

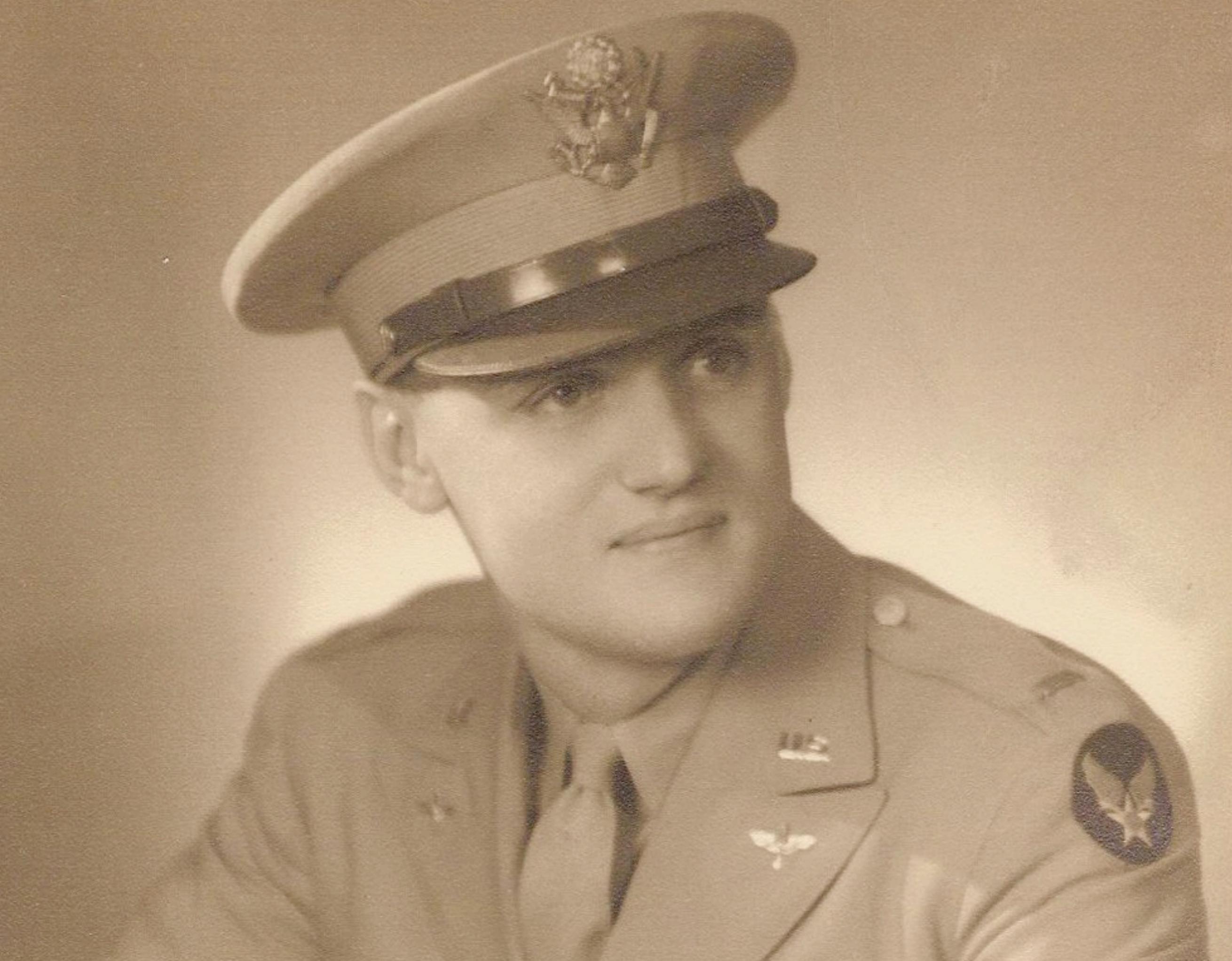
The Life and Career of Frank Badgley

1914-2009



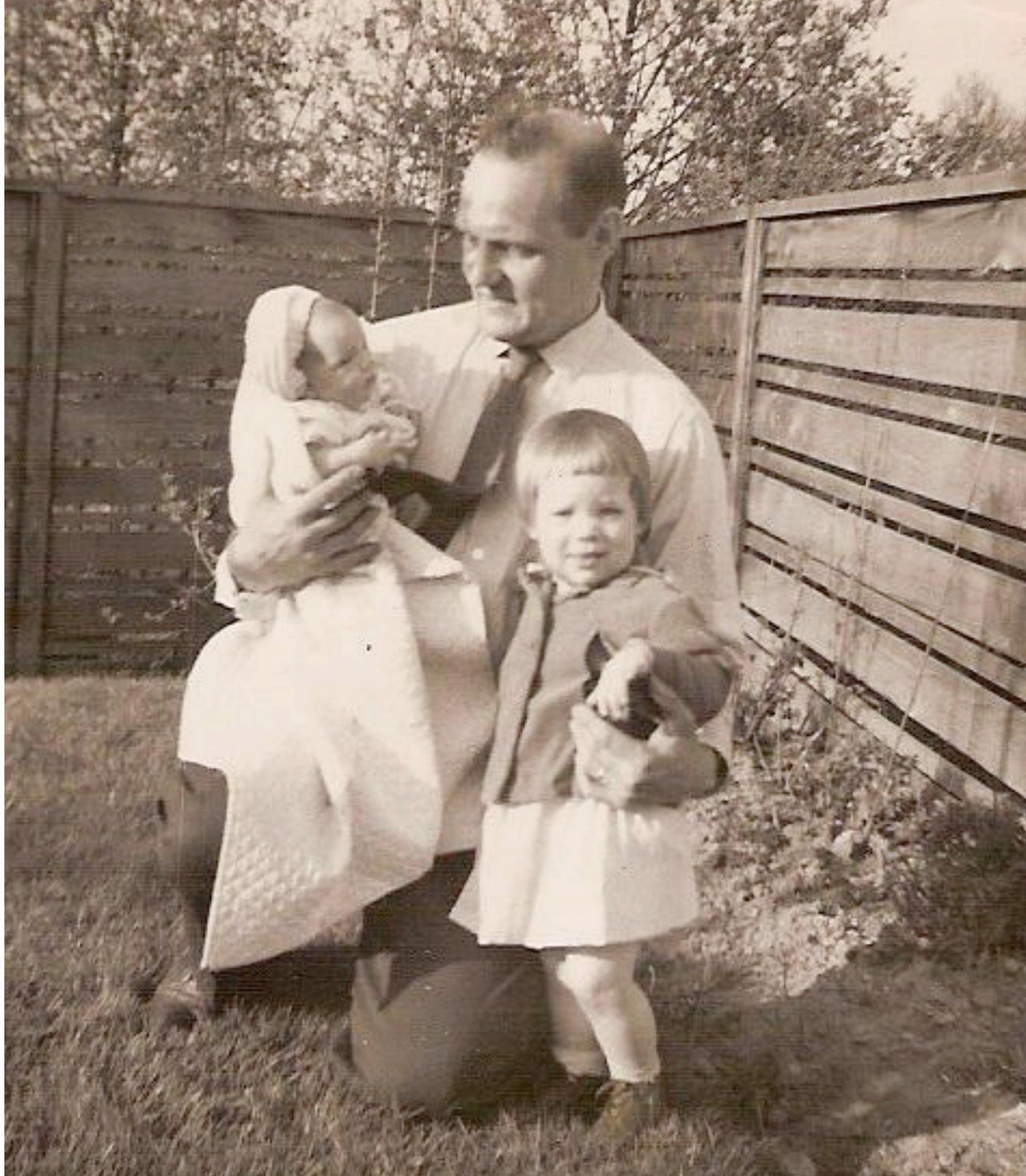












Born 1914 Mansfield, Ohio

BS 1935 University of Chicago

MS 1948 New York University

PhD 1950 New York University

Worked 6 years as a chemist after receiving his BS. Attended weather school at the University of Chicago followed by 3 years service as a meteorologist in the Air Force, 3 months as an instructor and the final year as squadron officer in weather reconnaissance, in charge of 10 officers.

Part time instructor at New York University.

P. E. CHURCH
DEPT OF METEOROLOGY
UNIVERSITY OF WASHINGTON

3 June 1949

REGRET I CANNOT APPLY FOR POSITION STARTING SEPT
1949. NEED ONE MORE YEAR INTENSIVE WORK ON DOCTORATE.

BADGELEY

3 June 1949 Telegram with regrets
16 December 1949 Informal offer letter
20 December 1949 Declination letter
27 December 1950 Acknowledgment



Dear Mr. Badgeley,

16 December 1949

Would you be interested in coming as soon as you can if possible, and work full time on the two grants we have from the A.E.C., then substitute for Mr. Schallert... at his salary, which is \$412 per month...

By the end of the next academic year we will know for certain whether or not whether you can be retained here full time on the staff. The chances .. are exceptionally good. I am sure that you would like it here.

P. E. Church, Executive Officer

December 20, 1949

Dear Professor Church,

Thank you for your letter inviting me to join your group...

At present, however I...don't think I could break away before completing the work I have begun. The reasons for this are several: First, I am interested in the work itself and would like to see some results before leaving it; second, I feel a sense of responsibility to New York University, which has furnished me with considerable equipment and some student help to pursue my project, and third, I hate to leave any job, even an unpleasant one, which this is not, without feeling that I have done my best to master it.

December 20, 1949

Reluctantly, therefore, I have to say that I do not feel free to accept your offer effective January 1. ... In addition, I must admit that the salary ... is not very attractive unless there is a chance for summer work or for permanent association with the university at a higher pay rate.

Let me recall myself to you as one of your hundreds of students at Chicago in 1943.

Franklin I. Badgley

27 December, 1949

Dear Mr. Badgley,

...Of course we are all sorry that you felt you could not accept the opportunity to come here...

I hope that some time in the near future our paths will cross again. I must admit that I do not recall you among the hordes of students present at the Institute of Meteorology in Chicago in 1943.

*P. E. Church,
Executive Officer*

3 June 1949 Telegram with regrets
16 December 1949 Informal offer letter
20 December 1949 Declination letter
27 December 1950 Acknowledgment

3 June 1949 Telegram with regrets
16 December 1949 Informal offer letter
20 December 1949 Declination letter
27 December 1950 Acknowledgment
18 April 1950
31 May 1950 Informal offer letter
9 June 1950 Acceptance telegram
10 June 1950 Acceptance letter
15 June 1950 Acknowledgment, arrangements
23 June 1950 re. request from President's Office
27 June 1950
3 July 1950

31 May, 1950

Dear Mr. Badgley,

...I am sure that we have some news which we hope will interest you greatly..

Dr. Fleagle, Mr. Schallart and I are unanimous in extending you the offer to come out here to be the senior supervisor on these contracts.

You know something of the advantages which the Pacific Northwest and the Seattle area offer in pleasant living conditions.

May we look forward to an affirmative answer and an application early next week?

*P. E. Church,
Executive Officer*

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

WESTERN UNION

1201

(59)

W. P. MARSHALL, PRESIDENT

1950 JUN 9

SYMBOLS

DL = Day Letter

NL = Night Letter

LC = Deferred Cable

NLT = Cable Night Letter

Ship Radiogram 02

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DUPLICATE OF TELEPHONED TELEGRAM

• NA 099 PD=FP NEWYORK NY 9 1220P=

PROF PHIL CHURCH=

208 Thompson Hall

DEPT OF METEROLOGY UNIV OF WASHINGTON SEATL=

GLAD TO ACCEPT YOUR OFFER OF POSITION FOR COMING YEAR
LETTER FOLLOWS=

=FRANK BADGLEY=

BY *HA* *1093* *AV*
mail

me 0630

June 10, 1950

Dear Professor Church,

The position you describe seems to offer many interesting possibilities and I look forward to them with anticipation. As you are well aware, the field of micro-meteorology, including the study of turbulent diffusion of matter and other transport phenomena, is still pretty much wide open, with many avenues of approach still to be tried....

Franklin I. Badgley

15 June, 1950

Dear Mr. Badgley,

We are delighted that you have accepted and I am sure you will like it here.... You can obtain a partially furnished unit of two bedrooms for the sum of \$52.50 per month.... so it seems you have nothing to worry about with respect to housing.

.....Mainly thinking of it in monetary terms to you, the sooner you can come, the better. Do you expect to come by car or train? ...Further, I suggest that if you come by train you can have very comfortable accommodations west of Chicago on a 45 hour train trip from Chicago if you travel tourist class on the Chicago-Milwaukee, St. Paul-Pacific Railway train the *Olympian Hiawatha*. Few people in the east know about this tourist class....

P. E. Church,
Executive Officer

23 June, 1950

Dear Frank,

I am very pleased that you have agreed to come out to work in our department during next year...

The President's Office has just informed us that you must fill out the enclosed form and have it notarized before your appointment can be approved by the President...

*Robert G. Fleagle,
Assistant Professor*

June 27, 1950

Dear Dr. Church,

I am sending the enclosed oath of allegiance, all signed and sealed..

Both my wife and I are looking forward eagerly to our arrival in Seattle. Everyone to whom we talk who knows anything about the area has a good word to say for it.

Frank Badgley

3 July, 1950

Dear Frank,

Thank you very much for your letter of June 27 with the “Oath of Allegiance” signed and sealed.

The heat is bearing down on us to the point where it is difficult to work. The temperature will pass 75 today. For the past week there hasn't been a cloud in the sky. I am sure that you and your family will enjoy the Pacific Northwest.

*P. E. Church,
Executive Officer*



1948 Robert G. Fleagle
1951 Franklin I. Badgley
1954 Richard J. Reed
1955 Konrad J. K. Buettner
1958 Joost A. Businger
1962 Norbert Untersteiner
1963 Peter V. Hobbs
1965 James R. Holton
1966 John M. Wallace
1967 Conway B. Leovy
1970 Robert A. Houze
1971 Robert G. Charlson

22 January 1951 Letter to Dean Lloyd Woodburne

Dean Lloyd S. Woodburne
Arts & Sciences
120 Thomson Hall
Campus

Dear Dean Woodburne:

Pursuant to our conversation today I am writing this letter as a summary of the staff situation and the necessity of adding Mr. Franklin I. Badgley to the permanent staff of the Department of Meteorology and Climatology.

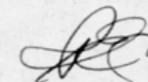
- (1) With the present staff (3 full time) we are able to offer a nearly complete undergraduate curriculum, but our graduate offerings are limited to three 3-hour courses on dynamic meteorology, seminar, and one course on atmospheric turbulence, the latter being taught by Mr. Badgley. This means that a Master's candidate can just barely eke out enough graduate credits with non-thesis research, to satisfy the department and Graduate School requirements, with Mr. Badgley having part-time status in the department. All other members of the staff teach a full 10 hours per week plus non-thesis research.
- (2) The research program of this department is centered mainly on the meteorological and climatological characteristics of the lower atmosphere. This includes, among others, the important problem of atmospheric turbulence, diffusion of particulate and gaseous substances, and vertical exchange of heat and moisture. Mr. Badgley has specialized in this difficult field. He is one of the three most able, from training and experience, man in this field in the country; one being employed at Hanford, and the other, a German brought to this country after the end of the War, at the Geophysical Directorate of the Air Force.
- (3) During this month Mr. Badgley has received communications from E. I. DuPont concerning a position which they want him to fill. Mr. Badgley will be interviewed by DuPont, both in New York and in Wilmington, Delaware, next week when he attends the American Meteorological Society meetings and a classified meeting called by the Atomic Energy Commission. Mr. Barad, of the Hanford Works, will also soon make Mr. Badgley an offer of a position.

- (4) Mr. Badgley is by far the best qualified man that we have found in this country for both the teaching (including meteorological instruments in addition to atmospheric turbulence) direction of research, and research for the necessities of this department.
- (5) Mr. Badgley is a thorough, effective teacher; this information having come from both students and Dr. Fleagle who has been attending his course on atmospheric turbulence. Mr. Badgley has had teaching experience as a part-time instructor at New York University from 1947 to June 1950.
- (6) Mr. Badgley has completed all his academic work for his Ph.D., finished his dissertation, and takes his final examination this month and will receive his Ph.D. from New York University either in February or June of this year.
- (7) The staff of this department is unanimously agreed that Mr. Badgley is the man we want and need.

The department respectfully requests that approval to add Mr. Badgley to the permanent staff be granted and that an offer be made to him which will be attractive enough such that the University of Washington does not lose him.

Submitted for the department.

Sincerely,



P. E. Church
Executive Officer

PEC/av

October 1954 Recommendation for tenure



Frank's Teaching

Ph.D.

Elderkin, Charles Edwin, PhD, 1966, "Experimental Investigation of the Turbulence Structure of the Lower Atmosphere"

Engelmann, Rudolf Jacob, PhD, 1964, "Rain Scavenging of Particulates"

Havard, Jesse Boyd, PhD, 1960, "On the Radiational Characteristics of Water Clouds at Various Wave Lengths"

Holland, Joshua Zalman, PhD, 1968, "An Application of Some Statistical Techniques to the Study of Eddy Structure"

John, P. T., PhD, 1958, "Vapor Pressure Gradient and Water Movement in the Top Layer of Soil"

Leavitt, Eric Duane, PhD, 1973, "Spectral Characteristics and Statistics of Surface Layer Turbulence Over the Tropical Ocean"

Staley, Raymond Clarence, PhD, 1964, "Growth and Dissipation of Wind Generated Water Waves,"

Sundararajan, Ananthanarayanan, PhD, 1975, "Mean Reynolds Stress Modeling of the Atmospheric Boundary Layer"

M.S.

Barr, Neal MacGregor, MS, 1959, "A Study of the Temperature Eddy Spectrum Containing Buoyant Eddies"

Baughman, Robert George, MS, 1958, "Some Field Measurements of Drifting Snow"

Brooks, Donald Loyal, MS, 1971, "Development of an Infrared Absorption Hygrometer Using Solid State Energy Sources"

Connolly, Steven Thomas, MS, 1983, "The Energy Balance of an Arctic Ocean Buoy"

Duchon, Claude Edward, MS, 1965, "The Relationship for Net Radiation Crossing a Plane Normal to the Axis of a Symmetrical Radiation Field"

Fuguay, James Jenkins, MS, 1952, "On the Application of Stereo-Photography to the Study of Turbulent Air Motions Near the Ground"

Kaimal, Jagdish Chandran, MS, 1959, "An Absolute Velocity Meter for Low Wind Speeds"

Katz, David Ira, MS, 1979, "An Investigation of the Arctic Planetary Boundary Layer"

Lake, Robert A., MS, 1967, "Heat Exchange between Water and Ice in the Arctic Ocean"

Levin, Leonard, MS, 1969, "Laboratory Study of Effects of a Surface Film on Momentum Transfer and Water-Wave Spectra"

Lieske, Bruce Jerome, MS, 1962, "Energy Flux Balance of the Atmosphere-Ice-Ocean Interface in the Arctic Ocean During the IGY"

Maykut, Naydene Elizabeth Nutley, MS, 1966, "Dissimilarity in Heat and Momentum Transfer Under Stable Conditions," (Businger/Badgley)

Miyake, Mikio, MS, 1962, "Transformation of Atmospheric Boundary Layer Induced by Inhomogeneous Surfaces"

Schafer, Pedro Joaquin, MS, 1965, "Computation of a Storm-Surge at Barrow, Alaska by a Method of Numerical Integration"

Stevens, Donald Wilmot, MS, 1959, "Numerical Experiments in Forecasting Air and Soil Temperature Profiles"

Twedten, Harold Allen, MS, 1955, "A Comparison of Micro-Wind Profiles and Large Scale Data"

Wagner, Norman Keith, MS, 1955, "An Analysis of Turbulence Near the Ground by Means of Stereo-Photography"

Wolf, Marvin Abraham, MS, 1961, "A Theoretical and Experimental Investigation of a Vortex, Free-Air Thermometer"

AIR FORCE INSTITUTE OF TECHNOLOGY
OFFICE OF THE COMMANDANT
WRIGHT-PATTERSON AIR FORCE BASE

22 April 1957

Dear Dr. Church,

Meteorology graduates of the University of Washington frequently comment favorably on the capabilities of your staff...

Dr. Frank Badgely is frequently praised as an excellent professor. Many students have singled him out as the finest of their college days. I do not wish this to reflect unfavorably on the rest of your excellent staff, as remarks have also been made commending Drs. Reed and Butner and Mr. Danielsen. However I do think it appropriate to single out Dr. Badgely at this time on the basis of the large number of officers who have commented on him favorably.

John Tyler, Col. USAF

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH
BOULDER, COLORADO

Dec. 3, 1965

Dear Phil,

I have always thought that Dr. Badgley is as good or better teacher than any in your department. His main qualities for this are

- a) his step-by step teaching method in which no details are left out or sloughed over -- no intuition used
- b) his pace, which is slow enough so that students can ask pertinent questions on the spot
- c) his emphasis upon the unsolved aspects of problems; always mentioning what is not known and not certain
- d) being readily available to students for consultation

In retrospect, I believe that quality c) is the most outstanding one.

James W. Deardorff



October 5, 1978

3. The following problem was submitted by an inveterate bicycle rider who frequently encounters crosswinds enroute to and from the university:

The drag force on an object moving relative to the air can be given by

$$F_D = A \rho C_D V_R^2$$

F_D is the drag force

A is the cross-sectional area normal to the wind

ρ is the air density

C_D is the non-dimensional "drag coefficient"

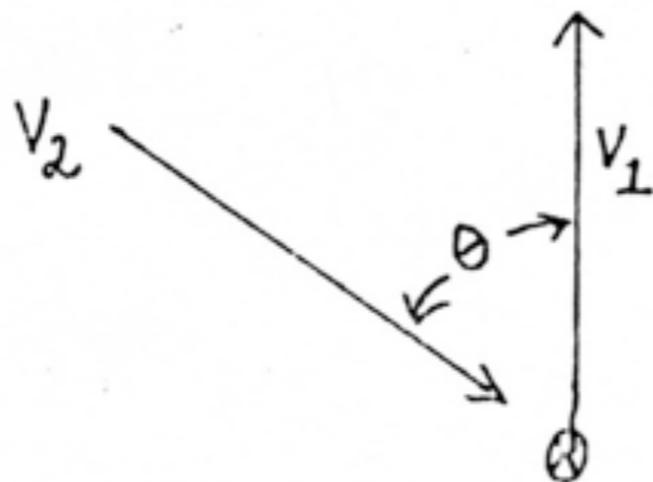
V_R is the relative velocity

The direction of the force is in the direction of the relative wind.

For the purposes of this problem consider a symmetrical object such that A is constant regardless of wind direction. Also consider C_D a constant, independent of wind speed or direction.

For the purposes of this problem consider a symmetrical object such that A is constant regardless of wind direction. Also consider C_D a constant, independent of wind speed or direction.

- (a) The object moves northward with speed $|V_1|$ with no wind. At what rate is energy dissipated?
- (b) A wind with speed $|V_2|$ is blowing at the same time as the object moves northward at speed $|V_1|$. From what direction (with respect to north) must the wind blow in order that the dissipation rate be the same as in (a)? (You can leave the answer as an implicit function of θ .)





Frank's Research

U. W. Scientist to Head Arctic Research Party

Dr. Frank I. Badgley of the University of Washington is going to be "on ice" until January.

Dr. Badgley, assistant professor of meteorology, will leave tomorrow for the Arctic Ocean to take charge of a research party of eight American scientists. They will remain on the floating Arctic pack ice 800 miles north of Point Barrow, Alaska, until January.

The research project is a part of the International Geophysical Year program.

Dr. Badgley will investigate fluctuations of the pack ice in relation to climate. He will relieve Dr. Norbert Untersteiner, Vienna meteorologist on the University of Washington staff, who has been on the ice floe since May. Dr. Untersteiner is due in Seattle about October 1. The ice has drifted 300 miles north since the study began.

The men will live in in-



CAKE ADMIRER: Dr. Frank I. Badgley admired a cake given him today. An "ice floe" in the frosting depicts the Arctic region to which Dr. Badgley is going.

sulated huts. The party will receive supplies from the Air Force. Their nearest neighbors will be a Soviet scientific party 300 miles away.

A \$70,000 grant from the National Science Foundation is financing the university's project.

Seattle Times
Dec. 31, 1957

Antarctic Research Described

It was relatively warm inside the Arctic Circle last fall, according to Dr. Franklin I. Badgley, who returned recently from a research station 850 miles north of Point Barrow, Alaska.

"The temperature almost went up to the freezing point," Dr. Badgley recalled.

Of course, 29 degrees above zero would sound good to anybody who



DR.
FRANKLIN I.
BADGLEY

had seen the mercury drop to 50 degrees below zero two weeks ago.

Dr. Badgley, 43, assistant professor of meteorology at the University of Washington, left Seattle September 19 to take charge of a team of American scientists at a research station on an ice pack floating in the Arctic Ocean.

Grant Finances Project

As part of the International Geophysical Year, "Project Ice Skate" is financed by a National Science Foundation grant.

Dr. Badgley returned here December 24 in time to spend Christmas with his wife and their two children at 2700 E. 100th St.

The meteorologist reported that the scientists had discovered information concerning ocean depth, wind velocity and temperature on the Arctic floe ice which measured an average of 12 feet thick. 1½

miles wide and 2½ miles long.

Depth Estimated

"We found the ocean was more shallow in that area than had been recorded previously," he said. "The ocean is charted as being about 10,000 feet deep at that point. We estimated the floor to be less than 5,000 feet below the surface of the ocean."

Wind velocity was expected to reach about 60 miles an hour, the professor said. Instead it was measured at about 40 miles an hour at its peak.

By means of observation balloons, the scientists were able to determine that temperatures at an altitude of 40,000 feet were much lower than expected.

Memories of Frank Badgley by Joost Businger

When I joined the Department of Atmospheric Physics in 1958 as a young upstart, Frank was already well established in the department. Both of us worked in the Energy Transfer Group, in the area of turbulence in the atmosphere, but we never published a paper together.

In 1968, when Boeing still had a research laboratory in Seattle, the company organized a meeting on Clear Air Turbulence (CAT). It came as a surprise to me that Frank and I were to present papers concerning different aspects of the same problem in the CAT process. His paper is entitled: "Large-scale processes contributing energy to clear air turbulence," whereas my paper is titled: "On the energy supply of clear air turbulence."

Interestingly, G.I. Taylor, by then a venerable old fellow, participated in this same meeting as well. He had solved the critical Richardson number, which comes into play when the shear in the laminar flow is becoming unstable. Both Frank and I worked on the inverse problem of the critical Richardson number, which occurs when turbulence is suppressed into laminar flow. As far as I know this last problem has not yet been solved and may have more than one solution.

In the 1960s, Frank and I took part in a continuous grant to do research in the Arctic. We would take turns coming and going, and never were there at the same time. This also happened with other expeditions to far away places. The result was that we did not have much interaction with each other. I remember Frank as a kind and friendly person and never saw him angry or upset. In retrospect I believe he was a perfectionist with respect to his research which prevented him from publishing it. To me, the most interesting work he did concerned the formation of fixed eddies in aircraft contrails; I am not sure this was ever published.

After I retired and returned to Washington after an absence of seven years, Frank and I shared a retirement office at the department, where we from time to time met up.

October 11, 1966

Dear Phil,

Now considering the wind tunnel that Bob asked about: I have discussed it with the architects and with the mechanical engineer that they hired so I believe they have all the necessary facts....

If we had not lost contact with him in the meantime, we would have liked to bring you together with one of the landlords we encountered while looking for a house here, a Mr Machette. He was sure he had the finest little home in the best neighborhood in the most desirable town (West Hartford) in the most beautiful state situated in the unbeatable region of New England. We were forced to disagree with him on the first point and it would be interesting to see the sparks fly as you countered him on the others.

I'll be writing Dick a separate letter one of these days to tell him of my athletic activities. After a moratorium of a month or more, they have recently picked up to the point where I should not be falling much behind his torrid pace.

Frank



Frank's Retirement Party







Stories about Frank







Frank's Life After Retirement

