to see scientists all over the globe. All of these were mentioned in the weekly bulletin and added to the mailing list.

Far from relying on ORNL policy, ALEX did his best to circumvent it. He worked relentlessly to open the Biology Division for all to visit. From the 1940s to the end of the 1960s, Oak Ridge tried to hide itself from view. Everyone in Oak Ridge had to have Q-clearance and visitors were regarded with suspicion. The security division of the AEC could and would prevent even the investigators at the laboratory from knowing what was going on simply by classifying everything "Confidential." Even so, this didn't stop the Soviet Union from exploding hydrogen bombs. From the 1960s, the gate to the Biology Division was the only gate at X-10, Y-12, and K-25 unguarded by a security officer. (These were code names, taken from the map coordinates for the three major AEC installations in Oak Ridge.)

Even before ALEX turned to other agencies for funds to run his continually growing Biology Division, he had found ways to extend the Biology Division operation extracurricularly by using other peoples' money. He initiated a small program of sending young staff scientists to visit Southern colleges and universities to present seminars about their work as well as to tout the wonders of the Biology Division. The traveling scientists were asked to size up people at these colleges and universities and invite the interested ones to come to Oak Ridge to work during the summer months. When this program was successfully under way, it was managed by the Oak Ridge Institute of Nuclear Studies (ORINS), an organization originally set up in the early 1950s that provided predoctoral fellowships for graduate students interested in radiation studies. ORINS saw the utility of the program and extended this idea to all Divisions of the

ORNL. Other investigators in other divisions were recruited by ORINS to travel to Southern schools, but the Biology Division always was the power user.

The apolitical politician: *Myth:* ALEX HOLLAENDER was apolitical. He steered clear of the liberal-conservative whirlpools that stirred the country in the post-World War II period.

Mensch: ALEX did not steer clear of the liberal-conservative polarity; he used the situation to his own advantage. ALEX started an annual symposium at Oak Ridge on various topics related to work being carried out in the Biology Division. For the 1954 symposium, he wanted to have LINUS PAULING as a speaker. LEWIS STRAUSS, the Chairman of the AEC, talked to ALEX, trying to dissuade him of his choice of PAULING as a visitor to Oak Ridge, because those were the days of JOSEPH MCCARTHY. J. EDGAR HOOVER apparently thought that LINUS PAULING was a security risk, and LEWIS STRAUSS did not want to get the AEC into trouble with MCCARTHY. ALEX persisted relentlessly. Finally, the Chairman of the Commission, out of frustration, offered to pay to have the symposium held outside of Oak Ridge. ALEX was ready and immediately suggested Gatlinburg. Thus the Gatlinburg Symposia were born, and thereafter many scientific divisions at Oak Ridge copied ALEX's example.

LINUS PAULING was invited to attend the 1954 Gatlinburg Symposium, but he never appeared.

ORNL and the other two operations at Oak Ridge had only a small base of political clout, amounting to two senators from Tennessee and the congressman representing the district where Oak Ridge was located. ALEX improved this clout for the Biology Division by the simple ploy of assigning to each research group a suitable scientific consultant. The consultants were usually from different states, and they usually were eminent enough in their own state to be listened to. Whenever ALEX needed a little persuasion in Washington, he would ask one or more of the consultants to send a little note to their senators and/or congressmen to explain the problem. In this way, the Biology Division was represented by about 30 or 40 members of the House and Senate.

The traveler: *Myth:* ALEX liked to travel.

Mensch: Here Myth and Mensch coincide exactly. ALEX did like to travel. He devised ways to travel internationally while helping others to "spend money wisely."

After sending MARY ESTHER GAULDEN to South America as a scout in 1959, he initiated the Latin American Symposia, which the National Science Foundation (NSF) assisted in financing. The NSF funds were usually matched by the host nation, and every European country paid to send at least one scientist to speak at the symposia in "third-world countries" as they then were called. The annual Latin American Symposia always were arranged by Biology Division staff scientists, by one or two of the leading scientists in the chosen field

from outside, and by the hosts who had agreed to hold the symposium in their country.

ALEX didn't stop there. He decided that South Asia would be his next target, and so the South Asian Symposia were born. Here he exhibited his true genius in helping people spend their money wisely. The U.S. Agency for International Development raised most of its funds by having nations provide their own currency to pay for goods, like wheat, that were "given" to these nations in times of famine and for other needs. These local currencies were used mostly by the Central Intelligence Agency (CIA) for information collecting and other, more distasteful uses. Somehow, ALEX was able to convince someone in the federal hierarchy that some of these funds should be used to support the International Symposia. It never approached one part per million of the sums used by the CIA, but ALEX certainly did much more for international relations than the CIA ever did. In addition to promoting international relations, the symposia provided a lot of publicity for the Biology Division.

The domineering director: *Myth:* ALEX dominated others by the force of his personality and character. He collected and discarded scientific talent helter-skelter.

Mensch: There is no doubt that ALEX frightened those who could be frightened easily, but this was not how he operated. He never feared surrounding himself with individuals who had more intellectual ability than he had himself. A few of these were real intellectual giants, and several others were creative technical wizards with breadth of vision. These alone could provide the scope, the ideas, and the dynamism of the Biology Division for which ALEX, as Director, could take full credit.

Moreover, ALEX was indeed a collector of scientific talent, but a collector with exquisite taste. He collected potentially capable young scientists and urged them to collaborate with more experienced individuals. In the Oak Ridge of ALEX's day, the independent postdoctoral fellow was not an oxymoron. If a person did not take off on his own, he or she was shuffled into a highly successful laboratory. If those persons then failed either to integrate or to take off on their own initiative, ALEX found academic positions for them. He was proud of his ability never to fire anyone, but to find suitable positions for everyone. If they departed, it wasn't for lack of publications; ALEX had already seen to that.

The art collector: *Myth:* HENRIETTA HOLLAENDER had the artistic sensibility and the good taste for whatever art that ALEX and HENRIETTA acquired.

Mensch: ALEX and HENRIETTA were strong promoters of all the arts in Oak Ridge, and he was the first President of an Arts Council that brought together the symphony, the art gallery, the chamber music group, the theater, and the choral society as a strong voice in community affairs.

When ALEX emigrated to the United States after

World War I, his most prized possession was a drawing by OSKAR KOKOSCHKA. He and HENRIETTA collected the art of talented young artists with skill and insight. For example, ALEX happened to walk by an art dealer's window when he saw and purchased on the spot the first painting that FRIEDENSREICH HUNDERTWASSER ever sold. ALEX purchased perhaps the best painting that ASGER JORN had ever done. As was often the case, this painting was done during a transitional period of the artist.

HENRIETTA and ALEX did work together on buying art, but ALEX was always in charge. HENRIETTA would say, "Alex, I can't choose between these two." ALEX would reply, "We take this one." At another studio, ALEX would say, "Henrietta, take one of these three." Then HENRIETTA would make her choice. There was the occasional failure. HENRIETTA put it best: "We went back to Rome to see how that young genius was developing . . . and he had become a poet!"

The HOLLAENDERS' collection had paintings and lithographs by nearly every important artist in the 20th Century. The range and variety of their collection of the Cobra artists (Copenhagen, Brussels, Amsterdam) was unparalleled in the United States at the end of the 1960s; the first Cobra show in the United States was held in Oak Ridge with but one picture from outside their own collection.

The HOLLAENDERS were approached to leave their art collection in Oak Ridge. But when ALEX's postretirement consultantship with the Biology Division was canceled, HENRIETTA announced that she wouldn't leave anything in "this village." Their art collection now resides in the Elvehjem Museum at the University of Wisconsin.

Moreover, ALEX collected fossils from the nearby Cumberland Mountains where he hiked every Sunday. These he gave away as gifts to visiting scientists from around the world, whether or not they had room in their luggage.

The perfectionist: *Myth:* ALEX never made a mistake.

Mensch: ALEX was skilled at blaming others for his mistakes, and he nearly always succeeded in convincing them it really was their fault. The rewriting of unwritten history was a powerful weapon in his arsenal. This ability made administrators tread lightly around him. ALEX's memory wasn't better than theirs; he was just more alert and pragmatic than they were. For example, in the mid-1960s it came to the attention of the AEC administrators in Washington, D.C., that assimilation of heavy isotopes in the bones could constitute a hazard. ALEX immediately reminded them that when he had come to Oak Ridge in 1947 he would have liked to set up a large group to study the problem, but he had been told that the effect of radiation on cells and tissues was enough for him to take on. He rubbed it in, elaborating more and more on why and how they had failed to heed his

advice and why they would never have gotten into such a mess if they had listened to him. Since nearly all of the administrators had changed in the 20 years since ALEX had moved to Oak Ridge, they had to take his verbal punishment lying down. Back at the Division, ALEX was asked if he thought his remonstrances would bring in any more money. He replied, "No, they know me too well."

ALEX conveniently forgot that he had insistently urged people to write proposals for the Biosatellite program. When the investigators who were canvassed argued strongly and loudly that it was a waste of time and money, he simply replied, "Yes, but we need the money." So, for reasons of loyalty, a number of investigators complied. Then, several years later, when a news article in *Nature* by JOHN TOOZE quoted JIM WATSON as saying, "Biosatellites are a waste of money," ALEX went around to tell the investigators that they "should never have gotten into this program."

The psychiatrist and probation officer: *Myth:* ALEX did not understand people and their needs very well.

Mensch: He understood the capabilities of people extremely well. At meetings where someone would make a snide remark or give praise about one of the staff members at Oak Ridge, he would add this knowledge to his intracranial database, and through a continual assessment process he would integrate all the information until he knew exactly how each individual in the Biology Division was regarded by the scientific community as a whole. Moreover, because he knew how each staff member thought, he used them for advice. He knew who was usually right, who was usually wrong, who was overly enthusiastic, who was overly cynical, and who had unusual views of problems that should be taken into account. Then he would act and take credit if things went well. If they did not go well, he would seek out the people who had given him wrong advice and tell them that they were to blame. ALEX had an unusual capacity for integrating information obtained from others, far beyond that of any other administrator that we have known. But even he occasionally was fooled by sycophants who would agree with him and carry out his ideas unthinkingly. Like all administrators everywhere, he was susceptible to believing they must be highly intelligent if they agreed to do everything he suggested.

Nevertheless, ALEX's suspiciousness and perspicacity of capability bore to the center of the souls of the staff members of the Biology Division, and he knew how best to develop and use the talents of the first, second, and third class scientists in the Biology Division, whether it was by punishment and reward, flattery of egos, or increases of salary. He never showed mercy for wasted resources. For example, if a person wasn't particularly interested in money, he was not rewarded with an increase in salary. ALEX knew there are multiple ways to massage vanities, and he never misused the best way.

When people had done some excellent work, he put

them on display. He carefully arranged ways for the scientists to be better appreciated, through seeing to it that they were invited to local, national, and international seminars, meetings, and symposia, but only when they had something interesting to say.

ALEX told each person what he had arranged for them, but many of the staff already knew how the world worked and assumed their invitation had been his doing. Nevertheless, there were always those who assumed their gift must have come from a chance reading by a symposium organizer of their latest papers. ALEX kept better control when everyone knew that the goodies of this world had come from him. The one time that ALEX didn't get a chance to mention it was the day when W. K. ARNOLD learned he had been made a member of the U.S. National Academy of Sciences. Before ALEX could say anything, BILL ARNOLD came up to ALEX and said, "You must have done a lot of work to get me admitted." ALEX just grinned and congratulated him.

The Optimist: *Myth:* ALEX was too realistic to be optimistic.

Mensch: ALEX's iron rule was *be optimistic at all times*. No matter how many large problems were looming, ALEX's smile always gave courage to everyone. From his smile, we believed he had every situation well in hand, and only he knew the real truth.

The only times that his optimism grew thin, and pragmatism set in fast, was at the end of the fiscal year when deficits were beginning to loom. When the extent of the short-fall of the budgeted funds could be seen, ALEX might even send out a panicky order to the staff to stop buying everything from stores. He would have to sign every order of five dollars or more. The store was always prepared, ready to dole out plastic petri dishes in \$4.95 lots. In those last few weeks or months before the next budget came through, whenever something larger was needed from stores in order to keep the scientific show going, platinum crucibles were returned to the stores for which full value could be obtained. Objects made of noble metals had been purchased by different research groups for their own needs, usually during the years of excess funds, when the money had to be spent before the fiscal year ended. In that way "funds" were available to order badly needed consumables in dire times. This was a real saving in money for the U.S. government.

Also, platinum weighed less per dollar and took up less space than the heavy water that the physicists hoarded and sold back to the stores for about a dollar a gram.

Epilogue: This short account cannot list all of the facets that constituted the man named ALEXANDER HOLLAENDER. A book could be written about his administrative methods, and another could be written based on the anecdotes told by everyone who knew him. All his investigators respected him, and some feared him. And many have attempted to imitate ALEX's wonderful accent. Only KIM ATWOOD had perfect mimicry, and he often used it by telephone or by a voice coming from around a corner to gain the sudden, startled attention of the more fearing of the scientific staff members of the Biology Division.

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