In the book “The Vaccine Race” by Meredith Wadman there are numerous errors of omission and commission and also failures to provide adequate context. All this has been caused by her policy (1) to refuse to reveal her text before publication to those she describes and (2) failure of her publisher to use a fact checker.

Page 55-83. I never had an NIH grant or contract to develop WI-38 because I used bootlegged surplus materials from the cell culture lab that I ran. The contract later offered to me by NIH was to provide my pre-existing WI-38 strain of normal human cells to NIH grantees and others by producing, storing and distributing this and other cell strains. The contract, which I never signed, did not award title of WI-38 to the government. To this day there is no law that has determined ownership of a self-duplicating system. Dozens of companies world-wide make billions of dollars producing WI-38 based vaccines, or sell WI-38, and hundreds of research laboratories including NIH use WI-38, - all without title to WI-38 or accusations of theft. I have never sold WI-38, although Moorhead and I gave it the value that was, and still is, commercially exploited. In the subsequent 12 years of new or renewed distribution contracts from 1963 to 1975 no claim for title to WI-38 was ever made by the NIH.

I spent a decade of effort to have WI-38 used to produce safe and efficacious human virus vaccines. After more than a decade ignoring and rejecting the use of WI-38 for human vaccine manufacture, government employees of the NIH and FDA confiscated all of the WI-38 ampules from my laboratory in my absence and claimed title for themselves. Wadman fails to provide context by not describing the decade of efforts I made to prove the safety and efficacy of using WI-38 to make human virus vaccines. Wadman also omits writing that our efforts were so successful that the NIH/FDA provided the ultimate irony, - they confiscated all of my WI-38 ampules from my laboratory in my absence. In consequence of this, I filed a lawsuit against the NIH/FDA/DHEW. In the out-of-court settlement the government did not prove title to all of WI-38 nor did they claim ownership of the funds that I put aside for WI-38 mailing and preparation charges made to vaccine manufacturers, commercial sellers of WI-38 or researchers not in the field of aging. The funds remained in a bank account for five years until determination was made of the proper owner (later found to be me in the out-of-court-settlement).

Absent from Wadmans’ text here is my critical discovery that, upon freezing, and then after reconstitution, the normal human fetal cells retained their “memory” of what population doubling level (PDL) they had attained upon freezing and, when thawed months or years later, replication continued until the maximum total of about fifty population doublings was reached. This discovery suggested that normal human cells have a mechanism for counting DNA replications. This idea was later confirmed by the 2009 Nobel Laureates who discovered the molecular mechanism (telomere attrition) for my phenomenological findings.

Wadman, a physician, errs by defining plasma as “another word for blood serum.” Plasma is a blood fraction with the clotting elements retained. Serum is blood after the clot has been removed. It was not possible, as she asserts, to see chromosomes in living cells using my low power inverted microscope.

I never “adjust(ed) the components of the culture medium..” to determine why the cells stopped dividing because I knew that the identical commercial medium was capable of supporting the vigorous replication of the same cells at earlier population doubling levels.

The non-dividing normal human cells continue to metabolize for a year or more without requiring sub-cultivation. This omission by Wadman is critical because my discovery of this is assumed to occur in vivo where senescent cells may accumulate and produce manifestations of aging now called Senolytics (See Nature article Volume 550 page 448, 26 October 2017). I recognized the cessation of cell division microscopically by finding no cells in mitosis which indicated that no sub-cultivation was required.

Wadman writes, “Proving the absence of contaminating viruses in WI-38 “ ,,would eventually come to dog him” is inaccurate because the male/female mixing experiments that I did (and described later by Wadman) proves that contaminating viruses were impossible. I coined the term “population doubling level (PDL)” (not coined as Wadman states by the generality of “biologists”) to accurately explain the phenomenon that I discovered.

As is gratuitously stated, - and for which Wadman provides no evidence, - I never “loved to inhabit,… the rarefied universe of top biologists” then or now. But more important facts are omitted by Wadman who fails to describe my critical observation that only normal cells are mortal and only cancer cells are immortal, - an observation that could not have been made until I showed that only normal cells are mortal. The sixty year old dogma that I disproved (and unmentioned by Wadman) stated that all cultured cells are immortal. A new cancer research field resulted to investigate how a mortal normal human cell becomes an immortal cancer cell. The distinction that I first made of mortal normal cells and immortal cancer cells was later explained at the molecular level with the discovery of the enzyme telomerase by the same 2009 Nobel Laureates mentioned above.

“Hayflick also … codiscovered the cause of walking pneumonia.” As stated on page 42 of the paper in the Proceedings of the National Academy of Sciences in which this discovery is described, I am the sole person named who first isolated the mycoplasma species that Is the cause of “walking pneumonia” (primary atypical pneumonia [PAP]). These facts are unknown to Wadman because she never asked but apparently just

guessed. The facts are that I learned from the Robert Chanock the senior author of this paper (who visited me to obtain a culture of WI-38) that the cause of PAP was thought to be a virus called the Eaton Agent. It could be cultivated in embryonated eggs. Because I worked with PPLO (later renamed mycoplasmas) for my graduate degrees, I knew that they were the etiological agents of many pneumonic diseases in lower animals. When I asked Chanock whether PPLO had ever been studied as the cause of PAP he replied: ”What are PPLO?” I explained that these are the smallest free-living microorganisms and asked him to send me some egg yolk containing the Eaton Agent. It was from this material that, using a unique agar formula that I developed, that I first isolated the etiological agent of PAP and subsequently named it *Mycoplasma pneumoniae*. Members of Chanock’s NIH laboratory were then sent to my laboratory to be trained in how to cultivate and handle *M. pneumoniae*. Further evidence that it was I who first suggested the possibility of a mycoplasma etiology of PAP and first isolated the etiological agent is that I am the only recipient of the Presidential Citation Award from the International Organization for Mycoplasmology for this discovery.

My normal human fetal cells were inoculated by physicians into the forearms of terminal cancer patients. Omitted by Wadman is that HeLa cells were inoculated into the other arm of the terminal cancer patients as a critical positive control. The latter formed nodules later excised, - the former did not. Also, unmentioned by Wadman is the critical phenomenon of increasing aneuploidy as normal cells approach their replication limit. This finding led to using WI-38 for vaccine production to lower PDL’s.

Also omitted by Wadman is the context of my important finding that WI-38 could be frozen for years at various PDL’s and, after thawing, thoroughly tested for any potential hazard. Unlike what is possible using primary cells, this permitted a near guarantee that the remaining frozen normal human cells were safe for use in the manufacture of human virus vaccines.

I chose to publish in the *Journal of Experimental Medicine* (JEM) for two non-“ambitious” reasons as Wadman falsely asserts. First, the JEM published the work of Alexis Carrel whose work I was challenging. Second the JEM had then published the work of Theodore Puck who described his work with human cells but (1) failed to observe their limited capacity to replicate and (2) insisted that these cells were extremely fastidious necessitating careful testing of the growth medium constituents. I used untested (by me) commercially available media.

Page 83 Missing from Wadman’s text is mention of the serious problem of world-wide failures in WI-38 media preparation by many vaccine manufacturers. Omitted by

Wadman was my solution to this problem by my invention of powdered media which became a multi-billion dollar industry and from which I have received no remuneration.

Also omitted by Wadman is the fact that all inverted microscopes used in the cell culture field are descendants of my invention of a modified inverted crystallographer's microscope. This microscope was later accessioned by the Smithsonian Institution. Both of these inventions are omitted in the time frame discussed here.

Page 92-173. The Project Officer, Dr. Robert Stevenson, says that when he wrote the contract he "had no intention of claiming that the government owned WI-38."

Page 105-109. Again, as discussed first above, no mention is made here of my critical finding of the absence of contaminating viruses in WI-38 and the technology that I invented in which large amounts of WI-38 can be frozen, then thawed and tested for safety by many laboratories. When found to be safe, the remaining frozen cells can then be used for human virus vaccine production.

Two more critical context omissions here are (1) S.V.40 transforms normal human cells (WI-38) into cancer cells, - this discovery is far more important than anything else that Wadman describes here (2) neither Paul Moorhead nor I were named in either the rabies or rubella Wistar patents despite the fact that WI-38 was the enabling technology. Yet, WI-38 was named in both patents as the cells used. Wadman omits writing that WI-38 also gave to both vaccine viruses the key attenuated properties that made them superior to their competitors. Also omitted in the missing context is that (1) Moorhead and I were never told that patents were being sought, (2) the Wistar Institute profits annually by about 30 million dollars and, (3) Koprowski and Plotkin each benefitted financially (Page 258). Moorhead and I received nothing. I gave WI-38 to them both gratis.

Page 173. The crucial Opatija, Yugoslavia International Conference is ignored here, yet it and its' organizer, Dr. Drago Ikic, launched the world-wide use of WI-38 for the production of human virus vaccines. Also omitted by Wadman are details of the critical role played by the UK vaccine controller, Dr. Frank Perkins, in his efforts to promote the use of WI-38 for human virus vaccine production.

Wadman also omits that neither Moorhead nor I have ever received an award for our discovery of the enabling technology that made the awards she lists here possible.

Page 213. Wadman omits writing that WI-38 was distributed by Britain's Medical Research Council (MRC) and the WHO to virus diagnostic labs and vaccine manufacturers in England, Europe and Africa. The fact that I gave WI-38 to all of these entities and also to Russian cell repositories in Moscow and Leningrad gratis is also

omitted by Wadman. If her innuendo is to be believed,- that I stole WI-38 from the NIH, - then unstated by her, is that all of these entities are accomplices to a crime.

Page 223. " ..when no one was looking, Hayflick visited the Wistar basement.." and removed all of the WI-38 ampules. The truth is that I had been going to the Wistar basement weekly or daily for eight years where I stored the WI-38 ampules I worked with. I also was there frequently in my efforts to invent a a system of scales on which the freezer rested that would trigger an alarm when the liquid nitrogen level in the freezers fell to a dangerous low level. In subsequent years manufacturers have used this principle to develop modern alarm signals. Contrary to Wadman's guesses that I surreptitiously stole into the Wistar basement "when no one was looking" there would never have been an occasion when any member of the Institute would have been surprised to find me in the Wistar basement. Wadman does not know that I also had reason to be in that basement because I was responsible for supervision of the media preparation laboratory which was located in the basement.

Although Murray wrote to invite Plotkin to this important conference, absent is a statement by Wadman that I was not invited at all.

The $13,350 was collected from scientists for preparing and shipping the cells to researchers not in the field of aging. To write that I "sold WI-38" is a miss-representation of the facts. The cells were not sold but costs for preparation of the cultures and shipment were requested. These funds were then placed in a separate account until ownership would be determined. I did not "bump up the prices" for shipping and preparing WI-38 unilaterally but increased them in line with the rise in prices charged for the same costs by the quasi-governmental ATCC for the WI-38 cultures that I gave to them gratis. Omitted by Wadman here is also the critical context for the reason why the bank account was established. It was established to avoid my having to pay taxes personally on the increasing interest.

Page 273-276. This bank account rose to "$65,000 in 2016 dollars" from charges I made to WI-38 recipients for packaging and shipping the cultures as explained in the above paragraph. During the 1970's the interest rates rose to 12-14% which accounts for the increase in 1970's dollars. This fact is omitted by Wadman as is the fact that the Medical Research Council in London also raised its prices for preparing WI-38 cultures that they sent to commercial companies. The funds in the account that I established were never used by me personally because their ownership was not established. My subsequent lawsuit (described later) against the government was settled out of court when the Justice Department came to me with a proposal in which they did not request these funds. The funds were given to my attorneys whose expenses far exceeded what remained in this bank account. Wadman fails to mention these facts in this paragraph.

My efforts to have pharmaceutical companies pay a few thousand dollars for any new WI-38 cultures they requested were based on my having previously given to them gratis, and for several years, many ampules of WI-38 from which they profited in the billions of dollars. It seemed to me to be a reasonable request to make after this realization as other biologists were now doing for their discoveries. I believed that whoever was ultimately awarded these funds would have not questioned this reasoning. My belief is contrary to that of Wadman and the FDA, NIH, and DHEW who argue that any person or company world-wide can legally sell or use WI-38 for profit except the estate of the fetus or the scientists who created WI-38 and gave it value.

Wadman writes here that: “Hayflick executed a contract with Merck..” I never signed a contract with Merck as Wadman later admits on Page 310 where she writes “Merck officials said that the huge contract with Hayflick…was never executed.” Inexplicably, Wadman misleads the reader here by omitting what she knows and writes on Page 310.

The “unpatented WI-38” remains unpatented because at the time that I developed WI-38 in 1963, living cells could not be patented.

The techniques and materials used by Boyer to found Genentech, Inc. were created in his University of California, San Francisco laboratory and supported by NIH grants using taxpayers’ money. Genentech, Amgen and Cetus lawyers, asked my attorneys for permission to provide amicus briefs when my law suit against the government went to trial. These lawyers knew that, should I lose my case, they could not justify the legal establishment of these firms founded with materials from their grant supported academic laboratories and paid for with taxpayers’ funds.

Contrary to Wadman’s assertion, the NIH did not pay me to develop WI-38. This not a part of the 1963 contract with the Wistar Institute that I did not sign. The government never claimed title to WI-38 in the 14 years from the date of the original contract. In the out of court settlement they were given title to the confiscated WI-38 ampules and I was awarded title to six WI-38 ampules that they returned to me.

Page 279-280. Lamont-Havers is not accurate, if Wadmans’ attribution to him is correct. She writes that he said that “I made no such request.” On the contrary, I specifically asked him “that the NIH please send their most brilliant lawyer” to me in order to determine the title to WI-38 and to the funds I had banked for preparing and sending the hundreds of cultures of WI-38 to colleagues not studying aging and to commercial entities.

I wanted their “most brilliant lawyer sent” because title to a self-replicating cell population was unique in law. I also wanted this matter to be settled before I considered the offer by Lamont-Havers himself to become the first Director of the

National Institute on Aging. My subsequent rejection of this offer was based on my realization that the salary for this post was far less than what I was receiving as a full professor at Stanford University and that was supplemented by my ability to have my five children attend Stanford gratis or to many other universities with whom Stanford had a reciprocal arrangement for their senior faculty members. These facts were far more persuasive than would be an NIH Directorship.

It is inaccurate to write that "Hayflick was anything but above board with the agency about his sales of the cells to companies until the most senior NIH officials learned of those sales almost accidentally." The "senior NIH officials" did not first learn "of those sales almost accidentally" as Wadman falsely asserts and without evidence. They learned about my concerns directly from me. After telling Lamont Havers of my concerns before accepting the NIA director's offer, I met with Donald Fredrickson at his National Academy of Science office where he then drove me to the NIH in Bethesda. Fredrickson said to me "I hear that you have a problem." He learned why I made my request for a brilliant lawyer from Lamont Havers to whom I first told. Wadman again errs to write that Lamont Havers said that the offer to me of NIA Director was "contingent upon the resolution of a possible conflict of interest in relationship to selling the WI-38 cells." That statement was not said to me by Lamont Havers. Perhaps it is because he recalled this "one year later" as Wadman writes.

Wadman fails to note the importance of the historical scientific revolution that occurred in the mid and late 1970's. The mind-set of biologists reversed then in respect to their belief that they were now entitled to profit from their intellectual property rights. Wadman writes of altruistic biologists, as I was prior to the mid 1970's, but she fails to emphasize the enormity and the significance of the revolution that was taking place then.

In the mid-1970's the Medical Research Council (MRC) in London began to charge several hundred dollars for WI-38 and MRC-5 sent by them to commercial companies. They realized, as I did, that companies using these cells, (formerly sent to them gratis by me and by them), were now making human virus vaccines in these cells yielding profits in the billions of dollars or pounds. Dr. Frank Perkins, (head of the UK vaccine authority) and I, both realized that it was unreasonable for such profits to be made without some benefits to accrue to the estates of the two fetuses and to the scientists who gave the cells value..

I felt that profiting from the sale of WI-38 was now, - in the mid 1970's, - legally acceptable because the executive order then made by President Reagan allowed commercial entities to profit from materials produced under grants or contracts using tax-payers funds. That became law later in 1980 with passage of the Bayh-Dole Act which granted scientists themselves, universities, and small businesses to profit from

discoveries that they made using federally funded research. Thus, it became clear that WI-38 could be sold legally for profit and also by those who gave it value.

By this time thousands of biologists, were now profiting from the emerging recombinant biotechnology industry. All of these companies were founded by academic scientists whose discoveries made in their university laboratories were supported by NIH grants or contracts. These scientists took the materials and the technology that they discovered using tax-payers money to found companies like Genentech, Cetus and Amgen. Even the NIH itself celebrated the emergence of these companies (in which tax payers funds were used to start these companies) by holding their own annual science fairs in which the discoveries made by NIH scientists were marketed to industry. An NIH scientist could now have his or her salary supplemented up to $100,000 annually if their discoveries would be sold to industry. NIH's Robert Gallo received $100,000 annually above his salary for his discovery of the test for HIV. This possibility was not only unthinkable during the preceding decades but it was illegal.

Several of the 83 scientists (further described under Page 318) who signed a letter protesting the actions of the NIH towards me, and published in Science, remarked that "the pioneers like Hayflick are the ones who have the arrows in their backs."

For many years I was a co-organizer and Secretary of "The Cell Culture Committee of the International Association of Biological Societies and of the International Association of Microbiological Societies" and wrote all of the annual published reports. We invited all national vaccine controllers to our annual meetings at the WHO in Geneva. The US controllers demurred and attended rarely only as "observers." In our annual reports that I published for six years I included the names of WI-38 recipients and the fact that I was charging a nominal fee for preparation and shipping charges to researchers not in the field of aging and also to vaccine manufacturers. The fee was the same as that charged by the quasi-governmental ATCC for WI-38 cultures. What appears in this paragraph is omitted by Wadman.

In 1975 our efforts to prove the value of WI-38 were so successful that the NIH and FDA surreptitiously sent a team to my Stanford laboratory to confiscate all of the WI-38 ampules after waiting until I attended a conference in Israel. This was one element that persuaded me to file a lawsuit against their actions to be discussed subsequently.

Page 283. Wadman writes "That Hayflick continued to sell the cells as the government investigators trolled through his lab is testament either to his naivete or to his bullheadedness…" No mention is made by Wadman that charges were made for preparing and shipping WI-38 and not for selling the cells.

As for my “naivete or bullheadedness” there is a failure by Wadman to appreciate the magnitude of the revolution that was occurring at that time and mentioned by me above. The intellectual property rights of biologists were now legally recognized. Biologists were the last scientists to realize that they had intellectual property rights. They were preceded by engineers, software developers, physicists and others who, years earlier, began to profit from the discoveries made in their academic, tax-payer funded laboratories.

Significantly, Wadman never mentions intellectual property rights anywhere in her book.

Page 284. Wadman’s statement that my meeting with the Dean and his attorney was the time that I revealed the existence of the Merck contract is inaccurate. (Proof is that later on Page 310 she writes “Merck officials said that the huge contract with Hayflick…was never executed.”) The existence of this proposed contract, which I never signed, was not hidden by me or by Merck. I had no reason to inform the Dean or his attorney of a contract that I never signed. As indicated on Page 275 and in the next paragraph, Wadman has a copy of the Merck lawyer, M.F. Millers’ memorandum clearly stating that the NIH believes that I owned WI-38.

Wadman writes that Schriver “..called Donald Brooks, the Merck attorney who, according to Hayflick, had established that Hayflick owned the WI-38 cells” and that “..Brooks told Schriver that the company entered the pricey contract with Hayflick only after Hayflick attested that he owned the cells and that NIH concurred.” The full contents of the M.F. Miller memorandum reads that it was Miller who called Leon Jacobs of the NIH and learned that “…Dr. Jacobs is of the opinion that Dr. Hayflick is free to sell the cells.”

Here is an unabridged copy of the relevant “MEMO FOR FILE” dated 7/11/74:

“WI 38 HUMAN DIPLOID CELLS Stamped “Defendant’s Exhibit B 3-2-79 arl”

The subject cells were developed at Wistar Institute by Kuprowski (sic) and Hayflick under contract PH 543-62-157. A question was raised whether Dr. Hayflick had rights to the cells to offer them for sale. Dr. Leon Jacobs of the NIH had a search of the records made by counsel and he told me by telephone on 7/11/74 that there is no patent that the NIH knows about. This work was done in the early 1960’s and it wasn’t until 1968 that an institutional patent agreement was made between NIH and Wistar Institute. Accordingly Dr. Jacobs is of the opinion that Dr. Hayflick is free to sell the cells. We should now be able to proceed with the development of a price to offer Dr. Hayflick.

SIgned M.F. Miller with copies sent to Banse, Brooks, Hilleman, MacMaster and Tytell."

Is it reasonable for Merck and the NIH to actually believe that "I owned WI-38" by simply saying so? Would this have been all that was required to establish title without providing any written evidence? Unstated by Wadman on this page is an explanation of why a major ethical pharmaceutical company would place itself in jeopardy by acting without requiring a legal document proving title.

Wadman's quotes from a memo that Jacobs allegedly wrote resulting from a phone call with Mr. Brooks of Merck, "Mr Brooks informed me that, regarding Merck's dealings with Dr. Hayflick, Merck relied strictly on Dr. Hayflick's representations – and not on my information obtained during a telephone conversation with me or anyone else." (Wadman's reference 62 in Chapter 21). See a copy of the refuting memo from Merck above.

Without having the written approval of the NIH, Merck would have had no basis to depend on my alleged "representations" of WI-38 ownership. As stated above,- would a major ethical pharmaceutical company rely on my exclusive, unsubstantiated and unproven verbal statement about WI-38 ownership? The NIH, on the other hand, claimed sole title to WI-38 based on the beliefs of a few uninformed employees and with no legal basis. (See the next page 286).

Page 285. Wadman's text here reflects her failure to understand the context in which the following events occurred: The reaction of Jacobs, DBS and "senior NIH official(s)" to my congressional testimony was, in my view and that of many other colleagues, their intention to seek revenge. I have no regrets about my testimony because, in my view, no government division like the DBS is entitled to be the judge and jury for products submitted to them for licensure in competition with similar products produced by they themselves. The WI-38 rubella vaccine developed at the Wistar Institute in competition with the same vaccine produced on monkey kidney cells by the DBS is an excellent example of this conflict of interest. In my testimony I suggested that the DBS be moved to the FDA which congress soon did. The DBS scientists now became FDA controllers which they resented.

Wadman provides no evidence for her statement that I was "..warned that NIH officials would be taking the WI-38 ampules from (my) lab on August 19." The ampules were confiscated from my lab during my attendance at a conference in Israel. I never received the "warning" that Wadman alleges. If I was "warned", as she claims, then why were the WI-38 ampules confiscated from my laboratory when it became known that I was to be absent at a conference?

For more than ten years many colleagues and I worked assiduously to have WI-38 accepted for use in the production of safer human virus vaccines. The resistance came from the DBS/NIH/FDA. We now experienced the ultimate irony, and actual proof of our success in demonstrating the value of WI-38, when the government confiscated WI-38 from my laboratory and claimed them as theirs.

The quote at the start of Chapter 22 on Page 288 by Nicholas Wade is noteworthy because it took someone other than me and my colleagues to realize the irony of how WI-38 came from being unwanted by the NIH to become so valuable that NIH/FDA public servants confiscated WI-38 from my laboratory.

Page 288-289. Wadman states that the Schriver report was released to reporters by the NIH without my rebuttal and she quotes extensively from the Schriver report in an apparent belief that what he wrote is completely accurate. Inexplicably, she has a copy of my rebuttal but fails to quote from it. In the quote from the Schriver report that "No record made available to us fully accounts for the 8th passage ampules" she has no knowledge of the following event: Mr. Pat Jacobs (a technician for the UK Vaccine Department Director, Dr. Frank Perkins) was the recipient of all of the WI-38 ampules that I brought to his Medical Research Council laboratory in Mill Hill, London from about 1963 to 1975. Schriver visited his laboratory in 1976 to see his WI-38 ampule inventory for those 12 years. That inventory plus my own did not as Wadman writes "..fully account(s) for the 8th passage ampules." The reason for this is unknown to Wadman because she never asked or showed me her text:

A year or more after Schriver's visit, Pat Jacobs wrote to me in a letter that "a laboratory notebook containing an additional inventory list of WI-38 ampules had unknowingly fallen behind a file cabinet." I had delivered a hundred or more ampules to the MRC over a 12 year period and Jacob's revelation would account for the alleged discrepancy. He apologized to me for this delayed discovery and the trouble that it caused. The absence of this fact misleads readers to believe Wadman and Schriver that I concealed an accurate disclosure of the WI-38 ampule inventory.

In respect to the contamination of some of the WI-38 ampules, the primitive conditions in which the ampules of WI-38 were made in 1963 is not described. This lack of context leads Wadman into much miss-representation. Laminar flow hoods were unknown at the time. Because of the number of ampules there was a need to hand seal hundreds of glass ampules by inexperienced technicians borrowed from other labs. Also, the demand by vaccine manufacturers to have cells free of antibiotics conspired to have several ampules become contaminated. In the context of cell culture technology in 1963 we were proud to have had so few contaminated ampules and correctly believed that we had a great success.

Unappreciated by Wadman is the fact that every component used in the culture of cells has at some time in its history been “cleaned up” either by autoclaving, filtration, ultraviolet light or use of antibiotics. There is no cell culture component that has not been “cleaned up.” The innuendo by Wadman that we were careless is unsupported. There is no evidence that I somehow put the safety of human virus vaccine recipients in jeopardy. On the contrary, the proof is that there are close to five billion people who have benefitted from the use of vaccines made in WI-38 and MRC-5 (which was originated 5 years later in the UK using my methodology). (Nature 528,12/10/15,178-181). There are no reports of any unwanted events traceable to the use of WI-38 and that fact is not noted here by Wadman.

Page 291. The discussion here of Nicholas Wade’s article in Science about me fails to appreciate the revolution in thinking that was occurring in the 1970’s in which biologists were, for the first time, awakening to their intellectual property rights and to their legal right to financially exploit those rights by becoming entrepreneurs. Fifteen years after Wade wrote a damning article about me in Science he now recognizes the revolution that has occurred. His letter (Wadman has a copy) is dated, January 3, 1990 and on The New York Times stationary. He wrote:

Dear Dr. Hayflick:

Thank you for sending me a copy of your interesting paper.

It’s certainly true that attitudes toward commercialization of research have changed in the last 15 years.

With best wishes for the new year.

Yours sincerely,

Nicholas Wade

Wadman writes, “The facts in the Science story (Wade’s article in 1976 were made worse by Hayflick’s efforts to explain that he had supplied all of the WI-38 cells to companies and could continue to do so, by using only the ten original eighth-passage ampules that he was permitted to keep for himself when he left the Wistar.”

It seems that Wadman has confused several events in this statement in which she asserts that I “made worse…the facts in the Science story”…” by using only the ten original eighth-passage ampules that he was permitted to keep for himself when he left the Wistar.”

When I left the Wistar in 1968, I removed all of the ampules that I had stored there to my new laboratory at Stanford University. I was then given a contract by the NIH to continue to distribute WI-38 to researchers in the field of aging. As described above the demand continued for WI-38 starter cultures by vaccine manufacturers and scientists not in the field of aging. I satisfied those demands by continuing to distribute WI-38 cultures gratis to all of them with a nominal charge for the costs of packaging and delivery for which I had no other support to do so. I was then in possession of more than 100 WI-38 ampules that easily met all of these demands. When my lawsuit against the NIH and FDA was settled in 1982 I agreed to accept six ampules of WI-38 from the dozens that the NIH confiscated from my laboratory. It is probable that Wadman is referring to these six ampules received 14 years after I left the Wistar Institute.

"the facts in the Science story"… that Wadman refers to actually occurred 14 years after this story was written by Wade and when I reached an out of court settlement with the Justice Department who was defending the NIH, FDA and DHEW. Wadman writes that the explanation of how I would have fulfilled the Merck contract if I had signed it was ".. terribly feeble" and "would be laughed out of court.." Her statement reveals a misunderstanding of how vaccines are made using WI-38 that is explained in the next few paragraphs. (See also the comments made under Page 347 which repeats her misunderstanding.)

Wadman writes on pages 346-7 that when Merck plans to make rubella vaccine it receives .."an ampule of WI-38 cells from the ATCC, it contains three million cells. The company expands these cells to create a working bank of cells – dozens of ampules – with population doubling levels in the low twenties, these it freezes. They will last eight or ten or thirteen years." She goes on to explain, that when the years' campaign to produce the rubella vaccine ends "..the cell population will reach a doubling level in the low thirties." Thus, one ampule of WI-38 from the pool of ampules that the NIH confiscated from my laboratory will last "..eight or ten or thirteen years" which refutes her previous claim (Page 291 above) that the six ampules of 8th population doubling WI-38 that she says I was going to use to fulfill the Merck contract (if I had signed it) was ".. terribly feeble" and "would be laughed out of court.." By her own calculations made here, if one ampule "will last eight..years" then six ampules would last 48 years of rubella vaccine campaigns at Merck!

If her statement is accurate that an ampule might last "ten or thirteen years" then my six ampules would last Merck 60 years and, if thirteen years is the limit, then my six ampules would last Merck 78 years. Wadman ends her discussion here by quoting the Merck rubella vaccine manufacturer as saying "If the company could begin each rubella campaign with somewhat older WI-38 cells than it starts with now- a change that would require FDA approval –" that would essentially make the supply infinite."

It seems that my arguments, contrary to being “terribly feeble” or “..laughed out of court”, according to Wadman herself, could actually “make (s) the supply infinite”

Furthermore, a key fact omitted in Wadman’s discussion is that manufacturers, then using primary monkey kidney cells, had learned to inoculate their culture vessels with as few cells as possible to allow the cells to replicate to confluency. This resulted in many population doublings of the primary cells thus reducing the number of monkeys killed for their kidneys. The financial savings in the use of fewer monkeys used for low seeding is enormous. If that routine practice was acceptable by licensing authorities then why would it be prohibited when using WI-38?

The article in Science by Nicholas Wade from which Wadman quotes on this and other pages is titled “HAYFLICK’S TRAGEDY: THE RISE AND FALL OF A HUMAN CELL LINE.” Like Wadman and Plotkin (discussed below), the accuracy of this title is doubtful in view of what I have listed below under Page 292 as the “tragedy’s” that I have experienced since 1976.

Page 292. After I produced WI-38 ampules in 1963, ten were loaned to the ATCC as backup but they lost them when I inquired about them in 1968. Ten were also loaned to the Coriell Laboratories in 1968 as backup. This was common practice then and continues to be done with critical biological materials to this day. An unknown number of WI-38 ampules were thawed by a technician without anyone’s permission (who was curious to see the cells!) when I stored the entire stock at the Naval Biological Laboratories in Oakland, California before the liquid nitrogen freezers arrived at my new laboratory at Stanford. Neither Wadman nor Schriver knew about these two dozen or more ampules.

As a result of the alleged failure of my stewardship of WI-38 asserted by Wadman and attributed by her to Wade is “The real tragedy for Hayflick …is what he has apparently done to the future of WI-38’s”.. because “it now appears that there are sufficient stocks only for the next several years.” Compare this statement to what she writes on Page 291 (described above) that at her visit to Merck she was told that if one ampule “will last eight..years” then six ampules would last 48 years of rubella vaccine campaigns at Merck.

There seem to be several inconsistencies in what Wadman believes about how long WI-38 will last. The paper sent to her in 2017 reports that over 3 billion people have, and still do, benefit from virus vaccines produced in WI-38. She, herself, has written that “An estimated 5.8 billion people have received vaccines made with these two cell lines..” (WI-38 and MRC-5 developed in the UK using my methods (Nature 528, 2/10/15,178-181).

In 2017 WI-38 is still being used to manufacture several human virus vaccines with large stocks of these cells held by several vaccine manufacturers, commercial sellers of WI-38 and by the Coriell Laboratories. The limited availability of WI-38 is clearly not as Wadman writes “..sufficient stocks only for the next several years.”

Until I read this in her book I have never heard of what Wadman reports here as “..the most powerful quote..” attributed to Stanley Plotkin. He is quoted by Wade as saying, “..many people warned (Hayflick) about the sales but he was not open to any kind of remonstrance.” I was never warned by anyone because there never was a justifiable reason for anyone to make such a warning. What reason would Plotkin or Wadman give? She continues to quote Plotkin as saying ”.. in the really classical Greek sense it was tragedy because it is a man who at the height of his powers brought about his own downfall..” On Page 299 Wadman writes, “Hayflick had willfully over the course of seven years created the circumstances that had brought his life crashing down around him.”

My “downfall” and “tragedy” (according to Plotkin” and my “life crashing down around (me)” (according to Wadman) have resulted in the following since these remarks were made by them both. From 1976 until today I have experienced the following:

I have had the following academic appointments: (1) Member, Scientific Staff, Bruce Lyon Memorial Research Laboratory, Children’s Hospital, Oakland, California, (2) Professor of Zoology and of Microbiology and Immunology, Director, Center for Gerontological Studies, School of Liberal Arts and Sciences and School of Medicine, University of Florida, Gainesville, Florida, 1981 – 1986 (3) Professor of Anatomy (Adj.), University of California School of Medicine, San Francisco, California. 1988 – Present (4) National Science Foundation Chautauqua Course Organizer and Lecturer, 1998, 1999, 2000, 2002. “How and Why We Age,” Temple University, Philadelphia, PA

From 1976, I was appointed to, and have continued to have, membership on, the Editorial Boards of more than ten professional journals including, in 1979, appointment to Editor-in-Chief of the international journal “Experimental Gerontology” (founded by Alex Comfort) for 13 years. I was appointed Honorary Editor in 2000. I was, or still am, a member of twenty scientific and professional societies in which I have held several high offices including President of the Gerontological Society of America from 1982 to 1983. I was, after 1976, Chairman of the Scientific Review Board of the American Federation for Aging Research where I was also voted Vice President and Member of the Board of Directors.

From 1976 I have been the recipient of more than twenty-five major awards including the $20,000 Brookdale Award "for nationally and internationally recognized scholarly and scientific contributions to biological and clinical research in gerontology." and the Kleemeier Award from the Gerontological Society of America, the Lifetime

Achievement Award of the Society for In Vitro Biology, the Sandoz Prize from the International Association of Gerontology, and the Presidential Award from the International Organization of Mycoplasmology. In 2014, I received the John Scott award and prize from the City of Philadelphia (the oldest scientific award in the United States and established in 1823 in honor of Benjamin Franklin).

In 1997, I was elected Academician and Foreign Member of the Ukrainian Academy of Medical Sciences. In 1998 I was elected corresponding member of the Société de Biologie of France. In 1999, I was presented with the van Weezel Award by the European Society for Animal Cell Technology and the Lord Cohen of Birkenhead Medal by the British Society for Research on Aging.

In 1997 the American Aging Association established an Annual Hayflick Lectureship. In 2000 a second Annual Hayflick Lecture also was established by the University of Alabama, Birmingham. I am the recipient of the year 2001, $10,000 Life Extension Prize and Laureate Diploma from the Regenerative Medicine Secretariat for my "..discovery of the finite replicative capacity of normal human diploid cells.." In July 2011 at Brighton, England I was awarded an Honorary Life Membership by the British Society for Research on Ageing. In 2014 the annual Hayflick Lecture was established at the Friedrich Schiller University, Jena, Germany (Friedrich-Schiller-Universität Jena). I was given an award there at the time in honor of the establishment of this annual lecture.

I was appointed Member of the Scientific Advisory Board, Foundation on Gerontology, Bradenton, Florida, 1985 – 1995, Visiting Professor in the School of Medicine, Department of Medical Microbiology Kurume University, Kurume, Japan, Member, Editorial Advisory Board, Protocols in Cell and Tissue Culture, John Wiley and Sons, Ltd., Member, Medical Advisory Board, Women's Health Digest, Member, Scientific Advisory Council, Society for the Inhibition of Age Related Processes, Holon, Israel, Member, Scientific Advisory Board member and Consultant, Geron Corp., Consultant, Genentech, Inc. 1982-2010, Member, Society for In Vitro Biology, and Vice President, Chairman, Awards Committee, Gerontological Society of America, Scientific Advisory Board Member, Origen Therapeutics, Inc., Member Scientific Advisory Board, Advanced Cell technology, Member, Council, and Board of Directors, Western Gerontological Society, Member, Argonne Universities Association Review Committee for the Biological and Medical Research Division, Argonne National Laboratory, Argonne, Illinois, Member, Virology and Cell Biology Study Section, American Cancer Society, Observer, White House Conference on Aging, 1981, representing the Gerontological Society of America and State of California, Professor of Microbiology Immunology and Medicine, and Director, Center for Gerontological Studies, College of Liberal Arts and Sciences, and School of Medicine, University of Florida, 1981-1985, Member, Advisory Board, International Exchange Center for Gerontology, State of Florida University System, University of South Florida, Tampa, Member, Research

Advisory Committee, Teachers Insurance and Annuity Association of America - College Retirement Equities Funds (TIAA-CREF), New York, N.Y., Elected Councilor, Society for Experimental Biology and Medicine, 1984-1988, Member of Sandoz Jury for Sandoz Prize in Gerontology and Geriatrics, Member of Council of the International Association of Biological Standardization, Treasurer and Member of Executive Committee, International Association of Gerontology, Member, Board of Directors, The Center for Climacteric Studies, Inc., Gainesville, FL, Treasurer and Member of Executive Committee, International Association of Gerontology, Senior Editor, Biological Sciences, The Microfiche Collection of Information on Gerontology and Geriatric Medicine, University Microfilms International, Ann Arbor, Michigan, Gerontological Society of America, Committee Member for Glenn Foundation Award in Basic Biological Research in Aging, Referee, Macy Faculty Scholar Award Program, Josiah Macy Jr. Foundation, Chairman, Cell Culture Committee of the International Association of Microbiological Standardization, Geneva, Switzerland, Member, Editorial Board, "Proceedings of the Society for Experimental Biology and Medicine", Member, Advisory Committee, Center for Aging Research, University of California, Santa Barbara, CA, Member, Scientific Advisory Board, American Longevity Association, Inc., University of California, Los Angeles, CA, Vice President, Member of Board of Directors and Executive Committee, Chairman of the Research Advisory Committee (Study Section), American Federation for Aging Research, New York, N.Y., Member, Board of Directors and Editorial Board, Bollettino Dell "Instituto Sieroterapico Milanese, Archivo de Microbiologia de Immunologia," Milan, Italy, Member California Foundation for Medical Research, Member, Editorial Board, "A Revista Portuguesa de Medicina Geriatrica", Member, Advisory Board, Lousiana Gerontology Education Center, Louisiana State University, New Orleans, LA, Visiting Professor at Oita Medical University, Oita, Japan for 3 years, Visiting Scientist, Weizmann Institute of Science, Center for Aging, Rehovath, Israel, Keynote speaker, Centennial Celebration of the Founding of the Free University of Amsterdam and Thirtieth Anniversary of the Founding of the School of Medicine,

In May 1983 the American Federation for Aging Research, Leadership award, was presented to me in New York City, "In recognition of his pioneering research in the fields of geriatrics and gerontology and, in particular, his seminal studies on the life cycles of cell growth and reproduction. His work has profoundly influenced the direction of present and future investigations into the biomedical mechanisms of the aging process."

Since 1976, I was appointed Fellow of the American Association for the Advancement of Science, an Honorary Member of the Tissue Culture Association and, according to the Institute of Scientific Information I am one of the most cited contemporary scientists in the world in the fields of biochemistry, biophysics, cell biology, enzymology, genetics and molecular biology. I am the author of over 275 scientific papers, book chapters and edited books of which four papers are among the 100 most cited scientific papers

of the two million papers published in the basic biomedical sciences from 1961 to 1978 as reported by The Institute for Scientific Information in 1980.

The 1958 inverted microscope that I adapted from crystallography for use in cell culture is the prototype for all subsequent inverted microscopes used in the field. It was accessioned in 2006 by the Smithsonian Institution along with original ampoules of WI-38 and the labeled containers of the Pfizer poliomyelitis and Wyeth rabies vaccines produced in these cells.

I am the author of the popular book, “How and Why We Age” published in August 1994 by Ballantine Books, NYC and in 1996 as a paperback. This book has been translated into nine languages and is published in Japan, Brazil, Spain, Germany, the Czech Republic, Poland, Israel and Hungary. It was a selection of The Book-of-the-Month Club and has sold over 50,000 copies world-wide.

In 1977, I won a several hundred thousand dollar NIH grant for three years. In 1982 I won a second NIH three year grant also in the amount of several hundred thousand dollars. Since 1976, I have been invited to give several dozen honorary lectures and keynote addresses at universities and international conferences in the U.S., Europe, Canada, Australia and Japan. In 2017 I was invited to give the opening keynote address at the 2nd Annual Australian National Conference on the Biology of Ageing.

Since 1976 I have given testimony to the following U.S. Congressional committees:

Subcommittee on Federal, State and Community Services of the Select Committee on Aging, House of Representatives, 95th Congress, February, 1978, Washington, D.C., Representative Claude Pepper, Chairman, (2) Subcommittee on Labor, Health and Human Services and Education of the Committee on Appropriations, House of Representatives, Representative Natcher, Chairman, May 1983 (3) Subcommittee on Pensions of the Senate Committee on Finance, Senator Chaffee, Chairman, July, 1983.

The above experiences, appointments, awards and honors are examples of (1) what Plotkin calls my “Greek Tragedy because it is a man who at the height of his powers brought about his own downfall..” and (2) what on Page 299 Wadman writes, “Hayflick had willfully over the course of seven years created the circumstances that had brought his life crashing down around him.”

Page 293. Wadman omits understanding the implications of the crucial statement made by Mr. Schwartz, the medical school dean’s (Dr. Clayton Rich) lawyer. She correctly quotes him as saying to me “You better get a lawyer.” This statement, made to me immediately as I entered his office changed the relationship from what should have been a collegial discussion of unique events to an immediate polarization to

create an adversarial situation. It was immediately apparent to me that Rich and Schwartz had accepted, without challenge, all that was told to them by Schriver and that I was, in their eyes, - a criminal. Due process seemed to be lacking.

Fortunately, several senior professors at Stanford, who knew the facts, immediately came to my defense. In particular, the Professor of Art History, Albert Ellison and the Professor of Radiology and Chairman of that Department, Henry Kaplan both of whom reacted swiftly. Each saw the leap of faith in Schriver's opinions made by Rich and Schwartz that was believed by them without benefit of my responses. Wadman writes, with no evidence , "..the lawyer whom Hayflick had hired the previous summer and causing Hayflick to sweat." I do not recall disrobing in order to allow anyone to determine if I was sweating.

Wadman omits that my reason for resigning from Stanford was in protest to the behavior of the medical school dean, his attorney and the school president for their unquestioned acceptance of the Schriver Report (which at this time did not yet have my rebuttal). More importantly, due process was denied. The unique legal and scientific situation (described above in detail) was unknown to them because they did not allow me to describe to them the complexities and the history of my position. I have no regrets in making the decision to resign. It was not "forced" as is Wadman's unsubstantiated and unprovable opinion.

Later, on Page 318, Wadman describes a letter protesting the actions of the NIH against me and published in Science over the signatures of 83 scientists from around the world. In my opinion it would have been more evenhanded to describe the existence of this letter on this page to balance the several negative statements she makes here.

Page 296. Wadman quotes Schriver as writing, "During our initial discussion with Dr. Hayflick he apparently recognized this and decided to withdraw his name from consideration." What actually occurred has been described above under Pages 279-280.

Page 297. Wadman writes that Schriver "shot back" that ownership (of WI-38) was implicit in the decision made "..at the meeting at the Wistar Institute" in January 1968. If title to WI-38 was legally vested in the government in 1963, as Wadman has written earlier, then why is title to it made five years later only "implicit" and does not have the force of law? Why did the government not claim title to WI-38 in any of the several new and renewed contracts they awarded to me in the seven years from 1968 to 1975 to distribute WI-38?

Wadman writes that Schriver expected "minimum standards" and that Hope Hopps of the NIH "expressed astonishment at the slovenly nature of the records and the slip-

shod method in which the ampoules were stored." There was not then, nor are there now, "standards" to which scientists must adhere in making entries in laboratory notebooks. Nor were there any standards for storing ampules in liquid nitrogen then. In fact, in the early 1960's when I first froze my normal human cell strains, first in dry ice, and then in the new technology of liquid nitrogen storage I invented the methods for ampoule storage of normal human cells because no standards existed.

More importantly, and unmentioned by Wadman, is that the NIH and DBS fought our efforts to prove the usefulness of WI-38 for 13 years from 1962 to 1975. The WI-38 ampules were stored exactly as was done safely by me for these 13 years. Neither Schriver nor Hope Hopps has ever provided evidence for standards of scientific notebook entries or for ampule storage of human cells in liquid nitrogen. Also, none of the NIH confiscators of WI-38 has ever presented standards for notebook entries or ampule storage. I pioneered the labeling method, storage of glass ampules in liquid nitrogen, and the system of record keeping for normal human cells in 1962. None of these methods existed in 1962 and my subsequently published methods were then adopted by the entire field.

Schriver, an accountant, makes the following false statements:

(1) "Hayflick had shipped some 1700 low passage cultures while at Stanford and that of these 1200 had been shipped to paying customers." Wadman and Schriver favor using the pejorative "paying customers" when the fact is that my colleagues in the US and many foreign countries were, at this time paying, not for WI-38, but for reimbursement for the costs of preparing the cultures and for mailing or shipping them. Those costs were identical to those made for preparing and shipping WI-38 by the ATCC, - a quasi-governmental organization. As stated above several times the funds were kept in a separate account until they were awarded to me and then given to my attorneys in the out of court settlement to which the government agreed.

(2) "What was more, paying customers had received preferential treatment, frequently receiving younger cells than the researchers studying aging whom Hayflick supplied under the contract."

The fact is that many of my colleagues, not working in the field of aging, were working in research areas that required cultures younger than those working in the field of aging. Schriver and Wadman apparently fail to understand the fundamental biology where researchers in the field of aging work with, and ask for, old (higher PDL) cells. Cells at higher PDL's are preferred by workers in the field of aging and because they are cultivated longest (using more resources) are the most valuable for them. Earlier in her book Wadman accurately explains why the youngest cells are so valuable to vaccine researchers and manufacturers. Her explanation earlier in her book flies in the face of what she quotes here.

(3) Wadman quotes Schriver as writing “It is obvious that the interest of the government was not protected.” As stated in (2) above “the interests of the government” were not compromised. Furthermore, “the interests of the government” did not exist for 12 years prior to Schriver’s remark and during which time we fought the governments disinterest until our success became so great that they not only confiscated WI-38 from my laboratory but the government claimed sole ownership.

Wadman and Schriver fail to observe here that millions of American citizens benefitted from my shipping early passage WI-38 to vaccine manufacturers in the United States. Those vaccines were produced in WI-38 that I shipped to them for a decade either at no cost at all, or for $15-$75 during the seven years when I was unable to personally pay for the costs of preparing and shipping the cultures. Those vaccine manufacturers profited in the billions of dollars and continue to do so. Rather than receiving a modicum of praise for (1) my invention of WI-38 (2) the technology for its use to make safe human virus vaccines for more than 35 years or (3) for its free or 15-75$ cost of distribution to vaccine manufacturers that benefitted billions of people, - Schriver and Wadman prefer condemnation.

Page 298-299. As reported under page 288-9 above, (1) Wadman did not know that Pat Jacobs in the UK lost a laboratory book containing an additional inventory list of WI-38 ampules and (2) that several dozen ampules were lost when stored in Oakland and (3) others were lost by ATCC. Thus readers are miss-led by her to believe that I did something clandestine to conceal an accurate disclosure of the WI-38 ampule inventory.

Page 299. Wadman writes, “Hayflick had willfully over the course of seven years created the circumstances that had brought his life crashing down around him.” (See the facts under Page 292 above for why Wadman erroneously believes that “(my) life came crashing down around (me).”

Wadman continues to make unproved assertions by providing no evidence for why I (or any other reasonable person) would “willfully” bring my “life crashing down around (me).”

Page 300. Wadman does not appreciate what the effect of my testimony had before the congressional subcommittee described above under Page 285. I advocated the movement of the DBS to the FDA. My testimony revealed that the conflict of interest between the DBS and academic and commercial institutions was indefensible. Those affected at the NIH/DBS by moving to the FDA sought revenge because they were known as “research scientists” at the NIH but at the FDA they believed that their status would be diminished when they would be known as “controllers”. Wadman seems to be unaware of this.

Page 301. All United States scientists should take note of what appears on this page. The sanctity of the peer review system that has been so vehemently defended for decades by the scientific community is described here now to be subject to the whims of US attorneys. I had won a large NIH grant in 1977 during the period of litigation. The grant, approved by the study section and the council of the NIA, received no funding for months after these approvals. At an NIA council meeting it was decided to suspend business until the mystery was resolved. Neither the Directors' of the NIA or the NIH itself could explain the delay. The pressure brought by the NIA Council, that threatened to make the situation public, resulted in the funds being awarded to me two and one half years after the grant was approved.

The explanation for the delay was revealed years later in a memo found by my attorneys during the period of discovery,- a copy of which Wadman has. Inexplicably Wadman opts to cite a newspaper reporter's text and not the original memo. The memo that was found and sent by the DHEW Secretary, Joseph Califano's chief attorney to his underlings read: "..shape up the disqualification procedure to deny Hayflick his grant."

My scientific colleagues should ponder this attack on what they have assumed to be the sanctity of the peer review system.

Wadman writes "He would rarely publish, new, lab-based experiments again." The fact is that I have published more than 100 papers since the government came to me with an offer for an out of court settlement. Most of those published papers have been based on either my previous lab based experiments, new interpretations of the data, or the evolution of my thinking about the fundamental etiology of biological aging.

Wadman, a science reporter, inexplicably does not seem to understand that wet lab experiments are not critical to the advancement of science. Experimental physics is to theoretical physics as wet lab biology is to theoretical biology. Enormous scientific advances have been made by biological theoreticians who lacked wet labs. One could mention Darwin, Metchnikov, Weissmann, Szilard and Watson and Crick.

Page 305. The "spectacular results" of the rabies vaccine described here would not have occurred without both the enabling technology and the WI-38 cells that I gave freely to the Wistar Institute scientists and to the vaccine manufacturers Wadman mentions on this page. No prose appears here describing these significant events. No credit appears here for these gifts or for the millions of people who benefitted from these gifts. Nor is mention made here of the millions of dollars profit made here from the rubella and rabies vaccine by Koprowski, Plotkin and the Wistar Institute.

Page 310. Here, 80 pages later, Wadman finally reveals the facts about the Merck contract. She writes here that "Merck officials said that the huge contract with Hayflick…was never executed." On Pages 234, 275, and elsewhere, she wrote

“Hayflick executed a contract with Merck..” Why does Wadman delay telling readers this after miss-leading readers for 80 pages to believe that I did sign the contract?

Wadman fails to write that the ATCC did not use Aureomycin in their WI-38 culture medium as was written in my culturing instructions and given to all WI-38 recipients for over a decade. Frank Perkins and I suspected that this masked the contamination that we discovered in 1974. The killing of the microbial contaminant by Aureomycin had no negative affect on the use of WI-38 for vaccine manufacture that benefitted billions of vaccinees as described above. By failing to report this here, Wadman misleads readers to believe that I am guilty of wrong-doing.

Wadman describes here how the seven WI-38 ampules confiscated by public servants from my laboratory “went a long way (to)…producing more than 120 ampules, each one containing enough young cells to make hundreds of millions of vaccine doses.” Yet, Wadman earlier described my “explanation of how I would have fulfilled the Merck contract with ten ampules”, (if I had signed it) was “.. terribly feeble” and “would be laughed out of court..” Apparently, although her opinion of my explanation is “.. terribly feeble” and “would be laughed out of court..” the governments’ identical explanation of how seven ampules go “..a long way (to)…producing more than 120 ampules, each one containing enough young cells to make hundreds of millions of vaccine doses ” is compelling for her and would be praised by a court.

Wadman’s writes that the WI-38 ampules that the FDA/NIH confiscated from my lab “..became available for purchase to vaccine firms for $30 per ampule.” Wadman avoids noting the irony in her statement that the government itself sold WI-38 for $30 per ampule. In earlier pages she, Jacobs, Schriver, Hopps, Stanford officials and many others she claims chastised me for “selling” WI-38. Title to WI-38 has not been established so that the persons and entities that she mentions should, by the same standard, including the governments “sale” of Wi-38 as equally chastizeable.

As stated several times above, the sums I requested were identical to those charged by the quasi-governmental ATCC for handling and shipping WI-38. They were from $15 to $75 per culture during the years that I met the demands for WI-38 from colleagues and institutions who did not do research on aging. I requested reimbursement for the costs of preparing and shipping the cultures, - not for the cells themselves. Despite the evidence available to her, Wadman prefers the pejorative language that I “sold WI-38”. Why?

Page 312-313. Wadman writes that I have “..describ(ed) the effects of (my) 1976 lawsuit against the government in grandiose terms.” The effects were these:

(1) The founders of the nascent biotechnology companies, Cetus, Genentech and Amgen believed that my lawsuit outcome was sufficiently important to them that their attorneys asked my attorneys for permission to file amicus briefs on my behalf if my

lawsuit went to trial. As described earlier (Pages 279-280) the founders of these companies used tax-payers money in the form of NIH grants to produce materials or technologies in their academic laboratories that were then used to start these companies. If I had lost my lawsuit they could not have legally formed these companies with alleged government owned materials.

(2) Although the determination of title to a self-duplicating biological system, such as HeLa or WI-38, was a part of my lawsuit the issue has remained unsettled. This lawsuit raised the issue for the first time and, significantly, the government did not obtain legal title to WI-38.

(3) Wadman makes no mention of the intellectual property rights of biologists in her book despite the fact that my lawsuit raised this critical issue. No other lawsuit but mine focused on intellectual property rights on which the nascent biotechnology companies were founded. During the litigation of my lawsuit President Reagan issued an executive order allowing commercial interests to exploit materials from academic institutions paid for by tax-payers in the form of government grants or contracts. This concept was later embodied in law by the 1978 Bayh-Dole Act. This act went so far as to specifically grant to federally funded academic scientists, - who discovered commercially exploitable materials, - permission to legally benefit financially.

(4) During the period of my litigation against the government, but starting earlier in 1972, the case of Chakrabarty vs Diamond was argued in lower courts. The plaintiff argued that a living bacterium could be patented. The case was appealed to the Supreme Court who decided that living things could be patented.

It cannot be proven but there is a good likelihood that my litigation was known to some of the players in the aforementioned matters. It is also believed by many that the Justice Department's decision to ask me for an out of court settlement was influenced by all or some of the above events.

I leave to readers the decision as to whether or not I have "..describ(ed) the effects of (my) 1976 lawsuit against the government in grandiose terms." Contrary to Wadman's unsupported opinion, I never claimed that the legal decisions described above were directly made in recognition of my lawsuit. Nevertheless, many independent observers believe that the originality and main thrust of my lawsuit may have made its way to some of the decision makers.

Wadman writes: "The forces that emerged to cause this landscape-shifting earthquake were far bigger than Hayflick and his lawsuit." Earthquakes frequently begin with smaller tremors.

Page 315. In describing the birth of the biotechnology industry, Wadman avoids any mention of the role that my lawsuit played in that history. Nowhere in her book does Wadman even mention the words “intellectual property rights” about which my lawsuit was partly based. The “earthquake”, to which she pays minimal attention, was substantially based on the emergence of belief that scientists have intellectual property rights.

Page 316. In her discussion of the Bayh-Dole Act, Wadman writes, “No longer would discoveries and inventions …remain parked in the academy. And no longer would academic scientists be looked at askance for collecting on their discoveries.”

O tempore! O mores!

- Cicero’s orations against Catiline

Page 320. In describing my discovery that overturned a dogma of 60 years duration that, “cells in culture would keep dividing...year after year”, Wadman inexplicably omits the other crucial discovery that I made in which I reported that the only cells that are immortal in culture are abnormal cancer cells like HeLa. The exclusive characteristic of immortality in cancer cells could only be understood after I discovered that only normal cells are mortal. Prior to my discovery the 60 year old dogma was that all cultured cells were believed to have the property of immortality and that, if they failed to replicate, it was because of some error in culture technique. My proof of the mortality of normal cells and the immortality of cancer cells gave rise to a new area of cancer research directed to understanding the phenomenon of immortalization. Close to 10,000 scientists have cited the two papers in which these discoveries have been published.

Wadman does not know of the following critical incident: An important conference on the biology of aging was held in the mid-1960’s at the Salk Institute and chaired by Bruno Bronowski after the recent death of Leo Szilard, - who was to have chaired the conference. Only about 15 senior scientists were invited including Sir Peter Medawar and Jonas Salk. It was one of the first national conferences on the biology of aging. Dr. Theodore Puck (discussed above under Page 55-83) gave his paper before me and reported that he had a population of cultured rabbit cells that he claimed were normal and immortal. It was not, as Wadman writes, that time “would eventually prove that Puck ..was patently wrong.” What proved that Puck was wrong was the finding by his colleague Tjio (who, with Levan, had earlier discovered the true diploid number for humans to be 46 and not 48 chromosomes). Tjio had erred in his first determination that Puck’s rabbit cells were chromosomally normal and which Puck reported at the conference. Because I reported that only aneuploid or abnormal cells were immortal I was embarrassed and eclipsed by Puck’s report.

After Puck delayed the publication of the book that was to contain the conference proceedings, he rewrote his paper to report that Tjio had erred and that the rabbit cells

were aneuploidy as I had predicted. Nevertheless, the report made in Science magazine about this conference described Puck's original claim that his rabbit cells were cytogenetically normal thus torpedoing my work. The truth was reported by him in the published book of the conference proceedings months later. Because the conference members heard all of the reports they never did learn the truth because they had no need to re-read in the conference proceedings what they had heard at the conference. It took several years of efforts before I was able to convince these senior scientists of the truth.

Page 322. Wadman's discussion of the differing replication limits found for different cells in a population is erroneously attributed to a paper in Science by my former post-doctoral student, James Smith and Ronald Whitney. Smith and I first discovered this phenomenon eight years before the citation given by Wadman (See In Vitro-Journal of the Tissue Culture Association 7(4):273, Smith J.R, and Hayflick L.(1972) "Life-span of Clones Derived from Human Diploid Cell strain WI-38."

Wadman writes: "Adding more complexity, a paper published in 1980 in Science showed that even which cells happened to have been randomly sliced from the lungs…doubtless influenced Hayflick's findings." There is, in fact, far more doubt than Wadman realizes. She mistakenly labels as "complex " what Smith and I found eight years before her Science citation. Our finding is not "complex" at all. We found that each cell has a different population doubling potential from 0 to 50. The Science article that Wadman cites simply confirmed what Smith and I discovered eight years earlier. It was later found that each cell had a different telomere length which determined the number of divisions for which each cloned cell was capable.

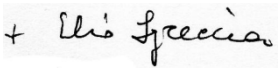
Page 323. Wadman is mistaken in her understanding of the experiment done by Woodring Wright and me. Woody fused enucleated cell cytoplasms (cytoplasts) from old cells with the free nuclei from young cells and showed that the "replicometer" was located in the cell nucleus and not in the cytoplasm. The reciprocal experiment confirmed this finding. Years later the counting mechanism that I proposed was found to be telomere attrition.

Page 334-335. Wadman does not adequately describe the letter from Vatican City to Mrs. Vinnedge dated June 9, 2005 and written on stationary from the PONTIFICIA ACADEMIA PRO VITA *Il Presidente.*

The letter says, in part, "..the WI-38 line …(of) human diploid lung fibroblasts, coming from a female foetus that was aborted because the family felt they had too many children … It was prepared and developed by Leonard Hayflick in 1964 …WI-38 has been used for the preparation of the historical vaccine RA 27/3 against rubella."

The Vatican letter continues: “In the specific case under examination, there are three categories of people who are involved in the cooperation in evil, …(one is) those who prepare the vaccines using human cell lines coming from voluntary abortions..”

Sincerely yours,



+E.Sgreccia

Wadman does not note that The Vatican officially named me as an evil person, - an omission that I wish to correct.

Page 347-348 Wadman writes that when Merck plans to make rubella vaccine, it receives ..” an ampule of WI-38 cells from the ATCC, it contains three million cells.” She goes on to describe what is detailed above under Page 291. By her own calculations, if one ampule “will last eight…years” then six ampules would last 48 years of rubella vaccine campaigns at Merck.

As I have stated above under Page 291, Wadman ends her discussion again here by quoting the Merck rubella vaccine manufacturer as saying “If the company could begin each rubella campaign with somewhat older WI-38 cells than it starts with now- a change that would require FDA approval –“ that would essentially make the supply infinite.” Wadman reverses herself here from first writing that my mathematics is “being terribly feeble” or “..laughed out of court” to reporting that my mathematics “make(s) the supply infinite.” How do she, and the others that she quotes here and on page 291, defend their faulty and accusatory statements?

Page 349. Wadman writes “ In the mid-1980’s when the WI-38 – based rabies and rubella vaccines were still under patent, the Wistar Institute collected more than $3 million in royalties annually; some 15 percent of these were shared by the inventors: Plotkin, Koprowski, Fernandes, and Wiktor before he passed away in 1986. Teva the company that uses WI-38 to make adenovirus vaccine for the Pentagon, earned about $30 million from sales of their vaccine in 2012. Merck’s sales of its rubella and chicken pox containing vaccines in 2015 grew 10 percent to $1.5 billion.”

Absent from the above description is that it was Moorhead and I who gave value to WI-38 and it was I who developed the enabling technology to make the rabies and rubella vaccines in WI-38. I gave WI-38 gratis to all of the scientists named and to the vaccine manufacturers. Without the work done by Moorhead and me these vaccines (and others) would never have been made. We were ignored by the Wistar Institute from receiving compensation. We are also ignored here by Wadman who fails to make any mention of our critical contributions.

Wadman quotes “Alta Charo, a lawyer and bioethicist..” as saying that in the case of the estate of Mrs. X from whose fetus I derived WI-38 “That doesn’t mean that compensating Mrs. X might not be the moral thing to do.” Apparently, Charo and Wadman, both believe that the scientists who invented WI-38, and then worked a decade to make it useful, valuable and safe for human virus vaccine manufacture would be committing an immoral act if they were to benefit from giving away their enabling material and their enabling technology. In about three fourths of this chapter a description is given of how people and institutions benefitted financially from using WI-38 given to them gratis by me. Charo and Wadman lament the exclusion of Mrs. X from benefitting but not the exclusion of Moorhead or me.

Page 354. Wadman writes “He (Hayflick) exaggerated, telling his elderly audience that if they ever received a viral vaccine of any kind “it’s almost a certainty that it was produced in WI-38.” The vaccines produced in WI-38 became used in the USA and then world-wide from 1966 to this day. I made this remark in 2014. During those 48 years the “elderly” people in the audience almost certainly did receive one or more of these vaccines: poliomyelitis, measles, mumps, rubella, varicella (chicken pox), herpes zoster, adenovirus, rabies or hepatitis A vaccines produced in WI-38,- Wadman’s unsubstantiated opinion notwithstanding. The evidence, ignored by Wadman, is in this published paper that she has read:

The Role of the WI-38 Cell Strain in Saving Lives and Reducing Morbidity ,S. J. Olshansky & L. Hayflick, Aims Public Health, 02 March 2017, ***Abstract:*** *We estimate the number of lives saved and morbidity reduction associated with the discovery of the first human cell strain used for the production of licensed human virus vaccines, known as WI-38. The diseases studied include poliomyelitis, measles, mumps, rubella, varicella (chicken pox), herpes zoster, adenovirus, rabies and Hepatitis A. The number of preventable cases and deaths in the U.S. and across the globe was assessed by holding prevalence rates and disease-specific death rates constant from 1960–2015. Results indicate that the total number of cases of poliomyelitis, measles, mumps, rubella, varicella, adenovirus, rabies and hepatitis A averted or treated with WI-38 related vaccines was 198 million in the U.S. and 4.5 billion globally (720 million in Africa; 387 million in Latin America and the Caribbean; 2.7 billion in Asia; and 455 million in Europe). The total number of deaths averted from these same diseases was approximately 450,000 in the U.S., and 10.3 million globally (1.6 million in Africa; 886 thousand in Latin America and the Caribbean; 6.2 million in Asia; and 1.0 million in Europe).*

ENVOI

In her 1984 book, published by the American Association for the Advancement of Science (AAAS, publishers of *Science*) and titled “Science as Intellectual Property: Who Controls Scientific Research?” Dorothy Nelkin writes: “The rapidly changing

viewpoints about individual entrepreneurial ventures in science are illustrated by the case of microbiologist Leonard Hayflick. In 1976 Hayflick, then at Stanford University, was embroiled in a conflict with NIH over the ownership of a cell line that he had developed in the 1960s. It was the first strain of normal human cells that could be established in a culture, and he formed a company to market the cells which were found to be useful in the production of vaccines. NIH publicly charged Hayflick with profiting from research conducted with federal support and claimed that the cells belonged to the government."

". . . [Hayflick] filed suit seeking title to the cells and the proceeds from sales. After a long, often acrimonious dispute, the case was settled out of court in 1981, with Hayflick retaining the money from sales but with the question of ownership of the cell line still unresolved."

"Today Hayflick's actions would not be controversial. It is now accepted practice for scientists and institutions to profit directly from the results of academic research through various types of commercial ventures."