SEARCH

Scientists Who Serve God

A Born Biology Teacher

Marilyne Sally Flora of Batavia, Illinois, is a "born teacher" who loves biology and loves teaching it, currently to students in an anatomy and physiology class at Judson College, a general biology class at Elgin Community College, and an environmental biology class at Waubonsee Community College. She has also made another kind of contribution to science education. As part of a family-run company called Intelitool, she has helped provide computer-interfaced equipment to give students "hands-on" laboratory experience.

Off to a Good Start—at the Bronx Zoo

Marilyne Freeman was born in New York City and through the fifth grade lived near the famous Bronx Zoo. She was an early reader but credits her interest in biology and in science in general to "hanging out" at the zoo as a child (on the two days a week with no admission charge). One of her earliest childhood memories is of being wheeled past the animal cages in a baby carriage. She also remembers the cultural richness of growing up in an Italian family in a predominantly Jewish neighborhood. Sundays meant big family dinners at Grandma's house. Marilyne's maternal grandparents had come to America via Ellis Island as immigrants from Sicily.

With a Protestant name from her father but a Roman Catholic extended family, Marilyne gained an early appreciation of religious diversity. ("We worship the same God," her mother would say.) Participating in Sunday school classes and other activities at a Presbyterian church gave Marilyne a head start at school. Instead of playing with dolls she was often "playing school" with her friends. When her immediate family moved to a semi-rural setting in New York's Hudson Valley, her father continued to commute to his Manhattan bookkeeping job but Marilyne had room to roam as a tomboy and keep ahead of her two younger brothers.

College and Beyond

In high school Marilyne was active in various clubs but made top grades in math by always double-checking her work. She began commuting to the college nearest home, at New Paltz, part of the New York State University system. One quarter she lived on campus and discovered the Inter-Varsity Christian Fellowship group, where she met Bob Flora, campus instrument technician. Bob received his M.S. in physics at nearby Clarkson College in 1967, the year Marilyne received her B.S. in biology education. The next year they married—spending part of their honeymoon finishing up Bob's thesis.

Marilyne and Bob moved to Illinois, where she did some graduate work at Wheaton College and earned an M.S. in biological sciences at the U. of I. at Chicago while Bob taught physics. After a brief return to New York, they settled down in Illinois when Bob became a physicist at the Fermi National Accelerator Lab in Batavia. They built a house there, doing much of the work themselves while raising daughters Linnann and Lisa, with Marilyne finding teaching jobs and baby sitters wherever she could. Then, with several other family members including Bob's brother Stephen (who is also both a biology teacher and a Christian), the Floras founded Intelitool, Inc.

It hasn't always been easy being wife, mother, teacher, and factotum of a new business enterprise—all at the same time. Marilyne Flora has had enough energy, and enough of God's grace, to pull it off, but sometimes it must have felt like running a zoo. Ω

Scientific Investigation

Providing Tools For Teachers

COMPUTERS IN THE LAB

Good scientists generally have lots of ideas. Some of their ideas make sense and a few lead to "breakthroughs." Since it can take a lot of tedious work to see whether an idea is worth pursuing, laboratories that can obtain and analyze data efficiently are more likely to make important discoveries.

Every research scientist knows the value of a good laboratory assistant. Today computers have become amazingly useful assistants. In research labs they were first used for the same kinds of tasks as in business: writing letters and reports; keeping track of student records, grant funds, equipment, and supplies; and looking up information stored in "data banks."

Today laboratory computers are almost a necessity in both theoretical and experimental work. On the theoretical side, computer-generated "models" are used to test mathematical equations and to visualize complex chemical structures. In experimental work, computers are hooked up to all sorts of instruments to "input" and process data directly instead of recording data points by hand and then analyzing them with a calculator.

Even high school students can experience this modern way of doing science. To learn more about computerized instrumentation for physiology, contact Intelitool, Inc., P.O. Box 459, Batavia, IL 60510-0459. (Tel. 1-800-227-3805)

Until the 1950s, medical students and graduate students taking experimental physiology left grubby fingerprints everywhere. The standard device for recording data in those days was a rotating drum with a glossy paper sleeve that first had to be "smoked" in a sooty flame. A stylus that moved with each heartbeat or other parameter being measured traced a white line on the smoked drum. Spraying with shellac was the only way to preserve such records.

New Technology to the Rescue

In the "electronic age" after World War II, more sophisticated instruments with pen-and-ink recorders began showing up in physiology labs. Teachers and students could focus on the experiment itself instead of fussing with cranky data-recording equipment. But expensive "physiographs" were out of reach for high school labs and even for most colleges.

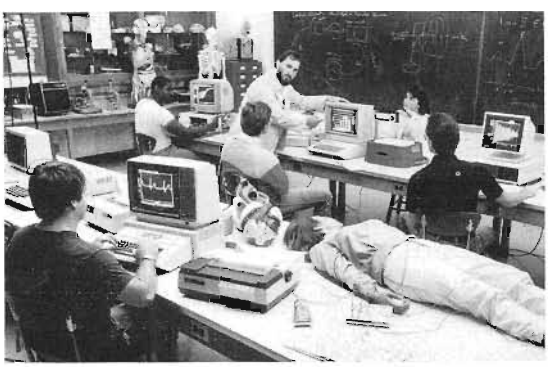
The tiny transistor that replaced the vacuum tube made possible new kinds of electronic "transducers." A transducer is a device for converting one kind of energy (such as the mechanical energy of a heartbeat) into another (such as an electrical voltage). Then the printed circuit board drastically reduced the size of electronic devices and ushered in the "computer age." By the late 1980s, personal microcomputers were everywhere and most schools had at least one "Apple" or "IBM compatible."

Fitting Human Physiology into the Budget

On Thanksgiving Day in 1982, after a big family dinner in the Flora home, the conversation turned to teaching and the need for better lab equipment in schools. The whole family was drawn in: Marilyne and her physicist husband Bob, Bob's brother Steve, and Bob's sister Hollie and her husband Alan. Alan had an M.S. in computer science, Hollie had managed a bookstore, and Steve, with an M.S. in biology, was a self-taught programming "whiz." Henry, family "patriarch" and a retired IBM executive with an M.B.A., encouraged them to turn their ideas into reality, and before long, Intelitool, Inc., was born. Each had something to contribute. Steve began designing and engineering affordable equipment while the rest learned how to run a business.

Intelitool's first product, the Physiogrip, came on the market in 1984. It enables students to measure fatigue, contraction, and other muscle phenomena on their own bodies. Other equipment followed: Cardiocomp for studying cardiac electrophysiology; Spirocomp for respiratory physiology; Flexicomp for reflex systems; Intelipulse, the latest, for pulse monitoring. All are cost-effective and designed for use with a standard microcomputer already in the lab. The experimental data go directly into the computer; software supplied with the device enables students to analyze the data in various ways. Students get a taste of how research is actually done.

Intelitool products are now in use in over 30 percent of the nation's colleges and in many high schools. Marilyne Flora temporarily left teaching to answer Intelitool's phone, take orders, help design ads for journals like the *American Biology Teacher*, demonstrate new products at NABT conventions, and do whatever was needed. Now she's back in the classroom. At the least sign of interest, however, she'll hook you up to a Cardiocomp and show you what your EKG looks like. Ω



INTELITOOL

The Intelitool series at work in a biology classroom. Intelitool says it is developing a full slate of new physiology instruments for classroom use.

Science is sometimes divided into "pure" and "applied" areas, based on the presumed motivations of researchers. Pure scientists seek to understand the natural world; applied scientists seek solutions to human problems. Applied science undergirds technology—the actual production of useful objects.

The three areas are closely related. It has been argued that instead of calling technology the most applied kind of science, science should be thought of as "the purest technology." That's one way of reminding scientists that a technical description of nature isn't a complete understanding. What science is *good* for is producing a better scientific description—on which a more efficient technology can be based. In the other direction, ability to do pure research depends on the "state of the art" of high technology, for things like scientific instruments and computers.

Pure and Applied Christianity

The Christian community knows a similar division. Some Christians seek a clear understanding of God's word; others seek to apply that Word to the needs of suffering people. Religious institutions tend to take over ministry the way private business and government dominate the technological scene. Things can get complicated, even messy, and theological explorations can't always be kept under control.

As in the technical world, though, the different aspects are interrelated. Some Christians want to "stick to the Bible." Yet without the risks taken by churches, and missions, in the world, they might not have had the Bible. Christian thinkers depend on those who have "made something" of the faith, just as scientists depend on commercially available equipment.

The Right Tools for the Task

Like science, Christianity has not only its divisions but its specialists, requiring special "tools of the trade." For medical mission work, Christians need full training in medicine and often specialization beyond that. High-level study of theology requires fluency in Hebrew and Greek. Some biblical scholars now analyze biblical texts the way scientists analyze laboratory data—using computers.

Most of Jesus' followers, however, will always be "general purpose" Christians, equipped directly by the Holy Spirit's activity in their lives. A familiar passage in Ephesians 6 deals with that equipment in the military language of the first century. Behind the metaphorical breastplates, shields, helmets, and so on, is a check-off list of spiritual tools for functioning Christians of any era: truth; righteousness; the gospel of peace; faith; knowledge of one's salvation; "the sword of the Spirit, which is the word of God" (v. 17); prayer; and perseverance.

In Christian service, "state of the heart" matters more than "state of the art." Ω

Marilyne's brother-in-law, Stephen Flora, programming software to accompany Intelitool data-acquisition and analysis hardware. Intelitool sales have increased 20 to 30 percent per year since it introduced its first product in 1984. Over 3,200 Intelitool units have been sold to colleges and universities in the USA, with some sales overseas.

Theological Reflection

Getting Down to Business

A NATION AT RISK

Since publication of the 1983 report, *A Nation at Risk*, dozens of studies have continued to bring to light the dismal state of education in the United States. Some fundamental needs can be summarized as follows:

1. Students need an atmosphere of *trust*. Learning is most effective when young people feel physically safe and emotionally secure. They need to believe that teachers and school administrators are concerned about their welfare. They need confidence that they will be treated with respect by teachers who model self-respect. Teachers must be trustworthy and be held accountable for that trust.

2. Students need to experience a realistic *hope* of bettering themselves and their life situations. They need to know that education will do them some good, allowing them to do important things they could not do otherwise. Hope is especially important for minority students marginalized by society.

3. Students need teachers who *love* the young people in their classes, love to teach, and love the subject matter they're trying to get students to learn.

Trust (faith), *hope,* and *love?* Sound familiar? Without a revival of these qualities, schools will continue to decline and teaching will remain ineffective. Many science teachers need to know their subjects better, but the study of science alone cannot generate spiritual qualities.

Intelitool, Inc., began with its office in a room in Hollie's house, its shop in Steve's garage, and everybody pitching in to mail out the first advertising flyers by hand. Such a pattern was more common in earlier times, when families were basic economic units as well as basic social units for passing on both biological and cultural heritage.

The Importance of Families

Intelitool "extended family"; Bob & Marilyne back row, center.

Whatever the shortcomings of the American educational system, our schools are being blamed for something that is not their fault. Many children are simply not ready to learn science, or anything else, because they come from families that no longer live up to their educational responsibilities. Children who learn self-esteem and social relatedness within the security of a loving family are more likely to enter school eager to absorb the knowledge and skills that schools can teach.

Many children have been cheated at home, and our country is beginning to suffer the consequences. To Christians the tragedy is even deeper because the Bible uses so much family imagery. Its primary picture of God's relationship to his people is the parent-child relationship. God is *Our Father* not merely in "the Lord's prayer" (Matthew 6:9-13) but throughout. In a vicious cycle, adults rejecting the biblical message may model parenthood in ways that keep children from believing in the heavenly Father's love for them. What kind of parents will *they* become?

One Big Family of Believers

In the New Testament, accepting the gospel is compared to adoption (Romans 8:15; Ephesians 1:5), giving hope of breaking an endless cycle of parents and offspring letting each other down. Jesus Christ offers "sanctuary" in a wholesome surrogate family—an international, intercultural, eternal family of believers. Any unloved child or cynical adult can be redeemed by Christ's forgiving love, to start a new cycle spiraling upward instead of downward. One's new "brothers and sisters" won't be all they should be, since their lives are also scarred, but the *promise* is there of a caring family.

Marilyne Flora has found her place in that larger family. She knows that Christians are divided on some issues, and has survived at least one bad experience. For four years she taught at a Christian high school where some parents insisted on a "young earth" interpretation of Genesis 1. Despite her own example of showing tolerance for various viewpoints, when she introduced her students to a broader range of Christian positions, she lost her job.

A "fellowship of kindred minds" in the American Scientific Affiliation has meant a lot to Marilyne. Brother-in-law Steve Flora is also a member. ASA brings together several thousand evangelical Christians for whom scientific work, including science teaching, is a way of serving Christ. In 1990, a new "branch of the family" was formed, the Affiliation of Christian Biologists, with Marilyne Flora as one of its officers. "It's a great bunch of people," she says. (Interested biologists can contact ACB c/o ASA, address at right.)

> *But when the fullness of time had come, God sent his Son . . . so that we might receive adoption as children. And because you are children, God has sent the Spirit of his Son into our hearts, crying, "Abba! Father!" So you are no longer a slave but a child, and if a child then also an heir, through God.*
> (Galatians 4:4-7)

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Thoughtful Worship

Family Enterprise

SEARCH

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The 1989 version of ASA's 48-page guidebook, *Teaching Science in a Climate of Controversy,* helps teachers cope with questions of science and religion. It is available postpaid from ASA at $6 for one copy, $5 each for 2-9 copies, $4 each for 10 or more copies.

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