

LOWELL OBSERVATORY ENTERS THE TWENTIETH CENTURY—IN THE 1950S

Joseph S. Tenn

*Department of Physics & Astronomy, Sonoma State University,
Rohnert Park, CA 94928, USA.*

E-mail: joe.tenn@sonoma.edu

Abstract: By the 1950s the Lowell Observatory was stagnant. The three senior astronomers had been there for decades, and they were no longer doing much research or publishing. Yet they jealously guarded the telescopes and prevented younger colleagues from using them effectively. V.M. Slipher, Director since 1916, had been a very productive astronomer in his youth, when he was guided by founder Percival Lowell, but now he devoted his remaining energies to his many business interests. The Observatory's sole Trustee, a nephew of the founder, was busy with his business and politics in Massachusetts and slow to exert authority in Flagstaff, Arizona. Finally, after C.O. Lampland died and V.M. and E.C. Slipher were in their seventies, the Trustee decided that he had to make a change. He brought in mathematician Albert Wilson, who had been leading the Palomar Sky Survey for Caltech. One of Wilson's qualifications seems to be that he was acceptable to the Slipher brothers. Wilson started the Observatory on the road to modernity but ran into personal problems as well as difficulty managing Observatory personnel, and he resigned after a little more than two years. John Hall became Director in 1958, just as the American reaction to Sputnik made abundant Federal resources available to science. In his nineteen years as Director Hall completely revived the historic institution and brought it into the late twentieth century.

Keywords: Lowell Observatory, V.M. Slipher, Albert G. Wilson, John S. Hall

1 BACKGROUND: V.M. SLIPHER

V.M. Slipher¹ (Figure 1) took over the Lowell Observatory as Acting Director upon the death of its founder, Percival Lowell (1855–1916), in 1916, and became permanent Director with the settling of the Lowell estate in 1926.

In 1951 he was still there, now age 76. He had worked at the Observatory since receiving his B.S. from Indiana University half a century earlier. He had been an extremely productive scientist in his youth, especially when Lowell provided direction as well as financial support, but the long squabble over Lowell's will and the Depression had driven him to consider financial security more important than astronomy. He invested in rental properties and build up a business empire, devoting less and less time to research and publishing no original research after 1939. In fact, he published very little after 1933 if we discount the papers of Arthur Adel (1908–1994) which Adel insisted were his own work and not even understood by Slipher, but on which Adel felt he had to list the Observatory Director as co-author (Adel, 1987).

The other two senior astronomers were V.M.'s younger brother, E.C. (Figure 2), who was 68 in 1951, and C.O. Lampland (Figure 3), who was 78. While V.M. devoted most of his time to business, it was politics for E.C. Very active in local affairs, he served as City Councilman and Mayor of Flagstaff and in both houses of the Arizona legislature, spending months in Phoenix when the legislature was in session. Although he had taken an enormous number of photos of Mars, he had to be prodded by the Observatory's sole Trustee², Roger Lowell Putnam (1893–1972), to finally publish them in the 1960s.

Lampland was a scholar and a perfectionist who would have made a great librarian. In fact he did supervise the Observatory library and built up a very large personal library which he ultimately left to the Observatory. A pioneer in infrared research, he con-

trolled the Observatory's largest telescope, a 42-inch reflector built by Alvan Clark for Lowell in 1909, but hardly ever found his results sufficiently perfect to publish.

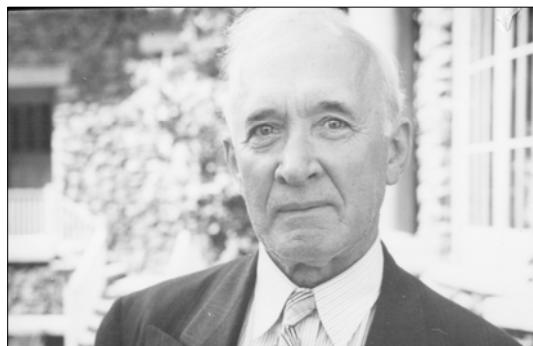


Figure 1: V.M. Slipher (1875–1969) was at the Lowell Observatory from 1901 to 1954 (Acting Director: 1916–1926; Director: 1926–1954) (Photograph courtesy Lowell Observatory Archives).

After World War II the Trustee persuaded the three old men to accept a few changes. The first Government grant—from the Weather Bureau, and later the Air Force, to monitor planetary atmospheres—was accepted, and one younger, more up-to-date astronomer, Harold L. Johnson (1921–1980), was hired in 1948. Henry Giclas (b. 1910), who had first worked at Lowell as a summer employee in 1931, was by now a full astronomer. He pursued research in photometry of the planets. Later, in 1957, he would begin an extensive proper motion survey, using the plates taken for Clyde Tombaugh's (1906–1997) search for planets for the first epoch. He also worked on the solar variation project, and took over much of the administrative burden from V.M., who could not be bothered with new-fangled things like social security.

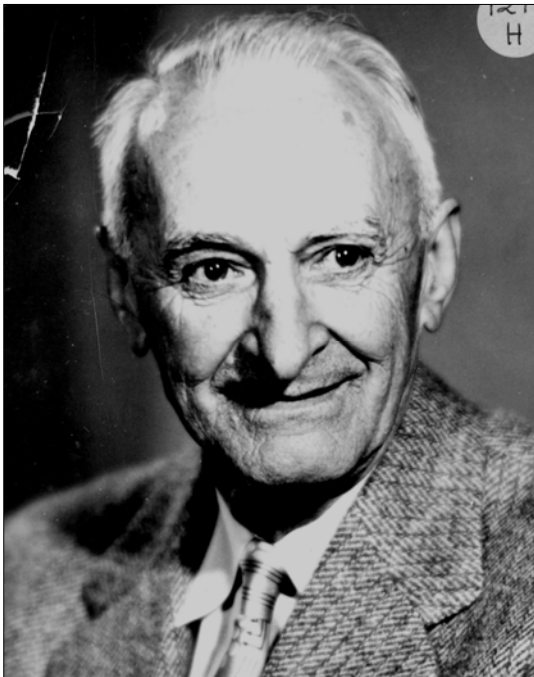


Figure 2: E.C. Slipher (1883–1964) was at the Lowell Observatory from 1906 to 1964 (Acting Director: 1957–1958) (Photograph courtesy Lowell Observatory Archives).



Figure 3: C.O. Lampland (1873–1951) was at the Lowell Observatory from 1902 to 1951 (Photograph courtesy Lowell Observatory Archives).

2 FIRST TRY: WHO WILL SUCCEED V.M.?

V.M. himself actually started considering a transition as early as March 1946 when he asked his good

friend and confidant, John C. Duncan (1882–1967), for suggestions. Duncan, who had been the first Lawrence Fellow at Lowell in 1906 and had remained close to the Observatory astronomers, replied with a carefully constructed list of “Some of the Younger Astronomers of America, 1946 compiled with ages derived from ‘American Men of Science’” (Duncan, 1946). Most were between 30 and 50.

I have met nearly all the men listed and know some of them pretty well. Compared to the general run of humanity, they are an extremely fine lot, as might be expected of a list of astronomers. On the other hand, it is a bit difficult to see any one of them headed for the directorship of the Lowell Observatory, the position that you have held so long and so honorably ... I believe that the two you mention, Whipple and Robley Williams³ are both excellent.

Nothing seems to have come of this early correspondence, although there is a handwritten note, presumably from V.M., enclosed with this letter listing a smaller set of names with numbers next to them: 1 Whipple, 2 Williams, 3 Edmondson, 4 Dunham, 5 Babcock, 6 Hall, 7 Mohler, 8 Weaver, 9 Seyfert, 10 Herbig, and not numbered, Elvey.

In 1952 the Trustee received a letter from Bart Bok (1906–1983), who was very unhappy with the changes at Harvard and in open rebellion against plans to close or sell Harvard’s South African station, asking to be considered as a successor to V.M. “... if the time for his replacement should arrive.” (Bok, 1952). By some coincidence, Putnam had received a letter a little earlier from Bok’s ally, Harlow Shapley, (1885–1972) hinting that the reorganization of Harvard “... may change things in such a way that a first-class local astronomer would be available for serious consideration for the top post at the Lowell Observatory.” (Shapley, 1952).

Harold L. Johnson, who had abruptly resigned from Lowell in 1949 and now had a good position at the Yerkes Observatory, wrote Roger Putnam in 1950 asking to return (Johnson, 1950). He had tried the Director first, but V.M. was not encouraging. Johnson was rehired in May 1952 by the Trustee. He brought with him a contract with the Office of Naval Research on solar variations. He found the old 42-inch reflector to be in very poor shape and inadequate for his work.

Johnson soon became quite unhappy with the old men running the place, who were not appreciative of electronics and felt astronomers should make do with whatever equipment was at hand. Soon after returning, he wrote the Trustee:

I have found the Lowell Observatory to be very different from the Yerkes Observatory in at least one respect. I have found the scientific atmosphere here to be extremely deadening. No one here now has much interest in the problems of modern Astronomy and Astrophysics, and I miss very much the stimulating atmosphere of the Yerkes Observatory. (Johnson, 1952a).

He continued by asking for the hiring of another photoelectric photometrist, Daniel L. Harris, III (1919–1962), as “It would be very much nicer here if there were someone else who talks my language.” The following month he added:

The point of all this is simply that it is not possible to have young and ambitious new men working here under the present administration. Intellectually and scientifically, the Lowell Observatory is defunct. Whatever these men have done in the long past (and we both know they have done good work), their total contribution now is to keep the Observatory 20 or 30 years behind modern developments in Astronomy. Before the Lowell Observatory can take its rightful place in the Astronomical world, it will be necessary to replace all of the deadwood with first rate men. The sooner this takes place, the better for the Observatory. (Johnson, 1952b).

It appears that arguments like this from the most productive member of the staff, along with the death of Lampland in December 1951, persuaded the Trustee that change had to come. John Duncan continued to keep a lookout for bright young men and was impressed by Albert G. Wilson (Figure 4) while visiting Palomar Observatory. Wilson, who had earned his Bachelor's degree in electrical engineering at Rice University and his Ph.D. in mathematics at Caltech, had returned to Caltech after serving in the Navy, and was then supervising observations for the Palomar Sky Survey.

After receiving an inquiring letter from Wilson, V.M. Slipher (1952) wrote the Trustee:

He is a younger man than we have been thinking and talking about, 33, I believe. He has a family of a wife and three children, and apparently of a stable temperament. He is product of Cal.Tech. and except for war service has been there and at Palomar since. "Our Universe Unfolds New Wonders" by him is an account of observations he has made in the sky survey at Palomar with the giant Schmidt, published in 1952 February number of the *National Geographic Magazine*, which I hope you may have a chance to glance over. Dr. Duncan knows him quite well and speaks highly of him (It seems that we have had to give up the hope of finding a little older man who has shown interest and ability more in the planetary sphere. There is only or two of these and they would be much more expensive if we could get them interested coming to Lowell Observatory.) We are hoping he will come here for a discussion of matters before very long. Would be glad to have your thoughts on him individually and whether you agree that his age is no objection if has other qualifications. He seems to be very much the most encouraging prospect at present. He is not much younger than was Shapley when he went to Harvard.

After that a brief visit by Wilson to Flagstaff and a couple of letters between the candidate and the Trustee were all it took. It appears that Putnam, who had been Trustee for more than a quarter of a century but had never hired a Director, did not spend much time thinking about the matter. He was very busy with his business affairs in Massachusetts, including starting a television broadcasting business, and had just spent a year as the Director of the Economic Stabilization Administration in Washington.

On 8 January 1953 the Trustee formally appointed Wilson Assistant Director, effective 1 July, at a salary of \$6,000 per year plus the house then occupied by Mrs. Lampland. Wilson was told (Putnam, 1953), "I hope and believe, as time goes on, we will

see very real progress with the Observatory, and of course, as opportunities increase, remuneration should also." Wilson had been informed during his visit to Flagstaff that he could expect to move up to Director after a year if all went well.

There was much correspondence between the two even before Wilson moved to Flagstaff. For example, in February Wilson was involved in negotiations to obtain a contract from the Office of Scientific Research. He wrote the Trustee (Wilson, 1953): "...we must negotiate with OSR as though we had the research talent in our pocket, and we must negotiate with the talent as though we had the contract in our pocket ..." and asked whether it would be possible to hire some talent immediately. He wanted to get Donald E. Osterbrock (1924–2007), whom he praised highly and about whom he assured the trustee: "We know he would be willing to come to Lowell on a one year trial basis, with opportunity for a permanent staff position at the end of that time, if all parties are satisfied ... He would like \$4500." Wilson also wanted to hire Robert H. Hardie (1923–1989) for a 6-month Fellowship to help Harold Johnson with photometry. Putnam agreed to Hardie, as a 6-month commitment could be afforded even if the contract were not won.



Figure 4: Albert G. Wilson (b. 1918) was at the Lowell Observatory from 1953 to 1957 (Assistant Director: 1953–1954; Director: 1954–1957 (Photograph courtesy Lowell Observatory Archives).

3 THE SHORT, UNHAPPY DIRECTORSHIP OF AL WILSON

As expected, Wilson became the Observatory's third permanent Director on 11 November 1954. When I asked him recently what he considered his greatest accomplishments as Director, he gave me essentially the same list he gave current Trustee William Lowell Putnam in a letter in 1990 (Putnam, 1994: 204-205). First on his list was the establishment of a retirement system for the astronomers. He did not want any future Directors to hang on until age 79 because of a lack of a pension.

Wilson hired a few young astronomers, among them Gerard de Vaucouleurs (1918–1995) and Wil-

liam Sinton (1925–2004), got the 42-inch telescope mirror realuminized, and organized the international Mars committee to coordinate observations during the 1956 opposition after getting the National Geographic Society to support E.C. Slipher's observations of the 1954 opposition from Pretoria. He held the first conference on exo-biology, and he hosted a meeting of the Astronomical Society of the Pacific. He is also proud of working with the Walt Disney Company in filming movies about Mars. He worked hard on attempts to get the forthcoming national observatory built near Flagstaff, hoping that Lowell could play some sort of host role, but eventually it went to Kitt Peak more than 400 km to the south. He also spent some effort getting the new image intensifiers, originated for medical use at Johns Hopkins, modified for astronomical use. When the Bendix Corporation took over the patents and development, Wilson worked to make Lowell a test facility for astronomical use of the devices.

Wilson has told me repeatedly that John Hall thanked him later for doing much of the necessary 'dirty work' which antagonized the staff but made it easier for his successor. Partly because of this his tenure as Director of the Lowell Observatory was short and unhappy.

Wilson fired Robert Hardie, who denounced him widely. Actually, the Trustee had told Wilson to reduce the photoelectric staff in order to increase the number of people doing planetary work, which had been declared the Observatory's primary mission by the founder, Putnam's uncle Percival Lowell.

By 1956 Wilson had severe problems in dealing with some of the staff. Harold Johnson, who had strenuously urged the Trustee to get rid of the deadwood during the last of the Slipher years, became extremely critical and wrote vituperative letters to Putnam (Johnson, 1956a) accusing Wilson of lacking ability to lead, knowledge of science, and even mental stability. Henry Giclas also became an enemy, and Wilson at one time discussed trying to fire him.

A year earlier Wilson (1955) had written the trustee:

There will be a period of being tough. But we suffer from some deeply entrenched inefficiency. A completely new broom must be used for the sweeping. I, nor anyone else, could not get the Lowell Observatory on a productive basis with the existing set up. I tried for 7 months to sell my program, win them over, but all I got was some rather contemptible back stabbing. Now the program goes on whether they like it or not, and if they continue to drag their feet they will have to go.

In the same letter he pointed out that some staff members had been helpful and cooperative, among them E.C. Slipher and, amazingly considering later developments, Harold Johnson.

There is some evidence that Wilson had tried to get along with his staff. Shortly before becoming Director Wilson followed up a visit by the Trustee to the Observatory by writing Putnam:

I know our group. They are all talented men. They are all competent scientists. Yet it takes a certain minimum of time for men to know and

appreciate one another, and to learn to work together. We must now work toward creating an effective team, erasing prejudices and pettiness. The observatory is not only what we see on Mars Hill, it is also within us—especially the future. And what is really within is confidence, enthusiasm, and eagerness to be on our way after a tired period of uncertainty. Our first job, working together, is to release these human forces, assuring each man rightful use of his talents, and the opportunity to be and produce his best. Faith that this can be done is a *sine qua non*. (Wilson, 1954).

But by 1956 the situation was irreparable. Wilson found himself under constant attack and his marriage was breaking up, so on 9 November 1956 he asked the Trustee to accept his resignation effective not later than 1 July 1957. Apparently conditions continued to worsen, as he formally resigned in a letter of 31 December, effective 3 January 1957, and in June he returned to California and a career in industry. Although this was his last full-time position in astronomy, he served as the founding editor of *Icarus* in 1962, and he published on cosmology and general relativity in the 1960s.

4 SECOND TRY

When Roger Putnam received Wilson's letter of resignation he appointed E.C. Slipher Acting Director. The last of the old men served from January 1957 to September 1958.

That day the Trustee wrote to Harold Johnson:

While in Flagstaff, I talked on the telephone with Dr. Bowen at Mt. Wilson, Dr. Shane at Lick, and Otto Struve at Berkeley, asking advice and suggestions from them which they are going to give me in the next few days, about suitable men to replace Dr. Wilson as Director. I felt I couldn't get better advice than theirs, and I already have the advice from Harvard. After I receive the advice from all these people, I shall make up my own mind, and plan then to pick a Director, myself. (Putnam, 1957).

Struve (1897–1963) replied immediately with a detailed letter including a paragraph about each of the 14 men he listed in rank order. Struve's (1956) list (with his ages, not necessarily correct) was as follows:

1. Olin J. Eggen, age 38.
2. Frank Edmondson "undoubtedly the best man on the list in so far as administrative ability is concerned."
3. John S. Hall, age 49
4. Dean B. McLaughlin, age 56
5. Daniel Harris, age about 37.
6. Harold F. Weaver, age 39.
7. Carl Seyfert, age 46
8. Arthur Adel, age 48
9. Allen [sic] Sandage, age about 32.
10. Arthur Code
11. John [sic] Leighton
12. Lawrence H. Aller, age 43
13. Bradshaw Wood
14. Merle Walker, age 30

Ira S. Bowen (1898–1973) and C. Donald Shane (1895–1983) probably replied by telephone.

Putnam's reference to Harvard is interesting. The new Harvard Director, Donald H. Menzel

(1901–1976), having just established a relationship with the Smithsonian Astrophysical Observatory, which had moved from the nation's capital to Cambridge, Massachusetts, tried to include Lowell in a three-institution partnership. He offered to move Harvard's 61-inch telescope to Flagstaff, but in return he wanted a dominant say in who would be the next Director of Lowell. Menzel proposed an arrangement whereby Lowell astronomers would be Research Associates of the Harvard College Observatory and the new Lowell Director would hold the title of Professor at Harvard. The new Director would be selected by a committee of four, three of them chosen by Harvard and the Smithsonian Astrophysical Observatory, and would then have to be approved by both the Lowell Trustee and Harvard's Dean of Arts and Sciences.

Menzel sent Putnam a list of 60 astronomers considered by those at Harvard for the Directorship of Lowell. Some were marked with an asterisk for high scientific standing, some with an *E* for executive ability, and some with a check mark for "man we should like to be associated with." (Figure 5). Only nine had all three marks: Frank K. Edmondson (b. 1912), W. Liller (b. 1927), A.B. Meinel (b. 1922), T.E. Sterne (1907–1970), R.N. Thomas (b. 1921), Harold L. Weaver, A.E. Whitford (1905–2002), Frank B. Wood (1915–1997) and K.O. Wright (1911–2002). Of these Edmondson was already a Director at Indiana University, Liller eventually became Director of his own observatory in Chile, Meinel was the founding Director of Kitt Peak National Observatory, Whitford became Director of Lick Observatory, and Wright became Director of the Dominion Astrophysical Observatory. It is likely that the reference to Weaver was intended to refer to Harold F. Weaver (b. 1917), who was the founding Director of the Radio Astronomy Laboratory at the University of California at Berkeley.

After meeting with Menzel at Harvard, Putnam (1956) was at first amenable, asking V.M. Slipher to suggest an East Coast astronomer whom he could appoint as his representative to the four-man Nominating Committee, which would meet in Cambridge. However, after consulting with Harold Johnson, who replied, "... I am very much opposed to our 'buying' the 61-inch at the cost of accepting the Harvard Department's orders on policy and on the choice of the Director of the Lowell Observatory." (Johnson, 1956b), Putnam decided to choose his own Director first and then let the new Director carry on any negotiations with Harvard.

Putnam soon offered the Directorship to Frank Edmondson, who declined after some thought—and successful use of the offer to gain some concessions from his administration at Indiana University (Edmondson, 1957).

Putnam and the Lowell astronomers had become well acquainted over the past few years with John S. Hall (Figure 6), the Director of the United States Naval Observatory's Division of Equatorial Instruments (renamed the Astrometry and Astrophysics Division when he left). Hall was a leading photoelectric photometrist and spectroscopist with several major discoveries to his credit. He had initiated the drive to move the USNO's 40-inch Ritchey-Chretien

(the first such telescope ever built) from its wretched site in Washington to a location with good seeing and dark skies. After some searching he had chosen a site near Flagstaff, and built an observatory there with Arthur Hoag (1921–1999) the on-site Director. He made many visits to the area to observe, and often visited with the other Flagstaff astronomers.

* High scientific standing
E executive ability
 ✓ man we should like to be associated with

Abt, Helmut	✓ <i>E</i> *	Liller, W.
* Aller, Lawrence	✓ <i>E</i>	McCroskey, R.
Arp, Halton C.		McNamara, D.H.
* Babcock, Horace	<i>E</i> *	Markowitz, W.
Baum, William A.	✓ <i>E</i> *	Meinel, A.B.
* Blaauw, A.		Merrill, John
Chamberlain, J.	<i>E</i>	Miczajka, G.R.
Code, A.E.		* Münch, G.
Deutsch, A.J.	✓	O'Keefe, J.
de Vaucouleurs, G.H.		Pierce, Kieth
Donn, Bertram		Pinson, W.
✓ * <i>E</i> * Edmondson, Frank K.		Sahade, G.
✓ <i>E</i> Elvey, C.T.	✓	* Sandage, A.L.
<i>E</i> Hall, John		Savedoff, M.P.
Harris, Daniel	<i>E</i>	Seyfert, C.K.
<i>E</i> ? Henize, K.	✓ <i>E</i>	Shapley, A.H.
<i>E</i> ? * Herbig, G.H.	<i>E</i>	Smith, Harlan
Hess, Seymour	✓ <i>E</i>	Smith, Henry
* Hiltner, W.A.	✓ <i>E</i> *	* Sterne, T.E.
Hoag, Arthur	✓ <i>E</i> *	* Spitzer, L.
* Hoyle, Fred		* Thomas, R.N.
		van Wijk, U.
		Velghe
✓ <i>E</i> Hynnek, J.A.		Walker, M.F.
✓ <i>E</i> Irwin, John B.	✓ <i>E</i> *	* Weaver, Harold L.
✓ <i>E</i> ? Keller, Geoffrey		* Wellmann, P.
King, Ivan	✓ <i>E</i> *	* Whitford, A.E.
King, Robert B.		Whitney, Charles
Kraft, R.F.		* Wilson, O.C.
Kron, G.E.	✓ <i>E</i> *	* Wood, Frank B.
Lallemend	✓ <i>E</i> *	* Wright, K.O.
		Wyatt, Stanley P.

Figure 5: Harvard's 1956 list of potential Lowell Observatory Directors (enclosed with Putnam, 1956).

Roger Putnam invited the Halls to an overnight visit at his home in Massachusetts, there was compatibility and mutual respect (Hall, like Putnam, was a New Englander), and John Hall was offered the position of Lowell Observatory Director (Putnam, 1958). His starting salary was \$14,500 per year. According to his son, he almost accepted a position at the new Kitt Peak National Observatory instead, but was dissuaded by the length of the drive from Tucson to the telescopes. After some negotiations Hall (1958) accepted the Lowell Directorship, and the Observatory's deep problems were on their way to being overcome.

Since Hall wanted to finish some projects at USNO, the effective date of his appointment was put off to 1 September 1958.



Figure 6: John S. Hall (1908–1991) was at the Lowell Observatory from 1958 to 1977 (Director: 1958–1977) (Photograph courtesy Lowell Observatory Archives).

5 JOHN HALL RESCUES LOWELL OBSERVATORY

By all accounts Hall's Directorship was a total success. Not only did he stay 19 years, but he brought an open management style, leadership by example—he was a very productive scientist—and a warm personal relationship with the staff.

He came at the right time. While the Lowell Observatory had been starved for funds from the founder's death in 1916 until Mrs. Lowell's passing in 1954 (she had been receiving half the income from the estate), after Sputnik Federal funds began to flow into science in a big way. During Hall's Directorship, grants and contracts went from a tiny portion of the Observatory's budget to a very significant portion.

Hall rebuilt the infrastructure of the antiquated Observatory, adding or greatly improving the machine shop and electronics shop and buying computers as they became available. He formed a

partnership not with Harvard but with Ohio State and Ohio Wesleyan Universities, whereby the 69-inch Perkins telescope was moved to Lowell, and he rebuilt it so that it became a modern 72-inch with a Zerodur mirror. He established a new, dark site at Anderson Mesa, 25 km from Flagstaff, and installed the Perkins and other new telescopes there.

Hall hired young astronomers to do photometry and interferometric spectrometry with new equipment. He brought visitors to the Observatory, including a number from Europe on short appointments. Perhaps the most significant work done at Lowell during his tenure was by Carnegie Institution of Washington astronomers W. Kent Ford, Jr. (b. 1931) and Vera Rubin (b. 1928), who measured rotation curves of galaxies with their new image tubes on a Lowell telescope.

A comparison between one of the last years of the Slipher Directorship with one twenty years later is made in Table 1. The number of astronomers was up by 40%, their median age had decreased by 42%, and one measure of their productivity—publications per astronomer per year—was up by 230%.

6 ACKNOWLEDGEMENTS

The author is grateful to Antoinette Beiser, Archivist of the Lowell Observatory, for much assistance and for permission to publish photographs and quotations from letters in the Lowell Observatory Archives (LOA). He is also grateful to Peter Boyce, Otto Franz, Henry Giclas, Richard Hall, Robert Millis, and Albert G. Wilson for sharing their recollections of Lowell Observatory in the 1950s and afterward. This paper is an elaboration of a talk given in a special session on "Case Studies in How 20th Century Observatory Directors Got Chosen" at a meeting of the Historical Astronomy Division of the American Astronomical Society on 7 January 2007. The session was organized by David H. DeVorkin of the National Air and Space Museum, Smithsonian Institution, Washington, DC.

7 NOTES

1. No one at Lowell Observatory (Figure 7) referred to the three senior astronomers by their names. Vesto Melvin Slipher, Earl Carl Slipher, and Carl Otto Lampland were always referred to and addressed by their first two initials (Henry Giclas, personal communication).
2. Percival Lowell established his Observatory with all authority vested in a sole Trustee. To date all Trustees have been relatives of the founder (Putnam, 1994).

Table 1: Lowell Observatory in 1950 and 1970.

Year	1950	1970
Director	V.M. Slipher, 75, 49 years at Lowell Observatory, 34 as Director	John S. Hall, 52, 12 years at Lowell Observatory, 12 as Director
Other Astronomers	C.O. Lampland, 77, 48 years	Henry L. Giclas, 60, 39 years
	E.C. Slipher, 67, 44 years	Peter Boyce, 34, 7 years
	Henry L. Giclas, 40, 19 years	William A. Baum, 46, 5 years
	Harold L. Johnson, 29, 1 st year	Otto G. Franz, 39, 5 years
		Robert L. Millis, 29, 3 years
		Nathaniel M. White, 29, 1 year
Totals:	5 astronomers, 3 publications	7 astronomers, 14 publications

3. Robley Cook Williams (1908–1995) was an Associate Professor of Physics at the University of Michigan at the time. In 1950 he completed a gradual transition from astronomy to physics to biophysics and became a Professor of Virology at the University of California at Berkeley (Anonymous, 2006).

8 REFERENCES

The following abbreviation is used:

LOA = Lowell Observatory Archives, Lowell Observatory, Flagstaff, AZ, USA.

Abrahams, Peter, ~2001. "The Telescopes of Lowell Observatory." Available at <http://home.europa.com/~telescope/lowell.txt>.

Adel, A., 1987. Oral history interview by Robert W. Smith, dated 13 August, American Institute of Physics Center for History of Physics.

Anonymous, 2006. Biophysicists in Profile: Robley Cook Williams, *Biophysical Society Newsletter*, January 2006, 2–3. See: <http://www.biophysics.org/publications/jan06.pdf>.

Bok, B.J., 1952. Letter to R.L. Putnam, dated 22 July. In LOA.

Duncan, J.C., 1946. Letter to V.M. Slipher, dated 23 March. In LOA.

Edmondson, F.K., 1957. Letter to R.L. Putnam, dated 24 January. In LOA.

Hall, J.S., 1958. Letter to R.L. Putnam, dated 17 February. In LOA.

Johnson, H.L., 1950. Letter to R.L. Putnam, dated "March." In LOA.

Johnson, H.L., 1952a. Letter to R.L. Putnam, dated 19 September. In LOA.

Johnson, H.L., 1952b. Letter to R.L. Putnam, dated 14 October. In LOA.

Johnson, H.L., 1956a. Letter to R.L. Putnam, dated 24 September. In LOA.

Johnson, H.L., 1956b. Letter to R.L. Putnam, dated 15 December. In LOA.

Millis, R.L., 1992. John Scoville Hall, 1908–91. *Bulletin of the American Astronomical Society*, 24, 1323-25.

Putnam, R.L., 1953. Letter to A.G. Wilson, dated 8 January. In LOA.

Putnam, R.L., 1956. Letter to V.M. Slipher, dated 26 November. In LOA.

Putnam, R.L., 1957. Letter to J.C. Duncan, dated 3 January. In LOA.

Putnam, R.L., 1958. Letter to J.S. Hall, dated 10 February. In LOA.

Putnam, W.L., III, 1994. *The Explorers of Mars Hill: A Centennial History of Lowell Observatory, 1894–1994*. West Kennebunk (Maine), Phoenix Publishing.

Shapley, H., 1952. Letter to R.L. Putnam, dated 5 May. In LOA.

Slipher, V.M., 1952. Letter to R.L. Putnam, dated 7 August. In LOA.

Struve, O., 1956. Letter to R.L. Putnam, dated 28 December. In LOA.

Wilson, A.G., 1953. Letter to R.L. Putnam, dated 16 February. In LOA.

Wilson, A.G., 1954. Letter to R.L. Putnam, dated 13 August. In LOA.

Wilson, A.G., 1955. Letter to R.L. Putnam, dated 8 July. In LOA.

Joseph S. Tenn has been a Professor of Physics and Astronomy at Sonoma State University in the California wine country since 1970. During this time his interests have evolved from physics to include astronomy and history of astronomy, although he teaches only the first two of these subjects. He maintains the Bruce Medalists website at <http://phys-astro.sonoma.edu/bruce-medalists/>.



Figure 7: A recent view of the Slipher Building at the Lowell Observatory (photograph: Joseph S. Tenn).