As fate would have it, this spring brought forth a flurry of inquiries about my early professional endeavors, including my recollections of some of the scenarios and players from that era. One of these was a taped interview for the archives of the American Neurological Association, for which I had cause to review my life in the 1960’s at the Durham, N.C., VA Hospital and the Bascom Palmer Eye Institute in Miami, Florida. Another review was requested by Drs. Lawrence Yannuzzi and David Guyer, who asked me to share with them some of the pictures and experiences at the time of our first trials of infrared fundus angiography in animals and man using indocyanine green dye.

Then I spoke at a reception honoring Dr. Albert Heyman at the American Academy of Neurology meeting in Washington, D.C. That memory search brought back reveries of our earliest collaboration, courtesy of Drs. Novotny and Alvis, and the jocular supervision of Leonard Hart, your mentor in obtaining the first fluorescein fundus photographs in Durham, probably the second success after Dr. John Hickam’s group in Indiana. It was his talk and slide presentation that excited Dr. Heyman to organize our attempts to duplicate their technique.

So here I go on fluorescein. For the most part I must rely on personal recollections. I really have no idea of the length of document you desire, I shall try to be thorough (and outrageous when appropriate) and leave to you the editing, deleting and expurgation of the manuscript as you see fit.

As I have already mentioned, it was Al Heyman’s initiative that caused us to take up where the investigators in Indiana left off. It was 1961: Al had returned from a sabattical in England, lusting after some new gimmick to explore at the Durham, VA. Then came his former colleague, John Hickam, now chairman of the medical department at Indiana, to tell us how two students working in his laboratory one summer were following his suggestions for obtaining fundus angiograms. A safe fluorescing dye was available, but such particulars as the appropriate color filters at the light source and film gate had not been worked out. Indeed, the students, Novotny and Alvis installed a water bath at the light source and varied blueness by adding copper sulfate crystals. Hickam described his dismay when he returned to the lab to find the parts of the stripped Zeiss fundus camera lying about, presaging a similar experience of our own. But his boys came through with the method.

Dr. Hickam was a pulmonologist searching for a technique of estimating blood gas concentrations in the retinal vessels, and correlating these with regulation of the retinal circulation. He had long been interested in this vascular bed as a visible segment of the cerebral vessels. What he and his students achieved at the time was beautiful definition of minute details of the retinal vessels. I do not believe his group carried the fluorescein method any further at the time.

**Figure 1:** Leonard M. Hart and Dr. Noble J. David performing fluorescein angiography on a patient using the modified B&L fundus camera (1961). Leonard is now an Honorary Life Member of our society.
Meanwhile, Dr. J. Lawton Smith had told me that Dr. A. Edward Maumenee had used fluorescein to see lesions such as choroidal hemangiomas with the direct ophthalmoscope, using a cobalt filter. From there came the idea of measuring simultaneously the arm-to-retina fluorescein appearance times. Given a cooperative patient, Dr. Yoshio Saito and I would each be scooping one of the patient’s eyes as a third person injected the dye. We were trying to detect delay in appearance of the dye on the side of carotid stenosis or obstruction. Although we found a few positive results and enjoyed watching the dye course through the retinal vessels, the technique never gained widespread clinical use.

At Al Heyman’s instigation and with information supplied by Dr. Hickam, Leonard Hart had adapted his Bausch & Lomb fundus camera to take fluorescein photos. Leonard had previously adapted this carbon-arc fundus camera with an electronic flash tube and power supply that was furnished by his friend, the founder of Speedotron.

I was interested in swelling of the optic nerve head, especially to see if his method would help us to distinguish papilledema due to increased intracranial pressure from inflammatory and ischemic optic neuropathy. I was also trying to learn about obstructive arterial disease in retinal arterioles, the circulatory changes associated with Hollenhorst plaques and the like. Then there were occasional attempts at physiologic studies.

Perhaps you remember the patient I studied before and after inflating a cuff around his neck. I think you knew him when you were both in an orphanage near Kinston, N.C... As I remember, he was a prisoner who begged me to keep him for further studies. One day the sheriff had enough of our science and trundled Freddy back to the hoosegow! Our physiologic studies were severely disadvantaged by the slow recycling time of the electronic power supply which powered the camera’s strobe light (8-10 seconds).

Kodak was tepid about our description of what we were doing and balked at giving me the information I needed about their Wratten gelatin filters. I was obliged to take these to our physics department at Duke University to have the spectral transmission characteristics charted. Nor did the technique excite much interest in the department of medicine. In fact, a friend told me that Dr. Eugene Stead expunged the section of an omnibus grant request that asked support for further studies with this technique. Of the ophthalmologists, only J. Lawton Smith seemed to grasp its potential. And it was mostly through his insistence that I and then later you were brought to Miami to start it up. It was my original plan upon leaving Duke to go into the private practice of neurology in Jacksonville, Florida, my hometown. Lawton was determined otherwise. He wanted me to go to the Bascom Palmer Eye Institute in Miami to set up fluorescein and collaborate with him in neuro-ophthalmology. Initially I was unimpressed, but he kept getting Dr. Edward W. Norton to up the ante—when it got to 25 G’s I told them I would try it for a year. By the time Lawton and I came to Miami in the fall of 1962, Leonard Hart at the Durham VA Hospital had adapted a B&L binocular ophthalmoscope with a headlight bulb to take movies in dogs.

I do recall that when Leonard Hart allowed you to take your very first fluorescein that it was very good indeed and in perfect focus. Apparently, Leonard did not properly impress upon you the importance of focusing in the eyepiece setting prior to studying a group of patients that we scheduled a few days later. I also recall that I was very upset because every one of the studies performed that day were completely out of focus due to an improper eyepiece setting and were of no clinical value whatsoever. I understand that the quality of your angiograms have been consistently in focus since the "chewing out" that I put upon you that day.

Once in Miami I was very busy, busy, busy. There was virtually no neurology service; my job was to create one. For the first time I was also seeing private patients—in the rare book room of the Bascom Palmer Eye Institute library, where I also practiced my cello. What time I had left was to set up fluorescein fundus angiography.
The only fundus camera at the Bascom Palmer Eye Institute (for all I knew the only one in Miami) did not belong the Eye department, but had been smuggled into Miami piece by piece by Dr. Olga Ferrer with her luggage and personal belongings when she left Havana, Cuba. Al Weinberg, who was Leonard’s counterpart at the medical photography service at the Coral Gables, Florida VA Hospital helped me to collect the appropriate Kodak Wratten filters. We were in the backroom with the camera dismantled when Olga came in. She was horrified.

“What are you doing to my camera?” she asked.

“Don’t worry Olga, you are going to love this camera when we get through,” I said. I tried one patient and got contrast but poor focus (never having taken one before. Same eyepiece problem that you had.) When you came down from Durham a couple of weeks later, your fluorescein photos sent Dr. Norton into a frenzy. He was in that moment transformed into a fluorescein enthusiast. Several of us began writing NIH grants, looking for disorders to study and using the instrument to study just about each patient who appeared with almost any type of retinal disease.

Dr. J. Donald M. Gass arrived in Miami, and along with Dr. Norton and other investigators at the Bascom Palmer Eye Institute, such as Drs. J. Lawton Smith, Victor T. Curtin and Raymond J. Sever, began to unravel the mysteries of the retina and choroid utilizing your angiograms, and the rest, as they say, is history which in its successive phases is a tale of some humor and irony.

Once we had employed the filters and film which would yield good contrast and definition, we wanted a system which would allow pictures at closer intervals than one every 14 seconds (you would hear the power pack click when ready—is it still that way?) At that time Zeiss did not think that the xenon bulb would withstand one per second flashing, and did not seem interested in undertaking modifications. Enter Eastern Airlines.

Someone found Bob Bussey, who was an electrical engineer with Eastern. At our request, he built a unit which could be hooked up to the Zeiss power supply and would supply the flash for photos at the desired speed—about one per second. It quickly became obvious that advancing the film manually and without a rapid wind lever was frantic and distracting along with producing callouses on the thumb and forefinger. EAL came to the rescue again. Bob Bussey recruited Perry Herzeg, a mechanical engineer from the airline, to adapt the camera mount to a motor driven Nikon SP camera back, which smoothly and rapidly rolled the film into place—provided the batteries and connectors were all working properly. With these modifications, the Bascom Palmer Eye Institute had the workhorse that set the standard for years to come. To review briefly, lone technicians working in garages adapted a fundus camera smuggled in from a third world country into a state-of-the-art instrument! How’s that for modern science and American ingenuity?

Similar attempts to build into the system an internal timer which would record on film the exact time it was taken proved to be more frustrating. I forget the name of the German engineer who slapped that square tube along the barrel of the camera; it was a mess. I understand that problem has been resolved with later instrumentation by the Japanese optical companies and later by Zeiss.

At my request Perry Herzeg applied his talents to the problem of taking 35mm movies in the monkeys. Once again we jury-rigged with whatever materials were available, not being able to afford new high-priced equipment. He adapted the Zeiss fundus camera to take on its camera mount a 35mm wind up movie camera, which had been taken from the wing of a WWII fighter plane. At sixteen frames per second we had to use continuous illumination from a xenon arc bulb which was focused by means of an ingenious double eccentric mount which Perry had devised. This was the instrument I used in the experiments done with Drs. Steve Kulvin and Henry Ring on experimental retinal clot and air embolism.

The last technologic experiment for me was the collaboration with Earl Choromokos and Dr. Kyuya Kogure using indocyanine green and infrared sensitive film. I understand that the details of this endeavor is covered in another article in this publication. I also understand that nowadays TV amplification of ICG in the choroidal vessels allows contrast visualization, a means to which ICG had been adapted.

Finally I collaborated with Drs. Marcos Tsacopolous and Gerard Eperon in physiologic studies of the effects of oxygen and carbon dioxide on the retinal circulation. It is curious that the purpose for which Dr. Hickam had originally conceived the method was the last major study I undertook.

That’s about it, Johnny. By the mid-1970’s it had become very difficult to find competent English-speak-
ing fellows. Space was limited and vied for. I still had
to see my patients, teach and administer the VA neu-
rology service. Although the work itself was supported
by grants from the VA and NCH, I never got any salary
support. I figured it was time to move on to other things.
But it was exciting and fun to be a part of this phase of
medical research.

Before closing it is only fitting to say that all these
experiments and studies depended heavily on the oph-
thalmic photographer, of which you must serve as the
prototype. The later efforts of Earl Choromokos, Dixie
Sparks Gilbert, Geer McKee, Mel Johnson—I ask all of
you to accept my bleated thanks for the successes all of
us at the Bascom Palmer Eye Institute enjoyed. It
would not have been possible without your performance
in that role.

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Figure 5: Dr. J. Donald M. Gass (1967) is an Honorary Life Member
of the OPS.