

# IN VIVO

Newsletter of the University of Tennessee Division of Biology

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JUNE - JULY 2002

## From the Director

By Dr. John Koontz



Friends and Colleagues:

The Division is experiencing turnover not only with the retirement of senior faculty and hiring new faculty to replace them but also in its departmental leadership. Two of the four department heads in the Division are stepping down from their positions as Head.

**Dr. Tom Hallam** has been the Head of Ecology and Evolutionary Biology for the past four years. He assumed this position shortly after the initial founding of the department. Tom was originally in the Department of Mathematics when in 1996, a group of four faculty members in Mathematics, working collectively in a group

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## Laboratories bring Microbiology to life

Crucial to the success of recruiting majors to Microbiology are the laboratories that give students a hands-on look at their future. Housed in the new Neyland Biology Annex (NBA) is laboratory space designated for use by Microbiology and organized by a small, but dedicated staff.

The Microbiology laboratories are used to teach non-majors, majors, Nutrition, Pre-Veterinarian, and Pre-Pharmacy students. The space is organized into four wet laboratories, two of which are dedicated to majors students, three preparation rooms, and refrigeration units placed throughout the area.

The students meet in these laboratories for three hours twice a week. They are asked to perform a myriad of tests on a bacterial sample and identify it. The bacteria used for these tests are classified as a bio safety level two and include *Escherichia Coli* and *staphylococcus aureus*.

The students are instructed to determine the biochemical aspects of the sample and also examine its morphology and gram stain characteristics. On average the students will see five to seven different organisms each week. Additionally, students study bacterial viruses, microbial ecology, medically significant microorganisms, and interactions of microorganisms with

anti-microbial substances.

The equipment for the laboratories has seen a recent overhaul with a \$55,000 grant from the College of Arts and Sciences. With this money new items were purchased such as microscopes, refrigerators, vortex mixers, scanners, water baths and a thermocycler.

Making sure that everything runs smooth is a capable staff supervised by **Elizabeth McPherson**. She is a native of Ohio and received her bachelor's degree in Microbiology from Miami University in Oxford, Ohio. She received her master's degree in 1993 from UT



**Elizabeth preparing samples**

and worked in **Dr. Robert Moore's** lab where she met her husband, **Jackson McPherson**. Elizabeth left UT for a short time to work at Miles Pharmaceutical in Connecticut, but preferred academic life over industry, so she returned to UT.

Elizabeth supervises the graduate students that lead the laboratories and

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## From the Head by Dr. Robert Moore

Last year I commented on the excitement generated by our new faculty members. **Drs. Wilhelm, Small and Urbach** are continuing as they started with enthusiasm, energy and fresh ideas.

In addition, we are in the final process of recruiting two new assistant professors with interests in immunology and virology. The candidates we have identified have excellent potential as instructors for our undergraduate and graduate courses and have interests that will complement those of current faculty in the department and division.



**Carole Vosdingh, Dr. Moore, and Paula Rutherford**

Plans for the near future include searching to hire two additional new faculty, which will bring the total to seven in as many years. A dramatic change of this magnitude is rare in academics and bodes well for the future of this department and for Microbiology as a discipline at this university.

Another exceptionally interesting observation I want to pass-along is the rapidly changing enrollment in our undergraduate program. During the 80's, we consistently averaged 40 majors in the old Microbiology B.S. program. With the introduction of a single Biology B.S. degree with concentrations in the mid 90's, Microbiology "majors" increased to 60 to 75 per year. This past year we experienced a dramatic increase in students in the Microbiology concentration.

Based on enrollments in a few

critical courses, the indications are our "majors" will approach or exceed 100 students next academic year. The curriculum for our concentration is difficult, which, to me, indicates that our instructors and courses are recognized for the quality we strive to maintain. The department's undergraduate major is rapidly reaching the size of the larger quality programs in the nation.

The positive changes, however, are tempered by the uncertainties of State funding. The established, senior faculty in this department are uniformly successful and recognized for their accomplishments at both national and international levels. Success in times of uncertainty leads to vulnerability, and this year we lost three of our established faculty (**Drs. Hacker, Stacey, and Zaghouni**) who made well-deserved, upward moves to other

institutions. So, at a time when class enrollment is increasing, our "teaching power" is diminishing. The new faculty will help to restore a balance, but not put us ahead of our teaching needs.

This past year the deficit was very ably met by staff professionals and research faculty in the department. These individuals include our instructional laboratory supervisor, **Elizabeth McPherson**, and **Drs. Kim Nixon, Alice Layton, Jim Fleming, Steve Ripp, and Neil Quigley**.

Simply put, we could not have offered our courses without their help. This coming year, we will call again on these extraordinary people to help us through the transition as our new faculty come on board.

Over the past year, I have received numerous messages from former students. Please continue to write. Your messages are important as well as enjoyable.

## Microbiology

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**DIRECTOR, Continued from page 1**

known as the Math Ecologists, sought to become part of Ecology and Evolutionary Biology. Within two years he became the new Head of that department.

Under his leadership the department has flourished. In 1998 the department underwent a review of all of its activities. At that time it was recognized as having excellent research faculty. However, there was still a lot of work to be done as a consequence of the fact that it was basically a new department. Early this spring a follow-up review was conducted and the department came through with flying colors in virtually every area. Perhaps the most dramatic turn around involved the graduate students in the department. The review team was particularly impressed with the turnaround in the attitudes and sense of belonging expressed toward the department by the graduate students.

The reviewers, those from both inside and outside the university, attributed this great success to Tom Hallam's leadership. Tom has fostered a sense of community and collegiality among all the faculty members, graduate students and staff in the department. He has provided everyone a voice by listening to comments or suggestions about departmental activities.

He is firm, decisive and cares deeply for all those he serves. He is passionate in working tirelessly on their behalf. Fortunately, the department has a number of high quality faculty members who could assume the headship. And fortunately for whomever assumes that position, Tom will still be on the faculty and available to provide moral support and advice.

**Dr. Robert N. "Buddy" Moore** has been head of Microbiology for the past six years. He assumed this position following the retirement of **Dr. Dwayne Savage**. Buddy came to

UT as an Assistant Professor in Microbiology in 1981 and worked his way through the academic ranks, running a productive and well-funded research program and developing a reputation as a good teacher.

One of his major challenges upon becoming department head involved the College of Veterinary Medicine (CVM). The Microbiology department serves not only the College of Arts and Sciences but also the CVM. Buddy has been instrumental in reestablishing better relations with the CVM. He has been an active and contributing member of the CVM Dean's Executive Council and is playing a lead role in advising the CVM Dean on matters of research. The department and the CVM have both benefited from the effort Buddy has invested in building this relationship.

At the same time he has been very protective of the faculty in the Microbiology department. The department has suffered several setbacks recently as established, well-funded faculty have left the university for faculty positions elsewhere. In each instance, the person leaving was seeking to improve their situation. However, their leaving created difficulties in staffing the courses offered in the department.

Buddy has helped by taking on a heavier teaching load himself rather than assigning all of those courses to other, very research active faculty. At the same time he is vigorously pursuing recruitment of new faculty. Whoever assumes this position will face a difficult challenge at a time when the need for capable leadership across the university has never been greater.

As I reflect on the changing leadership just discussed I feel compelled to make a few comments about the role of a department head. It is the most important administrative position at a university. The department head, or chair, sits at the interface between the faculty and the Dean

of the college. They must have the credibility of significant scholarly activity and of making a real commitment to teaching in order to have the respect of the faculty and students.

**"It is the most important administrative position at a university."**

They serve the faculty, staff and students of the department. Their primary function is to manage the resources allotted to the department in a manner that facilitates and enhances the teaching and research activities of the faculty and students. They must involve these same individuals in the decision making process and provide a forum for input into and feedback on decisions that are made. At the same time they must be able to persuasively communicate the needs of the department to the Dean in a manner that will benefit the department.

They must be accountable in all of this. In most cases they are still trying to maintain an active research program and are teaching. The demands on their time are inordinate as they nurture, cajole, exhort, counsel and empathize with faculty and students, respond to next day deadlines from the administration, argue with the Dean for more resources, prepare for their next lecture or write their next exam, and find time to guide the graduate or undergraduate students working under their tutelage. No other rank at the university has a more immediate understanding of the challenges of the daily execution of the university missions of teaching, research and service.

My personal thanks go to both Tom Hallam and Buddy Moore for selflessly investing themselves in striving to meet the demands of this position.



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## A model think tank

“Most of the problems we (scientists) work on will never be solved by any one discipline.” It’s this interdisciplinary thinking that Distinguished Scientist, **Dr. Gary Saylor**, of the Center for Environmental Biotechnology (CEB) is best known for.



The CEB is a Research Center of Excellence that was founded in 1986 with a \$1 million dollar equipment grant. It now covers 26,000 square feet of space; receives grant money from over 10 different agencies and corporations; is staffed by over 47 faculty and staff from various UT departments and ORNL; and supports over 45 graduate students.

At the core of the center is the philosophy of melding together biology with technology to work in any environment. Bringing together faculty from such departments as Agricultural Engineering, BCMB, Chemistry, Civil and Environmental Engineering, Comparative Medicine, Electrical Engineering, Chemical Engineering Geological Sciences, Microbiology, Physics, and Social Work takes a great deal of teamwork.

Dr. Saylor said, “One of the first things we have to do is learn how to communicate because everyone has their own jargon. There’s a degree of almost a foreign language requirement.”

The center is divided into four areas:

### BioMicroElectronics and Nanotechnologies

This area is where Dr. Saylor does most of his research along with **Dr. Michael Simpson** of ORNL. The

work involves a patented, hybrid chip where a microbe is physically placed on a microchip. “We modify the microbe to recognize the chemical or whatever we want to analyze in the environment, then the microbe can talk directly to the chip and the chip can tell us what the microbe found,” said Dr. Saylor. Work is currently being done for NASA to design a prototype device that will be used in future space stations.

The technology is not confined to any one use. For example, work with an NIH grant should develop an implant device to sense glucose in diabetic patients. This device will either be embedded with radio frequency telemetry to transmit data or interface with an insulin pump that will automatically deliver insulin to the patient. As Dr. Saylor said, “We have a fairly broad definition of *environment*.”

### BioEnvironmental Systems

This area of the CEB operates in a more traditional manner that represents where the center started 16 years ago. The scientists study biological agents to see how they interact with their physical/chemical environment. Work is still conducted on the molecular level, but it is applied throughout the environment being studied.

For example, a study being coordinated by **Dr. Larry McKay** of Geological Sciences and **Dr. John Sanseverino** of Microbiology focus on the transport, biodegradation and exposure of contaminants in soils and groundwater at Chattanooga Creek in Chattanooga.

### BioTechnical Applications

Living organisms are used in this research area, but the ultimate application has environmental overtones. For example, **Dr. Tanya Kuritz** of ORNL seeks to use microorganisms to make chemicals that would be a replacement process for petroleum-derived chemical technology. “The point being you get

microbes to make the same chemicals that you normally make from petroleum,” said Dr. Saylor. Not only would this process be cleaner, it would go a long way to achieving environmental sustainability.

Similarly, scientists at ORNL are working with pieces of the photosynthetic apparatus that could potentially be used for hydrogen production and could spur our country toward a hydrogen fuel economy.

### BioAnalytical

The Chemistry department founded this area by offering their expertise in developing new instruments and analytical technology that can be applied to biotechnology or the environment. While helping the center, this also gave Chemistry faculty a new outlet and new targets for their work. For example, **Dr. Robert Compton** works on laser technology and can now apply those techniques to the study of atmospheric pollution issues.

**“We have a fairly broad definition of *environment*”**

### The Unfunded Mandate

Although Dr. Saylor is very proud of the graduates they produce, he is concerned about the center’s ability to reach out to the K-12 students in the East Tennessee area. Because the CEB was not fully funded as originally proposed, Dr. Saylor has been working hard to find funding from other sources.

Dr. Saylor sees their work as giving students “an opportunity to step into a whole new lifestyle both in terms of how they choose their careers and how much they can make in their careers. I think the people of East Tennessee should know that a Ph.D. gets you a lot more than a tip of the hat. Let’s get our own people trained to make those six-figure salaries and maybe keep some of that wealth in the state of Tennessee.”



## Laboring in the field of discovery

What began as a desire to work as a veterinarian with farm animals has become a career-long quest in virology. **Dr. David Brian** grew up on a farm in Michigan and received his D.V.M. at Michigan State University (MSU) in 1969. However, before attending veterinary school he spent two years at a high school in Indiana teaching science while his wife completed her degree. This detour in his plans was the catalyst that ultimately brought him to UT as a professor of virology.

He soon discovered that in addition to his long-standing love for pure science, he loved to teach. Even though he had the diploma in hand, he never practiced as a veterinarian. He went on to receive his Ph.D. in 1974 in Microbiology at MSU and particularly enjoyed lectures by the professors who were active in research. All of the pieces fell together and pointed him to UT, where he joined the faculty in 1976. Dr. Brian said, "If you teach or practice full-time it's impossible to investigate the biomedical questions that still need answers." He now feels privileged to have the best of both worlds. He teaches virology to veterinary students and labors on an NIH grant that has recently been renewed through its 24<sup>th</sup> year (2006).

The focus of Dr. Brian's research is the mechanisms of RNA replication and regulation of gene expression for the coronavirus. This virus family can be found in most domestic animals as well as humans. It is spread through the air and is impossible to avoid. In animals the respiratory problems and diarrhea associated with the virus are often fatal because it affects primarily neonates.

From a veterinary medical point of view, this is a serious problem. Vaccinations have not been effective because it is difficult to vaccinate a newborn and the virus strikes soon after birth. In-utero vaccines are in the experimental stage, but according to

Dr. Brian, have so far not shown practical usefulness. As mentioned earlier, the coronavirus is not confined to animals alone. While fatal to many animals the coronavirus in humans expresses itself as the common cold. In fact, it is the cause of ten to 15 percent of common colds and upper respiratory infections.

However, current research is pointing to other, more serious problems. There is a possible connection between this virus and Multiple Sclerosis (MS). Experiments on mice have shown a link between the virus and demyelinating encephalitis, which has a pattern similar to MS. And while



there are many viruses implicated as a cause of MS, coronavirus could be one. This virus is also thought to contribute to the mortality of children with asthma, but the links between humans and coronavirus for diseases other than the common cold remain to be fully investigated.

These are the implications of Dr. Brian's work. He said, "We are studying the details of the replication of the coronavirus with the long view that some form of therapeutic blocking agent will be designed in the future" that will benefit both humans and animals.

The coronavirus, like the majority of viruses that infect animals and humans, has a genome of RNA not DNA. The genome, furthermore, has many features of a cellular messenger RNA. The coronavirus is unusual in that it has the largest RNA genome of

any known virus. One event that is perplexing Dr. Brian is that when the messenger RNAs for the virus are produced there is a mandatory RNA recombination step somehow signaled by the virus machinery. Only one other virus family shows this phenomenon. "The cells in which the virus replicates are full of cellular messenger RNAs, but the messages of the cell don't get replicated, so there is something telling the viral RNA replicating enzyme to bind the viral genome and replicate it or to transcribe it, but not the messenger RNA of the host cell. This is a very specific set of instructions that we are trying to decipher," Dr. Brian said.

In the laboratory Dr. Brian and his staff synthesize the RNA and allow it to make its secondary structures, then incubate it, and watch as a proteins from the infected cells bind with the RNA structures. Since they do not know which proteins these are, collaborators at the ORNL faculty will be using mass spectrometry in an attempt to identify them. From this they hope to characterize the complex of proteins that is binding and replicating the viral RNA.

For 20 years Dr. Brian's has studied the coronavirus and has one of only a few laboratories like it in the world. Among other tools in his laboratory, Dr. Brian and his staff use polymerase chain reaction-based site-directed mutagenesis of viral genes, and viral gene expression systems. He is aided by a post-doctoral associate, **Dr. Kimberly Nixon**; Ph.D. students **Gwyn Williams**, **Charmila Raman**, and **Hung-Yi Wu**, D.V.M.; and a master's student, **Carry Gay Brown**.

Dr. Brian's story is similar to many professors in the Division of Biology. He started with a simple goal and at some point in time followed another path to strive to give closure to the "questions that still need answers."



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## Rolling with the changes

In order for research to continue to develop, support technologies must also grow and change. **Ron Johnson**, Computer Systems Specialist and manager of BioComputing, knows this phenomenon first hand. For although he started his career in instrumentation, his experiences at UT have helped steer him toward computers.



**Aaron Reynolds, Denise Beach  
and Ron Johnson**

Ron is a native East Tennessean from Powder Springs. After receiving his degree in industrial electronics from Knoxville Adult Education School in 1975, he came to work for UT in the Chemical, Polymer, and Metallurgy department (Materials Science) of the College of Engineering. The technology needs of the day had Ron assembling custom-designed instruments for the research scientists. As time went on, he moved to the senior level and was designing and building prototype instrumentation and training entry-level Engineering Technicians for the field.

However, in the late 1980's instrumentation in research laboratories changed with the advent of personal computers. No longer were scientists required to spend an entire day manually controlling an instrument. Ron was drawn into this world of computers and began writing individualized programs for the researchers. He also became certified for various lab and analytical instrumentation.

By the 1990's, Ron left building instruments and began to focus his

attention on the process-automation field and UNIX systems. Windows NT came to UT via a technology lab fee and the College of Engineering needed to retool its laboratories. Ron was pulled from the department level and reassigned to install several new computer laboratories throughout the College.

During this time he also worked with

the engineering research centers providing technical and administrative expertise and also providing administrative support for grants from the Department of Energy (DOE) and Department of Defense (DOD). Ron used his instrumentation background to aid a DOE grant that focused

on high residual radiation areas that require constant monitoring. He helped develop robotic vehicles equipped with digital imaging, laser range finding, x-ray, chemical, and radiation sensors to monitor such places as the "Hanford Tunnel" at DOE's Hanford Nuclear facility.

Participating in a DOD grant, he helped develop miniature robots that carry various sensors to be deployed over the battlefield by cruise missiles. The smart-sensors are designed to be spread across a battlefield. When activated, the devices relay position, chemical, biological, visual, and radiation data to a rear area command center where the data is used to recreate a complete image of battlefield conditions.

Ron also worked for a high temperature melt laboratory developing single-crystal alloys for NASA and the Air Force. These alloys are used in the fabrication of rocket engines and in space shuttle blast cones. They are also used for jet engine components requiring extreme high temperature strength.

By the late 1990's Ron was ready to focus on networking infrastructure and saw an opportunity with the

Division of Biology. Ron is currently working to coordinate the use of Windows, Macintosh, Sun (Solaris), and Silicon Graphics Systems. He is implementing core UNIX technologies that will allow researchers in the Division to share applications across the various platforms and access them from their own offices and laboratories. The new implementation will centralize data storage and serve both commercial and custom applications to workstations throughout the Division. The target of the design is to provide application and data access to more of our scientists while improving cost effectiveness and maintenance.

Ron feels BioComputing could be enhanced with additional staff. **Aaron Reynolds** and **Denise Beach** provide day-to-day customer support for hardware and software, but they are overwhelmed most days. Ron often finds himself pulled to help with individual problems while at the same time he feels he needs to devote more time to network infrastructure, server administration and UNIX projects.

Whether in Engineering or Life Sciences, the research produced is only as good as the technology that supports it. Ron has had to re-educate himself over the years to keep current with these changes, not only to remain a viable employee, but also out of enthusiasm for the research being done here at UT.



### In Vivo

An alumni newsletter published by the  
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## Alumni News

**Cathy Wilson Gurley** completed her Microbiology degree in 1982. After graduating, she moved back to Memphis and went to work at St. Jude in the Department of Immunology for ten years before getting married and moving to Little Rock, AR with her husband, **Bill Gurley**. Her research is focused on immunochemistry, spinal cord injury and most recently, the IL-1 response in muscle to exercise.

**Mary Miller, Ph.D.** graduated from the Microbiology department in 1990, she then received her Ph.D. in Microbiology from the University of Virginia. She carried out her post-doctoral studies at the Rockefeller University in New York, NY where she studied (and continues to study) the spatial regulation of G1 cyclins (proteins that regulate cell division). In 2001 she accepted an Assistant Professor position at Rhodes College in Memphis where she continues her work. She says, "It is great to be close to home again!!!"

**Roel Funke, Ph.D.** received his undergraduate degree in 1988 in Zoology from **Dr. Larry Rome's** laboratory, then completed his Ph.D. with **Dr. Peter Gresshoff** at OHLI in 1995. He was a post-doctoral student at the University of Nebraska then moved to the Genome Center at Whitehead Institute at MIT and worked on the Human Genome Project. He now works for Exelixis, Inc. in San Francisco, Calif. using model-system genetics to discover new cancer-related genes in fruit flies and worms.

**Henry Ahn** graduated in 1998 with a master's degree from BCMB. He then received his MBA at Rice University in Houston, TX. He is currently work as a technology-licensing associate at Upstate Biotechnology, Inc. in New York City.

**Paul Pruett** completed his degree in 2000 from BCMB. He will soon begin his third year at Emory University Medical School. He will also marry **Sarah Trotman** this summer. While in medical school, he has conducted research on the insulin receptor and its role in growth promotion. He passes along a special thank you to **Dr. Neil Greenberg** of the Threshold Program. Paul said, "It was an educational experience that will not soon be forgotten."

**Melanie (Powell) Finnegan** received her masters in Microbiology in 2001. She is married to **Jeffery Finnegan**. They have moved to Kailua, Hawaii where Melanie works as a Research Associate for the laboratory of Matrix Pathobiology at the Pacific Biomedical Research Center of the University of Hawaii, Manoa in Honolulu.

Her research focus is a genetic mutational study of international PXE patients with hopes of a genotype/phenotype correlation to be used for genetic counseling.



## Goldwater Scholars Announced

Congratulations to **Ian S. Wallace** (Chemistry/BCMB) and **James Lepage** (Mathematics), who are two of three UT students recognized in the Annual Goldwater Scholars Competition.

Goldwater Scholars are selected nationwide from sophomore and junior college students, who are pursuing majors in the sciences, mathematics, and engineering with research-related career goals.

Past recipients from the Division include **Samantha Hopkins** (Biology/Geology) in 1998, **David Yam** (BCMB) in 1999, and **Peggy Chen** (Pre-Pharmacy) also in 1999.

More information is available at the Goldwater Scholars web site:

[www.act.org/goldwater](http://www.act.org/goldwater)

## MCPHERSON, Continued from page 1

the preparation of laboratory specimens for the 140 non-majors, 96 majors, and 60 veterinarian students that come through the NBA each semester. She is aided by **Jennie Allen** who is the media preparator and a student worker, **Brandon Holt**, who according to Elizabeth, "has a great attitude and does whatever is needed".

This small group is able to service its large number of students with teamwork and when it comes to teaching students, Elizabeth wrote the book, literally. Elizabeth authored the lab manuals for Microbiology 210, 319, and 429. She also teaches Microbiology 210, which is a Pre-Nursing class.

Elizabeth said that organizing this effort "was overwhelming at first, but now we are all in a groove and everyone knows their jobs." She also is happy with the funding for the teaching laboratories. She said, "We are fortunate that in the last five years we have been able to update the equipment, especially for the majors laboratories. All this helps to keep their education current."



Division scholarship winners for the 2001-2002 academic year have been announced.

### The Hollaender Fellowship Awardee:

**Nathan VerBerkmoes**

### Science Alliance Award Recipients:

**Tae-Houn Kim**  
**Sujin Lee**  
**Edgar Lickey**  
**Ayca Akal Stader**  
**Brad Stader**  
**Diego Vazquez**

Congratulations to these excellent students.

# IN VIVO

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The 5<sup>th</sup> Annual Friends of Biology Golf Tournament was a great success, according to organizer **Jan Hudson**. There were 12 teams and six corporate sponsors (Fisher, Kendall, Shimadzu, C-Squared, Millipore, and National Welders).

"The weather was beautiful and a good time was had by all. Our thanks to Fisher Scientific for sponsoring the tournament and fielding a team, and thanks to the graduate students who collected entry fees and "mulligan money" as well as taking pictures," Jan said.

The winners were **Don Carpenter, Paul Naylor, Dr. John Koontz and Dr. Charles Gouffon, Sr.** (not pictured).