

MS to Ph.D. via NOPI

September, 1949 – August, 1957

As I mentioned earlier, I received an offer of an assistantship from Ralph Hull, Head of the Purdue Mathematics Department in March, 1949. I came to Purdue University as a Teaching Assistant (TA) in Mathematics in September, 1949. Such people were normally hired to teach half-time. At that time this meant eight classroom hours per week plus preparation, grading papers, office hours, etc. I had some GI Bill eligibility remaining, so I was able to reduce my load to only one five hour course.

TAs usually taught Algebra, Trigonometry or Analytic Geometry. After getting a Masters degree TAs could teach Calculus. In those early days, I mainly taught Algebra.

The Purdue Mathematics Department had several specialized algebra courses. One was for “Home Ec” students. Typically, these classes were composed of only females. Except that the subject tended to be low level: conversion of units of measurement, etc., it wasn’t a bad class to teach. Mathematics for Agricultural students involved stuff about mixing concrete, number of board-feet in a log and the volume of hay stacks.

Through the Purdue housing office, we secured an apartment at FPHA 213-3. The rent was \$40 per month plus an additional \$8.50 for utilities. A space heater was furnished. The FPHA housing consisted of one story, tar-paper covered buildings which had been Army barracks somewhere.



Typical FPHA unit Hundreds of these units had been brought to Purdue to accommodate the housing crunch brought on by the returning veterans. Ours was an end apartment in a three apartment unit. This was nice in at least two ways. It had end windows for more light and air and it only received the noise from one adjacent apartment. The walls were rather thin, so this location was a real advantage. The windows fit poorly. When it rained it was necessary to place rolled up towels on the sills to prevent water from streaming into the rooms. The only heat was the gas space heater in the living room. All these units were about 24 inches above the ground, mounted on concrete blocks. So they were a lot like Ravenswood, but without floods. There was a “crawl space” under the building. The wind whipped through this and frequently blew out the flame in the heater. When

this happened at night, it got pretty cold in the apartment. Except for cross ventilation there was no relief from the heat in the summer. While life in these apartments was a lot like living at 1608 Haynes Avenue in Ravenswood, we did have indoor plumbing!

There were five such areas comprising perhaps 1000 apartments. FPHA 213 was for families who had two or more children. We, therefore, occupied a two bedroom apartment. There was large play space about fifty feet wide between buildings which was nice for kids. There was little traffic except for residents. No telephone service was available to individual apartments. There was one phone, placed high on a pole (so kids couldn’t get to it) between apartments that could be used for emergency outgoing calls. Notice of incoming calls was brought by the police as in the case of Aunt Josephine’s death (see below).

Lou, Dick, Ted and I shared our building with Don and Virginia Burroughs and their children Donald Lee, Virginia and John, and with Garnet and Carolyn Welch and their two children.

One of the things that made FPHA 213 memorable was both Dick and Ted contracting Chicken Pox. Not a terribly dangerous disease, it nonetheless causes a great deal of discomfort. Both kids required a lot of bathing with Calomine Lotion to allay the itching.

The money from the GI Bill and the assistantship let us live, but without many luxuries. Occasionally we would get “Spud Nuts,” doughnuts made with potato flour, from a little diner at the corner of Third and University Streets. This building was razed for a parking lot in 1999. In 2006 the new Computer Sciences building opened on that corner.

Typical entertainment for Dick and Ted included driving down the stadium “roller coaster,” a hill along west side the Purdue stadium that descended sharply, leveled off, descended again, etc. This road was eliminated in a stadium remodeling in 2002. Another diversion was parking on a Lafayette street to watch the trains go through downtown on Fifth Street. These trains were eliminated in about 2000. Sometimes there was some activity to be seen at the Purdue airport.

Dick was five years old when we first came to Purdue. He attended a cooperative Kindergarten on the Purdue campus. The site is now marked by the University water tank. Cooperative meant we all paid a bit toward the teacher’s salary, contributed juice and cookies and helped with instruction. It was the non-student adult, usually

the mother, who handled these chores. The second year Dick went to Klondike school. "Purdue kids" were not exactly welcomed with open arms because they lived in non-taxed homes.

In the summer of 1950 Aunt Josephine died in Chicago. I don't think I had seen her since that day in 1941 when she brought me the watch. I don't know why she lived in Chicago or what she did for sure. It is thought that she was a secretary. The Indiana State Police brought word of her death. They had been contacted by the Illinois police who got our name from a letter Lou had written to her. Apparently that was the only clue they found in her apartment. I had to take a day off from study and teaching to go to Chicago. None of us knew anything of her affairs. I met a lawyer who agreed to have her remains cremated and sent to me in exchange for signing whatever she had over to him. We had no resources to do anything else. It was one of the most stressful days of my life. I've been a little resentful that she kept herself so completely aloof from us. The lawyer kept his word. Her ashes did arrive and were interred in Crown Hill Cemetery in Indianapolis. Later a few pictures from her apartment arrived.

Because we were so busy with studies, there wasn't much social life. We occasionally got together late at night with Don and Virginia Burroughs. That's when the Spud Nuts came in. Occasionally fellow students Nick Vaughn or Walt Wood came to study and socialize.

Our church at that time was called the University Baptist Church. This church was really a mission to Purdue students. I think it was originally supported by an off-campus group as a mission activity. Reverend Stacy F. Shaw was the minister and put a great deal of himself and his business into keeping it going. Since I was mainly a student, I didn't take an active part in this church although we were faithful in attendance.

I shared an office with five other people in an old creaky building called Stanley Coulter Annex. Three of them were graduate students like me and two were non-student Instructors. Other graduate students were next to us with only a seven foot wall separating us. Generally, it was quiet, but on Friday, when the *Nation* weekly came things livened up a bit. This was not so much for the erudite articles in that intellectual paper, but because of the Crossword Puzzle. Many of the clues turned on puns: Nationality of Passengers on a bus at a stop perhaps? Lapplanders. Why did the brothers call their cattle ranch "Focus?" (Because that's where the sons (sun's) raise (rays) meet.)

Studying and teaching took up most of my time. Occasionally, a fellow student would have a party. "Charades" was a popular way to spend time at these parties. There was not much, if any, alcohol at these parties.

Because of a reduced teaching load (G.I. Bill help), I could enroll in more courses. As a result I completed the work for the Master's degree by January, 1951. (See Page 251) My examining committee was composed of Professors Howard K. Hughes, E. A. Trabant, Vivian A Johnson, Physics (I had a minor in Physics); and Ralph Hull, the Head of the Department.

I suppose Hull was a good mathematician; I didn't have a way to judge that. As a teacher, he left something to be desired. I had several good teachers; the best was Professor Michael Golomb, but that probably belongs in a later Chapter.

Along the way, I completed the requirement in reading in German (July 14, 1950) and French (August 18, 1950) which were required for my subsequent Ph.D. studies. Although I had come home from Europe with a fairly good, street level, speaking knowledge of German, I knew nothing of grammar. My teacher, and later colleague, Merrill Shanks, and I often joked about translating the opening phrase of Landau's *Grundlagen der Analysis* and having a word, "an," left over.

The next major event that influenced my life was the Korean War or Police Action, as it was euphemistically called. Korea had been divided into North and South Korea after W.W.II, the North being communistic and adhering to China. On June 25, 1950, the North invaded the South to force re-unification. The United Nations organized a police force to resist. The U.S. was a major player in this conflict. Men were being conscripted to fight there and reservists were being called back to service. I was still a Reserve First Lieutenant of Artillery. Having already enjoyed travel to one foreign country, I decided that I did not want another such tour. I looked for some way to ensure that I would not be called up.

While at Butler, I had interviewed the U.S. Naval Ordnance Plant, Indianapolis (NOPI) about a job. They wanted me, but I decided to go to graduate school. Now at the completion of my Master's degree, I contacted Kaj Nielsen of the Mathematics Division on January 11, 1951. Kaj responded in letters dated January 16 and 17 that pending completion of paper work necessary to qualify for a Civil Service appointment, he would be able to offer me a position as GS-9 with a starting salary of \$4,600 per year. I accepted

this position and started work as Mathematician in February of 1951. I was never called by the Army, but NOPI was a good experience.

I felt that I had taken a wise step since, under date of 1 December, 1950, I was appointed as a 1st Lieutenant in the Artillery. I had thought all along that I already had this by virtue of what I had been told at Separation in November, 1945. The on the 31st of that month, I was offered the opportunity to decline an appointment as a Reserve commissioned officer. I received an Honorable Discharge dated 1 April, 1953.

While I started work a NOPI, Lou and the boys stayed at Purdue during the Spring semester of 1951 so that Dick could complete the year at Klondike School. It was a tough winter. On one occasion the pipes in the apartment froze due to the space heater going off. Lou had to deal with that on her own. I came up to Lafayette each weekend.

I took a room near the plant, but I didn't like that kind of living. Bob and Rhoda were kind enough to offer me to live with them and share a room with my nephew, Robert John, Jr. When the school year ended, Lou and the boys moved to Indianapolis and we rented a house, which we ultimately bought, at 1536 East 73rd Street.

So, again, we were back in Ravenswood. This house was also in the flood plain of White River, but was elevated a full room level above the ground.



1536 East 73rd Street
The Picket fence was
added later.

There was a basement and garage under the house. It was like any small house one might find except for the elevation of the living quarters. We rented the house from Rosemary Delatore whose father, Frank Delatore, an Indianapolis policeman, had built it for her. When she wanted to sell it, we decided to buy it as we thought we were in Indianapolis to stay. We were able to borrow the money from a good friend Herbert Reeder (Herb) Bailey, whom I had met at NOPI. At this time Herb was a graduate student at Purdue and a student of a man I was to meet later, Lamberto Cesari. Without lawyers and by a simple hand-written note we completed the deal. The whole thing was handled very informally. Every time we made a payment, I calculated the interest due, added it to the principal and subtracted the amount of the payment.

July 24, 1952

I promise to pay the sum of \$6000.00 plus interest at 5.5% per annum to Herbert R. Bailey. The above amount due by July 24, 1967. Amount subject to reduction by monthly payments.

We made payments regularly until I returned to Purdue to complete my Ph.D. degree.

We put the house up for rent, as we fully intended to return there after the degree was completed. The renters often defaulted and when they did, Herb got no check. He never questioned what was going on. Mrs. Gambill, Bob Gambill's mother, sold the house for us when we decide to stay at Purdue, and we paid Herb off in full in 1964.

Herb later confided in me that his mother thought he was crazy to make such an unsecured loan. However, this gave us a start on equity development which stood us in good stead later on. Herb got a little higher rate of return on his money and we paid less than we would have paid to a bank. This act of friendship has always been warmly remembered!



Herb in 1952

While living at 1536 73rd Street, Lou had the misfortune to miscarry what would have been our third son.

Also while at 1536 East 73rd Street, Bob and I, along with Dad, spent a lot of evenings putting a solid foundation under 1608 Haynes. We mixed our own concrete for the footings and laid three courses of concrete blocks on these. In the process, we leveled the floors. This was good and bad as it developed that the floors had never been level. After this job we had to patch some corners where the wall board had come apart as part of the levelling process.

While living at 1536 E. 73rd Street I won a Sealy mattress from a radio show. A radio station called early one Sunday to see if someone would be home to take their call. They didn't want to waste time calling a number which wouldn't be answered. I assured them I would be home. However, we didn't have a radio! I borrowed one from Mom for the afternoon and listened carefully to a 15 minute detective drama. I decided that what they asked would have to do with numbers. I wrote down every number that occurred. The question was: "What were the odds on race horse?" I knew, and won the mattress.

When we came to 1536, the lot on which it

was built was a forest. The sun never shone on the house. It was still a forest after we had 11 trees cut down, but at least we could dry out somewhat due to increased sunlight. The cut trees provided a stack of firewood of fireplace length which was about four feet high and fifty feet long. The house had a nice fireplace and we used this wood in it to warm the house on chili days.

Different from Haynes Avenue, this house on 73rd Street had indoor plumbing. However, there were no sewers in Ravenswood. We had our own septic tank which drained into a “finger system” of clay pipes to diffuse the water into the subsurface gravel layer. One of our early jobs was to have repairs and extensions made to this system.

Another nice feature of 1536 E. 73rd Street was that Bob and Rhoda lived in Ravenswood also. That gave our sons, especially Dick who was older, a chance to get to know his first cousins, Robert John Fuller, Jr., and Deborah Sue Fuller.

I carpooled to work at NOPI with several others in the area. My memory problems showed up even in those days when I drove on a day when I also took the car to a repair shop. I forgot that I had passengers to take home. We were all stranded for a while. This car was a Maroon 1949 Hudson. It was a pretty car and had good riding qualities, but a long drive shaft with two universal joints was prone to failure. When we tired of the repair bills, we bought a Blue 1952 Chevrolet with an automatic transmission. Once Lou drove this kind of car, nothing else would do.

My immediate boss at NOPI was Kaj Neilsen, a good applied mathematician and avid Bridge player. He gave me one simple sounding assignment when I reported for work there. Kaj handed me a book entitled *The Mathematical Theory of Toss Bombing*. His words were: “Go away and become an expert on this.” Almost every thing I did at NOPI flowed from that assignment. By the way, “toss-bombing” is an approach to bomb delivery where the aircraft comes toward the target at a low altitude, pulls up into a climb, releases its bomb, rolls over and flies away in the opposite direction. An effective approach if the pilot wants to be out of the impact zone as rapidly as possible.

My principal work was monitoring and analyzing the efforts of several Navy of Bureau of Ordnance contractors. This work took me to various sites in and around New York City including Pleasantville and Syossett, Long Island. One Bureau of Ordnance contractor was located on *Skunks Misery Road*. It was always work; I never allowed extra time for seeing much of the city.

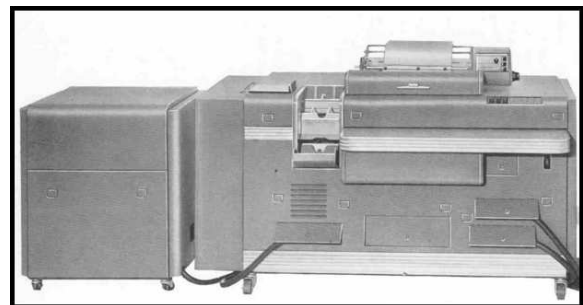
I also made a few trips to the Naval Ordnance Test Station (NOTS) at Inyokern, California on the edge of Death valley. This was where some of the ordnance was actually tested. They had an interesting view about humans and “black boxes,” as computers were called. “Humans are not as efficient as black boxes for certain specific operations, however, they are more easily maintained and may be produced by relatively unskilled labor.”

The flight from Burbank to NOTS was by a DC-3 commuter. Completing his work as ticket agent, the attendant became the luggage handler. Then he appeared on the plane as cabin attendant. No he didn’t fly the plane.

Most of the work I did at NOPI/NAFI was classified: CONFIDENTIAL, SECRET, etc., so I couldn’t take away copies of my papers when I left. My work required that I apply for “Q” clearance which was the level required whenever discussion of “special weapons” came up. This was a Civil Service job and I believe my rating was GS-12 at a salary of about \$7,000 per year when I left NOPI.

At NOPI I applied some of the mathematics I had learned. This included infinite series to approximate functions, differentials to estimate errors and sensitivity in mechanization of functions, and matrix theory. The elementary theory of motion from physics was also involved.

In 1951, calculations were done using electro-mechanical calculating machines. (Frieden and Marchant were manufacturers.) Around 1952 machines like this which could extract square roots became available. This was a major advance. Before they became available, we used Newton’s Method or subtraction of odd integers to find these roots. These calculators were desk top units which displayed the results of computation in a dial. Although these had to be copied down manually, they were a big step up from the slide rule.



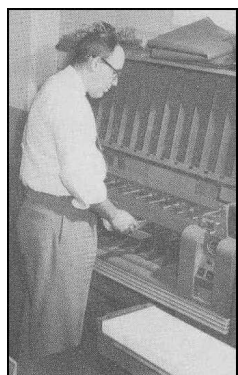
Then came the Card Programmed Calculator. (above)

The CPC was basically a printing device know as a tabulator. Electrically attached to it were one or more storage devices (ours at

NOPI had two). These devices were also electro-mechanical.

Each device held, as I recall, eight banks of ten wheels on axles. The numbers in decimal notation were printed on the perimeters so one could read directly what was stored there. A control panel, wired by the computer programmers of those days, directed the flow of impulses and provided computation of functions such as the trigonometric functions and logarithms. We, the users, wrote our instructions on the famous "IBM Cards." One operation between two numbers was allowed per card. These numbers could be punched on the card directly or the punch could call for a number in storage.

The "program" delivered to the machine operator was a collection of cards appropriately punched with numbers and/or sources. Instructions to the operator were like: "Run the deck with the pink stripe until the number output is less than (some specified value)." This was an early form of what became FORTRAN's LOGICAL IF. "Run the blue deck 51 times" pre-shadowed the "DO." and so forth. These cards, with one operation connecting two numbers, ran through the machine at the rate of 150 cards per minute if there were no jams. Very primitive, but in 1952 and 1953 this was as much of an advance as if we had been transported aboard the Starship Enterprise!



Sorting cards
for the CPC

The first electronic computer came to NOPI about the time I returned to Purdue to work on my Ph.D. On this new computer, which I hadn't used, the program on cards was read into the computer which then performed the computations without supervision. This was known as a Stored Program Calculator. Both of these terminologies have vanished from the computing vocabulary.

All of this was before the development of transistors and the miniaturization which they have made possible.

During the Spring Semester of 1954, I taught a course at night for Butler. The course was Algebra for Business and I was paid \$500 for teaching it.

In March of that year a friend, Bob Gambill, whom I had met while studying at Butler wrote to express his interest coming to work at NOPI. He did so and worked there several years, Our paths

continued to cross as Bob came back to Purdue several years later as I will relate in another Chapter.

Also during the late Spring of 1954, I went on a trip for NOPI to visit the Navy Bureau of Ordnance in Washington, DC, and to visit some researchers at the University of Virginia at Charlottesville, Virginia, on NOPI business. This was Cherry Blossom time in Washington, so we decided to make a family trip of it, combining business with vacation time. The blossoms were a little past their prime, but still quite lovely.

Enroute to Washington, we experienced a bit of history by stopping briefly at the Gettysburg Memorial.

In Washington, we camped in a camp ground on an island in the Potomac River. This was a very crowded site. We had two tents; one for Lou and me and one for Dick and Ted. We just had room for our tents and no more. We couldn't tell if the kids arguing were ours or some in another tent. This did give us a chance to see some of DC. We went to the Smithsonian, Lincoln Memorial and the Capitol Building among the sights of Washington.

Leaving Washington, we drove down the Skyline Drive to Charlottesville. While I visited the university, Lou and the boys toured Montecello, Thomas Jefferson's home. I didn't get to see that until a much later trip. Of course, this was the days before the Interstate Highway System had been built. Therefore, coming back to Indianapolis was an arduous trip with many miles of narrow roads through the mountains.

Toward the end of my tour at NOPI (which may have become NAFL, Naval Avionics Facility, Indianapolis, by that time) in the Summer of 1954, I was working on analyzing the motion of a gyroscope for controlling the direction of an aircraft firing machine guns toward a moving target. With use of rotation matrices to represent the gimbaling system of the instrument I was able to explain anomalies in the motion which the physicists had observed. For this simple work I received the Navy Meritorious Civilian Service Award. The award was dated December 6, 1955 and was signed by R. F. Scott, Capt. USN. (See Pages 255, 256)

My path recrossed with Roger Scott when he completed the RASTP (see next *Professional Life Starts*) and became a Science Counselor and Instructor in the Department of Mathematics and Statistics at Purdue.

During this period I received a bonus from the State of Indiana for my WWII service. (See Pages

197, 198) Records indicate that the amount was \$453.34. The length of service on which this was based does not exactly agree with my count, but I don't remember contesting their figure. Some of that money went for a new nylon dress for Lou. Having been used for parachutes during the war, nylon had not been available for clothing for several years. Nylon provided one of the first "wrinkle free" fabrics for clothing.



Lou in her nylon dress with Dick, Ted and me.

A truce agreement in the Korean War was signed and fighting stopped in July, 1953. I suppose the troops were not sent home immediately, because of the fragile nature of the peace. But by 1954 they were coming home in large numbers. Again this produced a flood of veterans returning to college campuses. The assistant department head at Purdue, Dr. Harold S.F. Jonah, remembered me as a good teacher and cooperative person who had wanted to pursue the Ph.D. He contacted me to see if I wanted to come back to Purdue as an Instructor (the lowest faculty rank.).

My reserve commission had also expired (See Pages 199, 200), so I could resume my graduate studies without concern for being called to active duty.

After a lot of soul searching Lou and I decided that returning to Purdue was the right thing to do.

The decision to return to Purdue having been made, I sought the support of Kaj Nielsen, and was granted a one year leave of absence from NAFI. I did not expect to return after one year, expecting extensions of my leave, but did expect to return eventually. I did work at NAFI during the summers of 1955 and 1956.

I accepted the offer from Ralph Hull on June 3, 1954 and returned to Purdue that Fall.

This meant that we had to find a renter for our house at 1536 E. 73rd Street and find hous-

ing in West Lafayette. It also meant leaving a church that had been important to us for the previous three years. That was the Victory Missionary Baptist Church in Indianapolis. We attended this church during our stay in Indianapolis from 1951 to 1954. We were very active in this church and I taught the adult men's bible class on Sunday morning during part of that time.

The mid 1950s was an era of extreme paranoia with regard to Communism and the Soviet Union. Senator Joseph McCarthy of Wisconsin chaired some investigative committees of which the House Committee on Un-American Activities was the best known. History books will have a lot to say about that organization, so I'll omit further discussion. But the atmosphere created was one in which Loyalty Oaths were required of all sorts of people. Before returning to Purdue, I had to complete President's Office Form 15 as were all "professors, instructors, and teachers in colleges and universities in the State of Indiana supported in whole or in part by public funds . ." We had to sign, in the presence of a Notary Public, an oath which read:

I solemnly swear (or affirm) that I will support the Constitution of the United States of America, the Constitution of the State of Indiana, and the laws of the United States and the State of Indiana, and will, by precept and example, promote respect for the flag and the institutions of the United States and the state of Indiana, reverence for law and order and undivided allegiance to the government of the United States of America."

This oath taking caused me no problem at all, but some objected to it on several grounds. One colleague wrote that he was not sure he could think of "examples" and if he were able to, how could he compel others to listen to them. While my own memory is not clear on this, the local newspaper reported that he was fired for not signing.

In 1954, as in 1948, housing was in short supply. I applied to housing director, Irving Wilson, to live in the FPHA area again. He responded that nothing was available at that time, but would "keep my request on file." When I checked later, they could not find my application. Finally, it turned up in a "completed" file. I asked why it had not been kept in a more active status. The answer was: "I guess we thought our letter settled the matter." A glimpse of the administrative mind.

We found housing in West Lafayette at 120 Sylvia Street. This was a double, converted into four apartments. We had one of the first floor units. The landlord, Francis Cobb also worked in the Chemistry Department. He was a decent landlord. One entered the apartment through our bedroom (which served as my study area as well); this was followed by the living room and, finally, side by side, a bedroom for Dick and Ted and the kitchen/dining room.

Dick had had a most unfortunate year at John Strange School on the near north side of Indi-



The Family in 1954

anapolis. This was the same school my brothers and I had attended in the 1930s. Dick's fourth grade teacher led them to participate in a sort of rhythm band based of clapping wooden blocks. This activity was such an obsession with the teacher that the kids progressed only a few months in academic subjects. Since we were now moving to a new city, we thought it would be a good time for Dick to repeat the fourth grade. The West Lafayette school officials agreed and that was what happened. The schools in West Lafayette were more academically oriented, so he would had a difficult time with the inadequate preparation he had been given.

Ted also started Kindergarten at this time. Both boys attended Morton Elementary School.

My salary as an Instructor in 1954 was \$4000 for the academic year. It wasn't much and the GI Bill benefits were exhausted. Lou was always a good cook and manager, but I remember eating a lot of tuna during that period. Lou prepared it as creamed tuna, served on toast; as a noodle casserole; a rice casserole and as tuna salad.

At 120 Sylvia we learned about Ted's ability to read into something only what it actually said. One evening, while Dick and Ted were in their room studying, we heard a loud argument. Dick finally came out and expressed dismay over Ted's inability to determine how many right angles there were in rectangle and in a square. I asked to see the text. There I found a figure consisting of a vertical segment and at right angles to it a horizontal segment of twice the length of the vertical one. Beneath this figure were the words "Right

Angle." I asked Dick if Ted had claimed there was one right angle in the rectangle and none in the square. Dick said; "Yes, but how did you know that?" I pointed out on the basis of the definition Ted was absolutely correct. The engineer, which Dick became, instinctively knew that translations and rotations didn't change the "right angle" but, logically, he had no basis for that. Ted's instinct was the more logical if not the more useful.

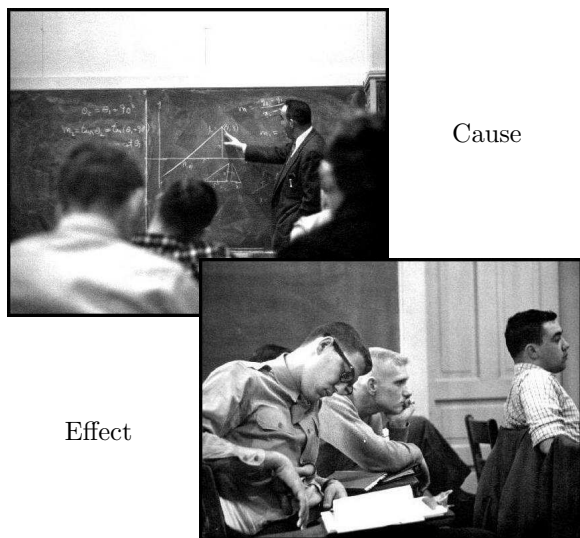
At another time Lou and I both contracted a very debilitating case of influenza. A neighbor and fellow graduate student, Alfred Schmidt, helped us by bringing prepared meals. Al was also a student of Lamberto Cesari.

There may have been as many as a dozen new Instructors at Purdue that Fall. I was the only non-Ph.D. in the group. I don't remember many who were in the group except for long time colleague Christoph J. Nuegebauer. Bob Baer and Nick Kazarinoff were two more. Instructor was the normal starting rank at that time. The Faculty Handbook stated something like: "The rank of Associate professor is the terminal rank for most members of the faculty."

Professor Hull met with us before classes began to emphasize the importance of good teaching. He explained that he or other senior faculty members would visit our classrooms in order to be able to make helpful suggestions. He related 12 points upon which the "senior observer" would be rating us. I have forgotten most of them. Three were: Is the Instructor wearing a neck tie? Does the Instructor have the students working at the chalkboard? Does the Instructor appear to be on the student's side in the struggle against the difficult material? I always thought the last one was worth while. I didn't think much of wearing a tie as a criterion for judging a teacher, but I always wore one! As for having students work on the chalkboard: that was already a practice I had started during my year of teaching at Butler. I'm not sure how effective it is, but it does give the students a moment to move around; sitting for an hour can be very tiresome.

A few days later, Professor Hull climbed to the fourth floor of Purdue Hall to visit my classroom. As soon as I saw him, I sent all my students to the chalkboard. Finally, out of boredom I suppose, he went to the board to work with some of the students. Later I asked him how he liked my class? He said that he had not expected to find anything wrong in my class. I then remarked that I had been embarrassed by an approach that some of the students had been following to one of the

problems. Professor Hull said: “Oh, that’s the way I was showing them to do the problem.”



Cause

Effect

Fourth Floor Purdue Hall - 1954

The University administration in 1954 considered the Mathematics Department to be a service department. Most departments were like that. That is, their primary function was teaching general education courses for students in the traditional “land grant” disciplines: Agriculture and Engineering. In mathematics, there were about a half dozen professors who had done research: the Head, Ralph Hull; Arthur Rosenthal, former Dean of the Faculty at Heidelberg University and a refugee from Hitler; Michael Golomb, from Berlin with a similar reason for being in the U.S.; Howard Hughes, Aubery H. Smith, Merritt Webster, Arthur Trabant, Cleota Fry and a few others who didn’t stay long after I came in 1954. The star of that period was Lamberto Cesari from the University of Pisa. I took courses from all of these except Smith and Fry. Golomb was the best teacher I had and his course “Mathematical Physics” brought all that I studied together into one homogeneous whole. Hughes was solid, but stodgy; Webster pretty much the same. Trabant was inscrutable until I found the book he copied his notes from. Hull was the worst. I always said he spent “six inches” in preparing his lectures. That is, he started thinking what to teach when he reached the door to the classroom and finished when he was through it. This frequently led to an hour fumbling for the proof of a “well-known” theorem, which he thought we should all know. Later, of course, I came to call all these people by their first names except Ralph Hull, who had departed by the time I finished the Ph.D. degree.

A humorous incident involving Hull and fellow graduate student Jack Forbes occurred at a time when Hull was on leave and Jack was sending him material from his dissertation for approval. In one large batch, Hull noted near the beginning that he didn’t like a certain terminology. From time to time, in this batch of writing, the same terminology came up, prompting similar comments. Finally, Hull wrote: “I wish you would stop using this terminology.” Of course, Jack had had no chance to modify it as all occurrences were in the same writing.

Arthur Rosenthal was an interesting person. He had been a student of C.L.F. Lindemann, who proved the transcendence of π . According to contemporary press, he had been Dean of the Faculty at Heidelberg University before coming to the States. Having gotten his degree in 1909, he was a contemporary of many of the great names in the foundations of modern analysis. He often told amusing anecdotes about some of these persons. My great regret is not having recorded any of them. Rosenthal and Golomb were brought to Purdue by William Leake Ayres. Ayres was head of the department in 1941 and later Dean of the School of Science, Education and Humanities.



A. Rosenthal

In 1955 I was one of those who complained about a calculus text we were using. It contained several errors of importance in understanding limit concepts among others. As a result. I was appointed to a committee to select a new book. I was also preparing to take the Qualifying Exams, a preliminary to starting thesis research. Because of my textbook committee work, Arthur Rosenthal, Acting Head (1955-56), thought I should put off these exams until the next semester. Although I felt that I was ready, I acceded to his suggestion. The book we selected was the first of the new approach to calculus instruction, combining the elementary functions and coordinate geometry with calculus. Previously, the freshman year had been Algebra, Trigonometry and Analytic Geometry, with Calculus in the Sophomore year. The new text was by Johnson and Kiokemeister.

I was a little unusual as a graduate student. I was older, a war veteran and returning from a successful, though short, career in applied research. This got me some respect that I probably didn’t merit. Harold Jonah, in his wisdom, saw to it that I was put in an office with Lamberto Cesari. It was then natural that I should choose him to be my major professor and he accepted me. At

that time our office was on the first floor of Purdue Hall. In 1964 Purdue Hall was razed to make way for the new Mathematics Building.

There was a great shortage of space for the Mathematics Department. Most people were in the Recitation Building, but others were scattered around the campus. The fourth floor of the Recitation Building had, in an earlier era, provided hand ball courts and showers for the faculty. By the 1950s these were no longer used and the space was converted to windowless offices. Cesari and I were moved to an office thus created which we shared with Lincoln Turner, another of Cesari's students.

One night, during an electrical storm while Cesari and I were working, the lights failed and Cesari and I had to feel our way to the steps to leave the building. There were no emergency lights at that time.

My fellow graduate students told me Lamberto considered me "the big man from Industry." He wanted me to call him Lamberto from the start. I couldn't do that. With his guidance I did finish my course work and the research for and writing of my Ph.D. dissertation. After the final exam over my dissertation, he asked: "Now will you call me Lamberto?" I did.

Lamberto was very enthusiastic about our work. He always exhibited great tenacity about everything, if not finesse. He often thumped the desk and said: "Bill, if we don't prove these theorems, nobody will!" He referred to our background in the field, but it could have meant something else.

I completed the work for the Ph.D. in August, 1957. (See Page 252) My thesis topic was "Existence theorems for periodic solutions of systems of differential and differential-difference equations." The final examining committee consisted of Professors Lamberto Cesari, Michael Golomb, Howard K. Hughes, E. Arthur Trabant, and Calvin R. Putnam. This committee was appointed by Professor Carl F. Kossack on July 14, 1957.

As a humorous note on the defense of my dissertation there is this. After I had talked about my thesis for about a hour and three quarters of a two hour period, the thought occurred to me: "The time is almost up. what can they do to me now?". One member of my committee did note that I misspelled "Lebesgue" as "Lesbeque."

I had taken a leave of absence from NAFI, when I returned to graduate study, in the fall of 1954. I returned to NAFI to work during the in-

tervening summers until I completed the Ph.D. degree in 1957. It was during one of those summers that I did the work for which I received the Meritorious Civilian Service Award. In 1957 I resigned from NAFI to accept a position as Assistant to the Head of the renamed Department Mathematics and Statistics at Purdue University.

We had rented 1536 East 73rd Street to a couple. They had trouble keeping up the rent payments. This made me pretty sure I didn't want to be a landlord. The husband of this couple was killed in an automobile accident. His wife collected the insurance, paid the back rent and moved out. We continued to rent the house until 1964 when we engaged Mrs. Gambill, Bob's mother, to sell it for us. We then liquidated the rest of our indebtedness to Herb Bailey.

Others who studied for the Ph.D. while I was there include: Bob Gambill, Jack Hale, Ralph Niemann, Jack Forbes and Walt Wood. All had successful careers. Jacl's was great academically; Walt did well as a technical entrepreneur.

Bob later returned to Purdue where, in addition to mentoring several Ph.D. students, he was a valuable member of the department administration.

Jack Forbes ended up at one of Purdue's Regional Campuses and wrote several successful high school text books.

Ralph Niemann and his wife Lois became and remain close friends. Ralph was ahead of me in graduate studies, but was delayed by being called up for duty during the Korean War. Ralph combined teaching with a successful venture at raising Black Angus cattle near Fort Collins, Colorado. I was fortunate to be asked on several summers, to lecture to Ralph's Institutes for teachers. We enjoyed Colorado very.

Walt asked me on a couple of occasions to join him in his consulting business. I declined. I guess I didn't have the nerve; the university provided a more secure environment.

While living in FPHA 213-3, Lou typed an Algebra book for Professor M. Wiles Keller. This had to be typed, error free, on camera ready forms. She typed it on her old portable typewriter without a tab key. She recalls that she was paid 25 cents per page for this job.

At 120 Sylvia, Lou worked for two biology professors. Charles Porter worked on preventing molds and fungi on plants. Richard Armacost directed biology students preparing for teaching careers.

During these years, we again attended the

Baptist Bible Union. In all these experiences with Baptists, and especially at the BBU, I became more and more put off by the attitude that if one didn't completely agree with theology of that local church, one was a heretic. After the BBU closed its doors a few years later, I no longer participated actively in any church although attendance continued to be part of our life.

This phase of life concluded with a trip to Pennsylvania State University to deliver a paper on my thesis at the Summer Meeting of the American Mathematical Society. We, along with several other math families, camped in nearby Black

Moshanon State Park. We took Lou's mother with us and dropped her off near Butler Pennsylvania to visit some of her relatives. On the return trip, we drove non-stop from Butler to Moline, dropped off Lou's mother and drove to West Lafayette.

I was about to enter a new phase of my life - which I describe in the Chapter *Professional Life Starts*. Because I was to have a higher salary, we rented a slightly larger apartment at 118 Sylvania Street. This was in the same converted house. We also bought our first TV, Black and White, of course.