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# OBSERVER

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## B. F. Skinner (1904 - 1990)

by Kurt Salzinger  
*Polytechnic University and  
New York State Psychiatric Institute*

Controversy enveloped Skinner, but it failed to shackle him. For years, attracting the largest audiences of any psychologist, he was, nevertheless, treated to the repeated seemingly obligatory pronouncement by cognitive psychologists that behaviorism is dead.

When, in his last address to his fellow psychologists — a mere matter of days before his death — Skinner likened cognitive psychologists to creationists, he did not choose a vague calumny, nor even merely a term that means

nonscientist to most of us; he carefully selected a term that described the critics of Charles Darwin. Darwin also formulated a theory that troubled people. According to him, as everyone now knows, the ancestry of human beings makes them less than unique. Skinner, with his theory, added to this injury the

SEE SKINNER ON PAGE 3

Photo by Donald A. Dewsbury, 1988



Psychologist B. F. Skinner died of complications from leukemia on Saturday, August 18, 1990, in Cambridge, MA. He was 86 years old.

## Behavioral Directorate for NSF Proposed in Congress

In a move that may mark a major resurgence in psychology's visibility in federally supported research, legislation was introduced this summer that would, for the first time ever, create a separate behavioral and social science directorate at the National Science Foundation (NSF).

The Behavioral and Social Science Directorate Act of 1990 (H.R. 5543) was jointly sponsored by Representatives Doug Walgren (D-PA) and George Brown (D-CA), both former chairs of the House Science Subcommittee that reauthorizes NSF. The legislation signals an increase in congressional interest in psychological science, particularly among senior pro-science members of Congress, and the bill is one way to address the

SEE NSF ON PAGE 7

### INSIDE

APS Is 2 Years Old	2
Sex Survey	5
AIDS Research	8
APS Growth	10
Call for Nominations	11
APS Dues Renewal	12
Psychophysiological & Social Research	22
Black Students	23
Fall Preview, Public TV	25

### Departments

<b>Spotlight on Research</b>	
Premature Infants	6
<b>The Student Notebook</b>	16
<b>Lab Notes</b>	
Ctr for Complex Systems	19
<b>Organizational Profile -</b>	
Society for Computers	26
<b>Announcements</b>	27
<b>Employment Bulletin</b>	31

101ST CONGRESS  
2D SESSION

**H. R. 5543**

To establish a Directorate for Behavioral and Social Sciences within the National Science Foundation.

IN THE HOUSE OF REPRESENTATIVES

AUGUST 3, 1990

Mr. WALGREN (for himself and Mr. BROWN of California) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

**A BILL**

To establish a Directorate for Behavioral and Social Sciences within the National Science Foundation.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Behavioral and Social Sciences Directorate Act of 1990".

SEC. 2. FINDINGS AND PURPOSE.

(a) FINDINGS.—The Congress finds that—

(1) the contributions of the behavioral and social sciences to the welfare of the Nation have been well-documented in reports by the National Academy of



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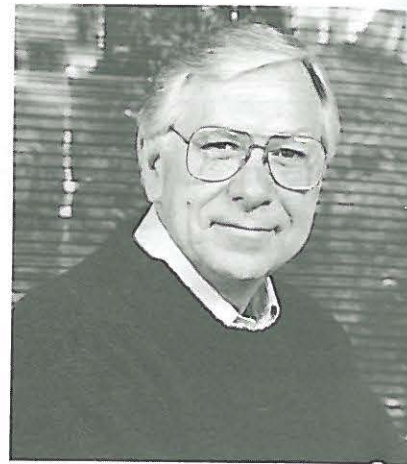
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# HAPPY BIRTHDAY AP

James L. McGaugh  
 President, APS



James L. McGaugh

The American Psychological Society is now two years old. In August of 1988 a small but hearty group of pioneers transformed the newly-established ASAP into the APS and, as they say, the rest is history. Well, not quite. The organizational structure was established quickly. But the development of APS to a national scientific organization with a Washington office and over 10,000 members has involved a lot of planning and a lot of just plain hard work. The accomplishments of our first two years are nothing short of remarkable.

But, one could properly ask what else should have been expected? Why shouldn't an organization developed to serve the aims of psychological scientists be expected to have a substantial membership? After all, APS did not invent academic/scientific psychology. As we all know, scientific inquiry into psychological processes was initiated in the latter half of the 19th century. And, as we also all know, APS was not the first American organization established to promote academic/

scientific psychology. The first precursor was established a hundred years ago. The aims of APS are deeply rooted in those early scientific and organizational developments.

In China, an infant's first birthday is celebrated on its day of birth. This is, the gestation period is officially acknowledged. APS has had a very long gestation period — one that no doubt accounts, in large measure, for its early maturity. In any case, happy birthday APS, and with respect to membership renewals (which will be sent out shortly), many happy returns.

See the New . . .

## Spotlight on Research

A feature column devoted exclusively to reviewing recent innovative psychological research and research applications.

Page 6



# SKINNER

(FROM PAGE 1)

insult of the elimination of an inner agent — an inner homunculus — and replaced it with the assertion that the environment selects our behavior. The latter provides still another similarity of Skinner to Darwin; both speak of selection — Darwin of species, Skinner of responses. Finally, both men were similar in being misunderstood and misinterpreted. When asked recently by Hans Eysenck how he could bear the strain of being so misunderstood, Skinner was said to have replied that he needed to be understood but three to four times a year.

I believe, however, that we should try to produce a better record of understanding by reviewing what he said and what he discovered over a period of some 60 years. That, I believe, would be a greater tribute to B. F. Skinner than a listing of the manifold honors bestowed on him over his lifetime.\*

First we should say outright that he was neither Watson nor Pavlov, though influenced by both. He was like Watson in believing that we must study behavior for its own sake, but he rejected no inner stimuli, just inner mental mechanisms. Although emulating Pavlov in the precision of control of experimental procedure, he eschewed physiological theorizing, believing firmly that behavior must be

explained on its own level. Skinner did not oppose relating physiology to behavior; indeed, he believed that as behavior analysts we should define the physiologist's task. Finally, while Pavlov studied classical conditioning, Skinner concentrated on the operant kind.

Skinner discovered intermittent reinforcement, thereby doing much to bring the psychology of learning in touch with the real world. He then studied extinction more thoroughly than had been done before him.

He found it useful to advocate the concept of probability of response, while abandoning the concept of the reflex. It is important to note that when he abandoned that concept, he ceased being a stimulus-response psychologist. The same is true of the area of behavior analysis which bears his stamp. Put another way, Skinner's behaviorism did not view organisms, including human beings, as robots desperately waiting for the environment to elicit behavior from them. According to Skinner, organisms emit behavior and the environment selects some of it through its consequences.

Skinner never rejected thinking or what is sometimes called higher mental processes. Indeed, he has written much on this topic. What he did reject was the mentalistic explanations that buried thinking inside an unexplained concept of mind.

Skinner never rejected individual

differences. On the contrary, individual differences have always been the hallmark of his approach as is evident from inspection of his long-term operant conditioning studies of single animals.

He never denied feelings, just the idea that they are the causes of behavior; he preferred to think of feelings and other states of mind as collateral effects of the real causes; according to him, it is not the feeling of pain that causes one to pull one's hand from a hot stove; the hot stove causes both the behavior and the feeling.

When he gave up S-R psychology, he substituted therefore the concept of the reinforcement contingency in which behavior emitted in the presence of a discriminative stimulus is reinforced. This is a three-term contingency.

Because he dealt with behavior without an eliciting stimulus, he developed and refined the concept of shaping, the reinforcement of ever closer approximations to a desired new response. New (creative) behavior is selected by the environment because behavior is variable and creative behavior sometimes survives.

Although some of Skinner's students use contrived reinforcers, Skinner's first foray into human behavior, albeit through his novel, *Walden Two*, made use of

SEE SKINNER ON NEXT PAGE

## APS Observer Address

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**APS Observer**  
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Upcoming Issues of the  
*Observer*



# APS Advocates Increased Funding, Behavioral Deputy at Child Institute

At the risk of oversimplifying, there are two basic components to APS's efforts in Washington. First is advocacy on Capitol Hill on behalf of scientific psychology and the federal agencies that fund behavioral and social science research. And, second, once funds are appropriated, the task is to make sure that those agencies support behavioral research in an equitable and stable manner. The Society's activities regarding the National Institute on Child Health and Human Development

(NICHD) make a good case in point.

Halfway through the FY 1991 appropriations cycle, the NICHD is well on its way to a significant increase in funding. The House of Representatives approved \$40 million more than was requested for NICHD by the President, and \$60 million over last year's budget. This occurred in part because APS and its sister organization, the Society for Research on Child Development (SRCD), as well as other of the Institute's "constituent" science

organizations, persuaded members of Congress that such an increase is justified even at a time when the budget is particularly tight.

However, this increase must survive several more steps in the budget process. The NICHD budget has yet to be considered in the Senate, where it remains vulnerable to competition from the numerous other demands on the federal

CONTINUED ON NEXT PAGE

## SKINNER

(FROM PREVIOUS PAGE)

natural and social reinforcement contingencies. The caricature of the machine-like behaviorist reinforcing people never applied to Skinner, or even to a significant number of psychologists who understand behavior analysis.

Skinner believed his book, *Verbal Behavior*, to be his most important contribution to psychology. In recent years, that book has had something of a revival in inspiring research. Those that know of *Verbal Behavior* only through Chomsky's book review are in for a surprise when they finally read the book.

Skinner was a radical, not a methodological, behaviorist and, therefore, he

was able to deal with private events, a concept not well known even though he first enunciated it in 1945. For a methodological behaviorist only those events that are currently observable can be considered. For the radical behaviorist a potentially measurable stimulus is not left out of consideration and, therefore, Skinner's behaviorism was more all encompassing than the others'. Recently, it has become possible to study private events experimentally through the use of drugs allowing the experimenter to specify the stimulus potentially controlling the organism.

Psychopharmacology is greatly indebted to Skinner, not only because he first studied the effect of drugs on conditioned behavior, but also because of his emphasis on the maintenance of behavior, a stable baseline can be used to gauge drug effects.

Skinner respected species-specific behavior and he inspired the study of imprinting through the concept of reinforcement, thus shedding light on a class of behavior ethologists said he rejected.

Skinner was not an effective public relations person, as witness his book title, *Beyond Freedom and Dignity*, but he never opposed either. He was in favor of freeing people from aversive control. When he said, "beyond freedom and dignity," he meant that people are not in a scientific sense free or possessed of dignity, but he favored promoting the

conditions in which people felt that way. More important, Skinner believed in improving the world, in part by substituting positive reinforcement for the aversive control usually practiced.

Although the accusation of narrowness is often directed at his radical behaviorism, a more justified accusation might address his refusal to limit its applicability. He applied behavior analysis to: the scientific study of conditioning, improvement of education (the teaching machine and programmed instruction), the betterment of behavior (behavior modification applied to both complex and simple behaviors, raising of children, management of companies, all kinds of abnormalities), language, perception, thinking, psychopharmacology, culture, government, and finally, when he got there, old age.

It is customary on occasions such as these to say that the deceased now belong to history. This pre-eminent psychologist surely does, but I believe that we will more honor him by aiding history to examine what he accomplished and by building upon that for a better science and practice of psychology. ♦

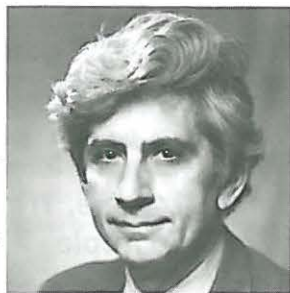


Photo by Pach Bros., NY

Kurt Salzinger

Kurt Salzinger, Ph.D., is Professor at Polytechnic University in New York and is Principal Research Scientist at New York State Psychiatric Institute. He is Past President of APA's Division of the Experimental Analysis of Behavior and is a Past President of the New York Academy of Sciences.

\* Among other awards, Skinner received the National Medal of Science (1968), and, shortly before his death, he accepted the APS William James Fellow Award, and received APA's Presidential Citation for Lifetime Contributions to Psychology.



# Sexual Behavior Survey on Hold

CONTINUED FROM PREVIOUS PAGE

budget. Too, it may be subject to mandatory cuts in order to satisfy the budget deficit reduction requirements of the Gramm-Rudman-Hollings law.

## No Guarantees

Even if the final NICHD budget includes an increase, there is no guarantee that it will result in improved funding for psychological, behavioral, and social science research. Accordingly, APS and SRCD are seeking a renewed commitment, both through increased congressional oversight and a greater presence for behavioral and social scientists within the Institute. Most recently, we have urged NICHD Director Duane Alexander to fill the Institute's vacant deputy position with an individual from a behavioral or social science discipline.

"As you know, our organizations are concerned that over the years the original mission of NICHD — which includes the support of research on the social, cognitive and emotional development of children, as well as their physical development — has been drawn out of balance due to several factors," said APS President Jim McGaugh in a letter jointly signed by Sandra W. Scarr, President of SRCD, and T. Berry Brazelton, President of the National Center for Clinical Infant Programs. "We believe that one of the most important factors is the lack of behavioral scientists in the leadership of the Institute."

Citing the need to examine the behavioral aspects of issues such as infant mortality, infant day care, accidents, and drug-addicted babies, the letter concluded that "it is necessary to have a behavioral scientist serve as your deputy in order to compliment, not duplicate, your own medical background."

In his reply, Director Alexander did not commit to having a behavioral scientist as his deputy, but he expressed strong support for research in this area and indicated that "a behavioral scientist has an equal opportunity for selection." ♦

[Editor's Note: From time to time, we have reported on the joint efforts of APS and the Society for Research in Child Development (SRCD) in addressing child and adolescent research issues. The following represents one such effort. It is adapted from the *SRCD Newsletter*.]

Increasingly, ideological and political pressures are being brought to bear in opposition to scientifically valid research having to do with AIDS. Funding for the already approved Survey of Health and AIDS Risk Prevalence (SHARP) — a large-scale feasibility study of methods of collecting representative data on adult sexual behavior — has been in limbo for well over a year while the Secretary of Health and Human Services (HHS) is conducting a "departmental review" of the survey instrument.

Citing "philosophical" concerns, the Office of Management and Budget (OMB) requested that the Secretary defer funding pending the HHS review of the survey instrument. This action comes despite the survey's approval, on scientific grounds, by HHS's own National Institute on Child Health and Human Development (NICHD). However, it is widely acknowledged that OMB's philosophical concerns are fed by Representative William Dannemeyer (R-CA), who is adamantly anti-homosexual, and others of the so-called "religious right" who appear to be obsessed with anything connected to AIDS.

Other research is being similarly threatened. For example, a different NICHD-approved grant relating to adolescent sexual behavior also is being subjected to departmental review and consequently is not being funded.

The SHARP survey currently rests on the desk of Assistant Secretary of Health James Mason. In May, APS and SRCD joined dozens of organizations in asking Mason to let go and approve the survey

quickly. Following are excerpts from a joint letter to Mason:

Despite the public health imperative for the project, SHARP is being held hostage by ideological and political pressures that are not based on the scientific merit of the study. Further, it appears that this is not an isolated incident.

It has come to our attention that conflict over SHARP has resulted in a department-level decision to withhold funding from another team of investigators from a different institution for a completely separate NIH peer-reviewed and approved research project grant related to adolescent sexual behavior. Such a decision sharply deviates from NIH policy related to grants funding, and we urge that funding for the teen study immediately be restored.

This latest decision leads us to question whether the integrity of the NIH peer review system is at stake. For science to advance, researchers and the federal research institutes must have latitude to evaluate science on the basis of its worth and potential contribution, not on whether some individuals might find the topic area politically sensitive. This system has served the country well in addressing past health crises and must not be abandoned in the face of the current public health crisis of AIDS. ♦

**Speak Write Up  
and  
Be Heard !**

**Send in Your  
Letters to the  
Editor**

Submit typewritten letters of up to 300 words in paper form and, if possible, on computer diskette: DOS (5.25" or 3.5" diskette) or Macintosh (3.5" diskette).



# Spotlight on Research — by Judy Folkenberg —

## Premature Infants

### Psychosocial/Educational Intervention Is Productive

Psychologists have discovered that a comprehensive educational program can boost premature underweight babies' intelligence and improve their chances of leading successful lives. The study, reported in the June 6, 1990, *Journal of the American Medical Association*, showed that not only did I.Q. increase, but infants enrolled in the program had better language and motor skills, and fewer behavioral problems.

Among heavier premature infants (weighing 4.4 to 5.5 pounds at birth), I.Q. scores were 13.2 points higher on average for the intervention group than for the comparison group infants. Lighter infants (weighing 4.4 pounds or less at birth) in the intervention group scored 6.6 IQ points higher on average than children who did not participate. Nonparticipants were nearly three times more likely to be mentally retarded.

"I was pleasantly surprised at the magnitude of the difference," said pediatrician Ruth T. Gross. Gross, of Stanford University, directed the four-year \$33-million study funded by the Robert Wood Johnson Foundation.

#### Intervention Program

At school-age, "a 13-point increase in I.Q. can mean the difference between enrollment in a special education class or remaining in the classroom," said psychologist Craig Ramey of the Frank Porter Graham Child Development Center at the University of North Carolina. Ramey was Director of the study's Program Development and Implementation component.

Parents of children in the intervention group also reported fewer behavioral problems in their children. Children cried and fussed less, and mothers said that their children were "more sociable, outgoing, and got along well with other children" than those infants in the routine care, said psychologist Donna Bryant, Associate Director for the study's program development.

The study looked at nearly 1,000 premature, low birth-weight infants from eight sites across the country. Mothers came from a diverse range of ethnic, educational, and economic backgrounds. All the infants saw a pediatrician regularly, but half the babies were also enrolled in an intensive program of educational services that started as soon as

the babies left the hospital.

The educational services included weekly home visits during the first year of life. During such visits, specially trained teachers taught the parents how to help their children's development. Teachers also showed mothers how to use play activities to improve their children's cognitive, language, and emotional skills. The teachers used "Partner for Learning," a curriculum of 200 games and activities developed by psychologist Joseph Sparling and teacher Isabelle Lewis.

At age one, the children attended special day-care classes at a child development center for at least twenty hours a week. Specially trained staff used the same types of play and learning activities — tailored to the children's developmental levels — used in the home visits. The infant/teacher ratio was high: one teacher for every three children aged 12 to 23 months, and one teacher for every four children aged 24 to 36 months.

Researchers were also heartened by high retention rate: 93% percent of the infants stayed in the study for all three years of the intervention program. The findings are particularly timely as states and the federal government consider how best to allocate social benefits for at-risk children in their earliest years.

A recent amendment to federal legislation (PL 99-457) allows states to extend benefits under the Education for All Handicapped Children Act to include children as of birth, rather than as of age five, and included benefits for early intervention services, noted R. W. Johnson Foundation Vice President Ruby Hearn who was responsible for the grant project.

Gross says that the costs for such services have not been determined as yet but results are expected sometime next spring. At this point she estimates that the costs are "not out of the ballpark of high quality day-care." In calculating the social costs, Gross said that the expense of such a program must be weighed against the money saved later. Children who develop into emotionally healthy, intelligent beings will not need as many services — such as special education classes and other community services — later in life. ♦

#### Sobering Statistics on Low Birth-Weight

About 250,000 premature babies are born each year. Many are born to poor women in rural or urban areas where prenatal care is often lacking. These babies have more medical problems, more behavioral problems and are more likely to fail in school than normal birth-weight children. Low birth-weight is defined as less than five pounds and eight ounces and is the most important factor associated with infant mortality.

Recently released statistics make the R. W. Johnson Foundation study particularly timely. Almost 40 percent of premature births in 1988 were low birth-weight, and there is a steady rise in the proportion of preterm births among blacks, according to the federal *Advance Report of Final Natality Statistics, 1988*, a study released in mid-August by the Center for Disease Control's (CDC) National Center for Health Statistics. The incidence of low birth-weight among blacks reached 13 percent in 1988. This is the highest level since 1976 and is more than double the rate for other groups.

The incidence of low birth weight among whites in 1988 was 5.6 percent and among Hispanics was 5.6 percent (Mexican and Central/South American births) to 9.4 percent (Puerto Rican births), according to the CDC report. Earlier this year, the National Commission to Prevent Infant Mortality reported similar statistics for 1987.



# NSF (FROM PAGE 1)

traditional problem of NSF's poor funding for the behavioral and social sciences.

"It has become clear that the NSF's enthusiasm for the behavioral and social sciences is at best lukewarm," according to Walgren. "I believe that the cause is largely structural. Since its creation, this Biological, Behavioral, and Social Science [BBS] Directorate has been headed by a biologist. Within NSF, the BBS is even informally known as "the Biology Directorate."

"Should NSF be more supportive? I believe it must be," he continued. "I hope this measure will give these critical but often overlooked fields the support and visibility within the federal government they deserve. BBS should be divided into its natural parts with a behavioral or social scientist at the helm of a separate directorate for behavioral and social science."

These sentiments were echoed by Brown. "The NSF as a whole has enjoyed a relatively large increase in funding over the past decade, and should be a strong source of support for behavioral and social science research," said Brown. "However, rather than sharing in the Foundation's good fortune, these areas of science have been languishing."

## APS Leading Role

APS worked closely with Walgren and Brown to develop the legislation. Since the introduction of H.R. 5543, several organizations have lined up in support of the concept of a separate directorate, including the American Psychological Association and the American Sociological Association, both of which have passed resolutions endorsing the concept.

But the concept of a separate directorate is not new. It had been under various



Photo by David Hathcox

Left to right: Rep. Doug Walgren, APS Exec. Director Alan Kraut, Rep. George Brown, and APS Director of Government Relations Sarah Brookhart discuss NSF legislation before its introduction.

forms of discussion before 1980, at which point the budget cuts of the Reagan Administration gave the behavioral science community other more pressing issues to consider. The concept has been revived, in part due to APS activities.

Brown said one of his reasons for pursuing the legislation was that "the concept of a separate directorate was considered by over 65 psychological and behavioral science organizations during the 1990 National Behavioral Science Summit, held under the auspices of the American Psychological Society. The groups voted overwhelmingly that establishing a separate directorate would be a priority for these disciplines."

And earlier, in March 1989, Nobel Prize winner Herbert Simon testified before the House Science, Space and Technology Committee concerning NSF's weak funding of behavioral and social science research. These areas "represent a large part of the title and a small part of the budget of the Biological, Behavioral and Social Sciences Directorate in the Foundation," he said.

The reason is clear, said Simon, "to anyone knowledgeable about how scarce resources are allocated in organizations." It is the lack of behavioral or social scientists at "the highest levels of the organization, where allocations of funds are effectively made."

## NSF's Response

In some ways, NSF is already on record as supporting a separate directorate. "Indeed," according to Walgren, "an ad

hoc committee commissioned by NSF to examine the organization of behavioral and social science within the Foundation recently recommended 'radically increased' resources for NSF's behavioral and social science programs and the 'consideration of a separate directorate for behavioral and social science.'

That committee was headed by psychologist Linda Smith of Indiana University "and it included a number of other distinguished behavioral scientists," said APS Executive Director Alan Kraut. "But its recommendations were not exactly the ones NSF wanted. NSF's response has been to convene a larger, more biologically oriented committee. It is sort of like the child who tosses a coin with a friend, loses the toss, and responds 'let's make it two out of three.' NSF now wants to use a more predictable coin."

Nevertheless, Smith feels the establishment of the second NSF task force is an encouraging sign "that BBS is seriously considering issues of reorganization."

"Although the issue of a separate directorate for behavioral and social sciences is not explicitly mentioned in the task force's charge, I expect it will be a major focus, as it was the impetus for the formation of the task force," she said.

H.R. 5543 doesn't guarantee that the picture at NSF will improve, added Kraut, "but it levels the playing field somewhat, and is a clear sign of increased congressional frustration with NSF's failure to address the situation in previous years." ♦



Photo by Sydney Sander, Bloomington, IN

Psychologist Linda Smith



# AIDS Researcher Receives First NIH Loan Repayment

by Don Kent

Almost painlessly, thousands of dollars of Bob Ketterlinus's educational debt are melting away as he conducts research aimed at curbing HIV infection among adolescents. Ketterlinus is investigating problem behaviors and risk-taking in adolescence that may place youth at unusual risk for HIV and other sexually transmitted disease (STD) infection.

He is the first intramural scientist at the National Institute of Child Health and Human Development (NICHD) to investigate what he calls the "behavioral antecedents of HIV/AIDS" among children and adolescents, and the first psychologist to qualify for the National Institutes of Health (NIH) AIDS Research Loan Repayment Program.

Recorded cases of HIV infection among adolescents have doubled in the last two years. But this may understate the problem because the real extent of adolescent infection is unknown. HIV can remain latent for 10 years or more before AIDS symptoms appear. Most AIDS cases occurring now in people in their 20's may be rooted in teen-age infections or teen-age behaviors persisting into adult years.

To attract AIDS researchers despite generally low federal pay rates, NIH will repay educational debts at a rate up to \$20,000 a year for each year of qualified service engaged in AIDS-related research.

## Repayment Rules

Types of research assignments that meet criteria for coverage under the program include epidemiologic studies of HIV infection, cofactors predisposing to HIV infection, and a recently added criterion of particular interest to psychologists: "Basic studies into the transmission of HIV involving high risk behaviors and research concerning the interruption of transmission by behavioral change and pharmacological intervention."

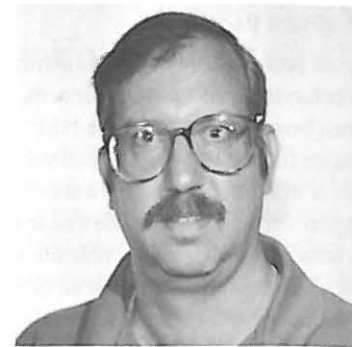
Ketterlinus says NIH opportunities for AIDS research and loan repayment

influenced the directions he took after getting his PhD in developmental psychology at Catholic University in 1987 and then becoming a Staff Fellow at NICHD. Originally, his specialty was adolescent problem behavior with a focus on early sexual activity and teen pregnancy. It was easy to shift the main focus to HIV acquisition, he says.

"The HIV/AIDS epidemiology of adolescents is unique," he says. "About 14 percent of adolescents with AIDS are female, compared with only 7 percent in the adult population. Similarly, there is a greater proportion of adolescents infected through heterosexual contact — 9 percent versus about 4 percent among adults. And there is a higher infection rate among minority adolescents than among minority adults."

## Unique Group

"So adolescents appear to comprise a unique behavioral risk group. That is one of the reasons we are looking for different ways to understand and conceptualize



Robert D. Ketterlinus

their risky behaviors, instead of simply borrowing from the literature on adult

"Centers for Disease Control data shows adolescents exhibit one of the largest increases in the rate of HIV infection compared with other age groups — doubling in the last two years. The numbers are still small, but we must remember the latency period of about years between the infection and the onset of AIDS symptoms. People with AIDS today and who are in their 20's — about one-fifth of all who have AIDS — probably became infected in their teen years," Ketterlinus says.

"That's why it's important to be looking at adolescents before the epidemic spreads down to this age group."

Ketterlinus is studying a variety of risky behaviors such as drinking, drug use, unsafe sexual activities and others that

SEE AIDS ON PAGE

## How the AIDS Research Loan Repayment Program Works

NIH determines whether the applicant has "substantial debt" relative to income. The part of the debt that is 20 percent of the researcher's starting pay or stipend is not covered by NIH. Upon acceptance, the participant serves a two-year contract which may be extended.

The program applies only to NIH staff researchers or those joining the NIH staff at Ph.D. or other doctoral levels who will be primarily engaged in AIDS-related research. It is not available at the National Institute of Mental Health or National Institute on Alcohol Abuse and Alcoholism, which are not part of NIH.

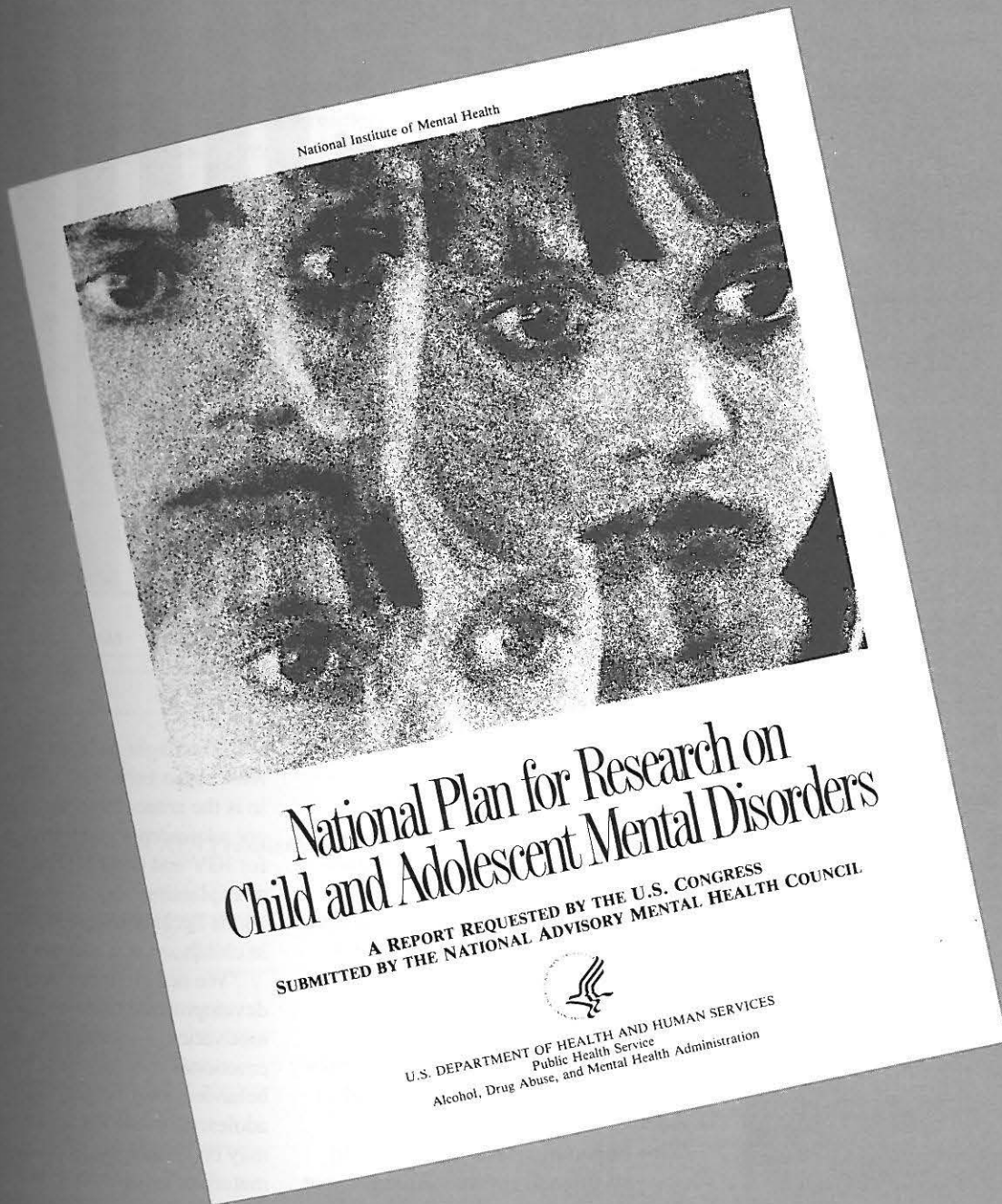
## For More Information

Call 301-402-0192 or write to AIDS Research Loan Repayment Program, NIH, Claude Pepper Bldg. 31, Room 3B19, Bethesda, MD 20892. For taped information on NIH job vacancies at professional and other levels, call 301-496-9541.



# NATIONAL INSTITUTE OF MENTAL HEALTH

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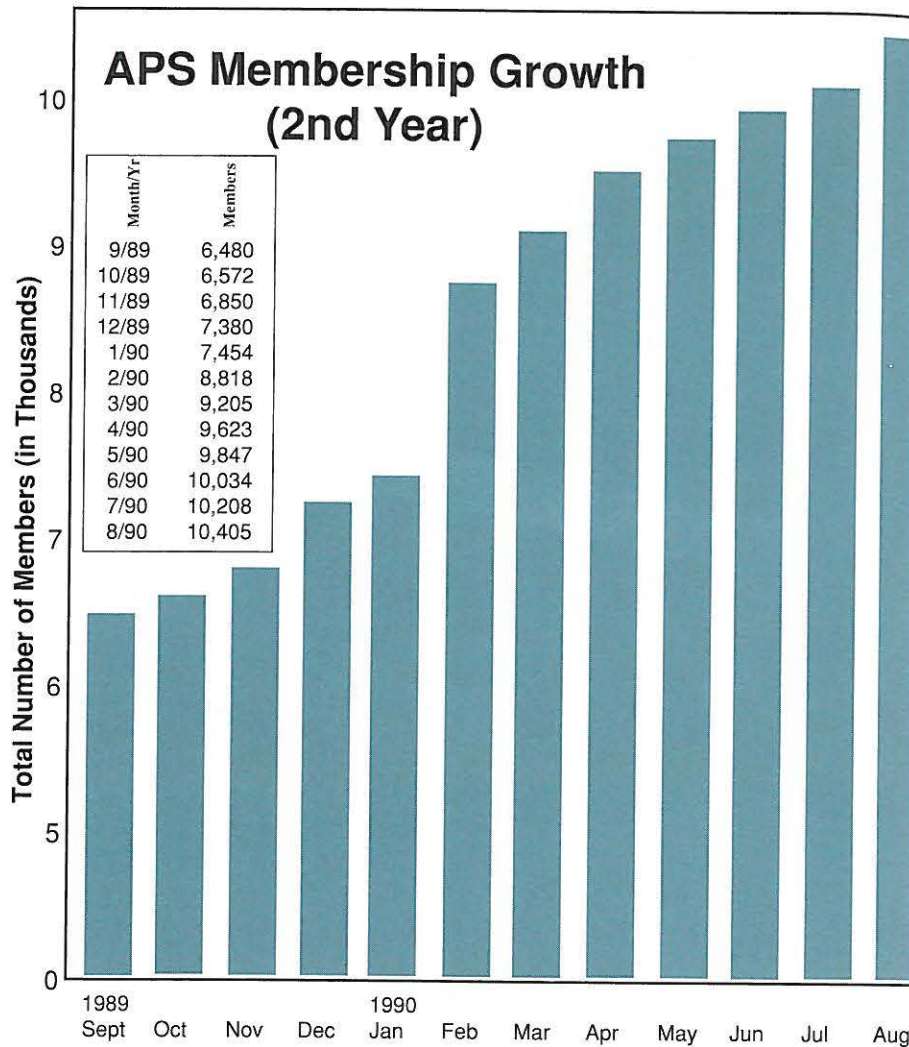
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### AIDS FROM PAGE 8

young people at risk for negative health consequences.

#### Behavior Cluster

"I want to see how those risky behaviors are interrelated. We can do this by trying to discover the common and unique causes or antecedents of all these behaviors. We want to see why education efforts don't seem to be working with adolescents in terms of HIV, sexually transmitted disease (STD), infection, risky sexual behaviors, and other risky conduct in general.

"One important question is: Why do adolescents seem to ignore warnings about health damaging consequences of their behaviors? Surveys show a large majority of kids know how you get HIV and how to prevent it. Unfortunately, a large number of adolescents don't seem to be adjusting their behaviors accordingly."

His research on adolescents also will

help shed light on adult behaviors, Ketterlinus believes. "What I'm interested in is the antecedents to the behaviors that put adolescents and adults at higher risk for HIV and other STD infection in terms of explaining why those who are now adults became involved in risky behavior in childhood and adolescence."

"We need to remember the unique developmental tasks of adolescents. The motivations — cognitive, social, and emotional reasons — for engaging in risky behaviors may be very different for adolescents than for adults. Adolescent may be attempting to prove they are mature or independent, showing they are successfully making the transition to adulthood. Some people think these are just normative behaviors, or just transient behaviors or experimentation. But they are nevertheless certainly risky behaviors and ones that may persist into adulthood — that is, if the risk-takers survive." ◆



# CALL FOR NOMINATIONS

The **APS Elections Committee** seeks nominations to fill three upcoming vacancies on the **APS Board of Directors** and the position of **APS President**. Board members serve four-year terms, and the President serves a two-year term. Send names of nominees by **October 15, 1990**, to APS Elections Committee Chair Kay Deaux. Self nominations are permitted.

Both the President's term and that of each of the three APS Board of Directors positions begin at the end of the June 1991, APS convention. James McGaugh is the current president. Board members for whom replacements are being sought are: Lewis Lipsitt [resignation], Duncan Luce [term expires], and Virginia O'Leary [term expires].

In the spaces below, you may name up to three individuals to serve on the APS Board and one individual to serve as APS President. Elections will take place in the Fall.

Be sure to include address, phone number(s), and email address, and, if possible, a current vita of the nominee(s).

I nominate the following for the **APS Board**:

(1) _____ <i>Name</i> _____ <i>Address</i> _____ _____ <i>City State Zip</i> _____ <i>Phone</i> _____ <i>Email</i>	(2) _____ <i>Name</i> _____ <i>Address</i> _____ _____ <i>City State Zip</i> _____ <i>Phone</i> _____ <i>Email</i>	(3) _____ <i>Name</i> _____ <i>Address</i> _____ _____ <i>City State Zip</i> _____ <i>Phone</i> _____ <i>Email</i>
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I nominate the following for **APS President**:

(1) \_\_\_\_\_  
*Name*  
 \_\_\_\_\_  
*Address*  
 \_\_\_\_\_  
 \_\_\_\_\_  
*City State Zip*  
 \_\_\_\_\_  
*Phone*  
 \_\_\_\_\_  
*Email*

**Send nominations to:**

**Kay K. Deaux**  
**CUNY Graduate Center**  
**33 West 42nd Street**  
**New York, NY 10036-8099**

**Email: KAY@CUNYVMS1**



# The Student Notebook by Travis Langley

## Focus on Penn State Chapter

Over the past months, student affiliates of the American Psychological Society have begun forming APS Student Caucus (APSSC) chapters at colleges and universities across the country. Each chapter is unique in that its structure is developed by the chapter members to meet their own particular needs and interests rather than to follow rigid guidelines laid down at the national level.

To get a sense of the unique character of APSSC chapters, the Student Notebook will focus on various chapters from time to time. And, instead of the usual APSSC news in this month's Notebook, readers will get a glimpse at the Pennsylvania State University caucus chapter through an interview with John Newman and Penn State caucus chapter President Bonnie Eberhardt. They describe the origin and current status of this chapter.

As a student, Newman was a founding member of APSSC and is founder of the Penn State chapter. He is now associate professor, but in his continued APSSC involvement as chair of the APSSC Mentorship Program Committee, he provides a valuable perspective on APSSC chapter development. Eberhardt, is a graduate student and is also involved in national caucus activities as a member of the Budget Committee.

### Interview with Penn State Chapter Officials

#### Q. How have you recruited members to form the Penn State chapter?

**NEWMAN:** In December of 1989, I sent out about 700 memos to students — in the different undergraduate and graduate programs — saying that a group of us was interested in forming a chapter. After that, we held six or seven organizational meetings between January and February. We had a charter committee, a program committee, and an election committee. Officially there were 24 charter members. Then we actually approved a charter, and held a signing ceremony complete with a wine and cheese reception.

Currently the chapter has 74 members including 25 graduate students — from the human development and family studies program, the college of liberal arts, and the college of education psychology programs — and 31 undergraduate students from across the board. Some people from engineering and computer science are interested as well.

We want to bring together everybody with psychological interests at the university and to encourage collegiality across subdisciplines. Our chapter is committed to cooperating with other existing organizations such as Psi Chi, the Psychology Club, and student governments. Officers from Psi Chi and the Psychology Club have been very helpful in promoting and forming the chapter.

**EBERHARDT:** I was impressed with how fast and efficiently we were able to organize and how enthusiastic people were. We come from such a big university that it's hard to get the word out. We're a new organization, so I think 74 members is commendable at this point, but we'll have to continue to work get the word out. It doesn't matter how many signs you put up at a university this size, people don't read them. The best thing has been word of mouth.

**NEWMAN:** Also useful were direct mailings to every psychologically oriented student.

#### Q. How is the chapter organized?

**NEWMAN:** Our chapter's organization structure is a little bit different. We specifically wanted to avoid a lot of organizational duties for the members because we wanted it to be more of a learned society, and we wanted the chapter operated on a day-to-day basis by the executives, with only three business meetings a year that would involve a few members of the chapter. In that way, most of the members would be involved just in the activities and would receive the benefits of the chapter, while administration would be done by the executives.

**EBERHARDT:** People are tired of meetings. I think they don't want to join a group if they have to go to a lot of meetings. What comes out instead is an action group.

**NEWMAN:** We decided that traditional structure wouldn't be effective in what we wanted to do. There were a lot of psychology organizations already at the university. One of the difficulties with those organizations was that they changed if the interests of the officers changed. If they were all into industrial or clinical psychology, for example, it became an industrial or a clinical group. We thought to provide long-term continuity with a research base and ongoing projects. We set up a business meeting group consisting of the President-elect, President, Past-president executive, with the Vice-president serving as chair. We hoped to have one person go through the three phases from President-elect to Past-president would provide continuity, so there might not be these major swings in what services and activities were provided for students.

#### Q. How is the organization of the chapter really relevant to what the chapter does?

CONTINUED ON NEXT PAGE



**EBERHARDT:** The Program Committee brings to our attention groups that need to be formed, and discusses activities we're involved in, things we want to be doing in the future. The Election Committee establishes our list of candidates and organizes elections at the end of the year. The Membership and Finance Committee is involved in recruiting scientifically oriented students into the chapter and into APS and is involved in our fundraising. As the need arises, other special committees will be formed.

In the department, there were some

effort that goes into a teaching or research assistantship in psychology is equivalent work. I know that there is inequity in the field after graduate school as far as things like faculty salaries go, but that's marketplace. Being a student, you're not in a marketplace. The chapter will try to convince our new administration that assistantships should be equal.

**EBERHARDT:** This is probably one of our most important long-range goals, because it emphasizes that we want to be taken seriously as scientists. What really drove that home for me was a student I

**NEWMAN:** We have already developed some activities, plans, and goals for the caucus chapter. We started a summer reading group. In the fall we'll be using theoretical readings and some of historical value.

We've published a recruiting flyer explaining the American Psychological Society and the Student Caucus from

## THE STUDENT NOTEBOOK IS CONTINUED ON THE NEXT PAGE



Founding members of the Penn State Student Chapter. *Left to right (Front row):* Lori Snyder, Jill Masach, Jay Wisor (Vice-president), Amy Spector (Treasurer), Michelle Dill, Paul Cornwell (Faculty Advisor), Bonnie Eberhardt (President), Michelle Morris (Advocate); *(Second row):* Julie Tatnall (President, Psi Chi), Sandra Weiss, John Newman (APSSC Advisory Board), Beth Santoli, Jay Wenger, Doug Park (Recorder), Dave Knepp (Protom Recorder); *(Top row):* Mike Snyder (President, Psychology Club), Rick Diesinger, Dave Clipper; *(Not pictured):* Lucille Tovcimak, Rachel Seidensticker

problems with students having enough research space or even desks in their offices. The Science and Research Committee is an investigatory committee finding out, for example, where space is, how funding or computer access could become available or increased — issues that are fundamental to the implementation of research. We feel psychology isn't treated with the respect it should be, isn't treated financially the same as any other natural science.

**NEWMAN:** We really want to advocate that social science assistantships be raised to a level equivalent to those in the natural sciences and engineering. The amount of

knew in Industrial Engineering who really wanted to be an Industrial Psychologist. However, he couldn't afford it because it meant a few thousand dollars a year difference. A very valuable person was diverted. I'm sure it happens all the time.

**NEWMAN:** We'd like the chapter to be the local resource for giving assistance to graduate students preparing grant proposals, so the students will actually be acquiring grant money.

**EBERHARDT:** We're trying to spread out funding to people who ordinarily wouldn't get the opportunity.

**Q. What exactly does the chapter do?**

### APSSC Executive Council

All the officers welcome students and others who wish to contact them about concerns particular to their own offices. Contact Secretary Paul Reber for general inquiries, regional student conference information, and other requests.

#### President

Kenn White  
Cronkrite Graduate Center - 100B  
6 Ash Street  
Harvard University  
Cambridge, MA 02138 Tel.: 617-495-8781

#### Graduate Advocate

Kathleen Morgan  
Department of Psychology  
University of California  
Davis, CA 95616 Tel.: 916-753-4941

#### Undergraduate Advocate

Michael Beddows  
17138 Brunswick Blvd.  
Kirkland, Quebec  
Canada H931108 Tel.: 514-695-4526

#### Student Notebook Editor

Travis Langley  
Department of Psychology  
Tulane University  
New Orleans, LA 70118 Tel.: 504-865-5331,  
504-895-6338

#### Secretary (Information Networking)

Paul J. Reber  
Department of Psychology  
Carnegie-Mellon University  
Pittsburgh, PA 15213 Tel.: 412-268-8115

#### Treasurer

Carolyn Roeker  
Dept. of Psychology  
The University of Iowa  
Iowa City, IA 52242 Tel.: 319-338-9817

#### Past-President

Kathie Chwalisz  
361 Lindquist Center  
The University of Iowa  
Iowa City, IA 52242 Tel.: 319-338-4990



students' perspectives. It's been well received! The materials have been distributed through the Psychology Department's Records and Advising Office. Our other publication is a list of the graduate students' research interests. Undergraduates have been picking up the list to contact graduate students about independent studies and helping as research assistants or subjects.

**Q. Will the chapter serve as an information network in other ways?**

**NEWMAN:** Through an intra-university newsletter, we'll try to help students understand what psychology involves. In the upcoming year we will co-edit it with Psi Chi, the Psychology Club, and the Psychology Department. If we can get the Human Development and Educational Psychology programs participating as well, then people will know what's going on in all our areas. We can use this to increase interdisciplinary activities.

**EBERHARDT:** And it'll help get people talking to each other. We're so big that nobody knows what anybody else is doing in the other departments. For example, I was working on infanticide and felt very isolated until I found that somebody in Anthropology was doing some fantastic studies and that we had one of the experts in the field in the Human Development Department. There's ordinarily no way to find those things out unless you happen to bump into them.

**Q. How does your group stay connected to the national organization?**

**NEWMAN:** One of our goals is to maintain a good relationship with the national Student Caucus, to implement their programs here at Penn State, and to make suggestions to them about programs in which we think all students in psychology might be interested. As our president, Bonnie is a national Advisory Committee member which will help maintain good contact. She represented our chapter at the annual conference in Dallas.

**Q. Besides the Science and Research**

**Committee, what do you do to promote students as psychological scientists?**

**NEWMAN:** We've had graduate students presenting papers at the APS conferences. Also, the Psychology Department and the Scholars Program set up an undergraduate research poster exhibition in concert with the graduate research exhibition. The Student Caucus chapter agreed to provide judges for a research competition.

**EBERHARDT:** Several of our undergrads made poster presentations. We encouraged them to prepare posters. The research didn't have to be completed. It was just to encourage people to think about what they could do, and to give them the chance to talk about what they were doing.

We have a group of honors students who have to do their own research, but nobody else in the department is supporting other undergraduates who are not in that select group. We're trying to open to all students the opportunity. One thing we'll be doing is a student paper series, to encourage them to meet in a forum to

The APS Student Caucus represents all of the Society's student affiliates. It is not an honor society, and there are no chapter dues. All chapter chairs are additionally recognized as members of the APSSC national Advisory Committee. Students or faculty who want information about APSSC school chapter applications should contact:

Donna Desforges  
Dept. of Psychology  
Box 32878  
Texas Christian University  
Ft. Worth, Texas 76129  
817-921-7414  
BITNET: RP711PS@TCUAMUS

When applying, student chapter founders are asked to provide information about their institution, department, and students, and to designate a faculty sponsor.

discuss what they're doing. A lot of students, especially undergraduates, don't have any idea what it's like to be at a professional conference. This gives them a good chance to be involved in colloquium or seminar presentations. Many undergraduates know they want to be in psychology, but they don't know in what way. This can give them some examples of what goes on in the different areas. **NEWMAN:** I'd like a bi-weekly lunch activity in which students discuss their research or recent readings. We could alternate with the reading group meetings and a research presentation — graduate and undergraduate students making formal presentations in a casual atmosphere.

**Q. You are considering hosting an APSSC regional conference?**

**NEWMAN:** We're preparing a proposal for one of the regional student research conferences that the Student Caucus is developing. Penn State has held regional undergraduate and area graduate conferences, but they haven't been combined and they haven't been consistent. It would be good to discriminate between student initiated work and that which is really faculty research that the students are working on. I would like the conference to be primarily what the students are interested in doing.

**Q. Anything you would like to add?**

**NEWMAN:** One more thing we'd like to do is lobby for the elimination of the APSSC restrictions on the course of graduate study for scientifically oriented students. They've started requiring distribution components to our course of study because they were essentially informed. 'If you don't require students to take the broad range of coursework, we won't certify you and then your graduates can't be licensed in Pennsylvania to practice clinical psychology.' That shouldn't have affected the science-oriented students because we're not going to look for licensure anyway. We want to eliminate some restrictions the Department of Psychology has been forced to adopt.



# Lab Notes

## Blending Physics, Math, And Psychology

### FAU's Center for Complex Systems

BOCA RATON, FL - During WWII, "Rosy the Riveter" corps used to plug up shrapnel holes in damaged war planes here on an airstrip where now sits an isolated cluster of temporary structures in which scientists attempt to plug holes in our understanding of nature's most complex system, the human brain and its relation to behavior. In a war against the mysteries that underlie mental illness and nervous system dysfunction, a small international, interdisciplinary group of researchers — including physicists, engineers, psychologists, neuroscientists, mathematicians, and computer scientists — is united in its quest for answers to some of the most interesting questions confronting psychology today.

Housed in a modest pair of dual house trailers connected by a corpus-callosum-like tangle of communications and power wires, these researchers are part of Florida Atlantic University's (FAU) four-year old Center for Complex Systems, a unique scientific research and research training environment. The outward appearance of the Center does not betray the state-of-the-art research apparatus, graphical display equipment, and computer facilities within. And, while the 40-odd researchers and graduate students do not directly focus on applications of their work, spin-offs could have significant impact on medical and technical areas such as prosthetics, pattern (including speech) recognition, flexible robots, and computer network design. A number of important clinical applications (e.g., in movement and communicative disorders) also exist.

#### The Beginnings

Center founder and Co-director Dr. J. A. Scott Kelso spent time recently with *Observer* Editor Lee Herring to describe the Center and its research and training programs. Kelso is on the faculty of the FAU Psychology Department and received his doctorate in 1975 from the University of Wisconsin-Madison. He received his hard knocks during an early career as an international rugby player in Northern Ireland and has the dubious distinction of scoring the first ever touchdown for the United States against England at Twickenham in 1977.

**Q.** How did you come to be founder of the Center and how did the Center begin?

**KELSO:** With a fair amount luck and pure chance, I was offered the FAU position of Eminent Scholar in Science in September 1985 which I promptly accepted and began building the Center. Normally, a science chair such as this would be offered to a chemist or physicist.

Colleague (and wife) Betty Tuller, Ph.D., and I were the two initial full-time faculty of the Center, and Drs. Gonzalo DeGuzman and Gregor Schoner (both physicists) were Research Assistant

Professors. We spent the first year or so seeking federal research grant support from various agencies including NIMH; the Office of Naval Research; the National Institute of Neurological, Communicative Disorders and Stroke; and the National Institute on Deafness and Communication Disorders. We were fortunate to receive such support.

**Q.** What's an Eminent Scholar in Science, a State effort to attract scientists?

**KELSO:** Indeed, it's an endowed chair supported by the state of Florida which provides a 50% match of private funds.

#### Growth of the Center

**Q.** So the Center has been a federal grant success story?

**KELSO:** I would say that in tough times and coming to a relatively obscure institution such as FAU that we have been lucky. Both Tuller and I were in 'soft money' positions at Haskins Laboratories on the Yale campus and Cornell Medical College, respectively. So we had a good idea as to what a grant proposal should contain. Also, FAU's institutional support has been considerable in terms of facilities and initialization of our research.

I am excited that our research has now expanded to include a pedagogical component. We have recently received the first training program grant from NIMH's new National Training Program in Complex Systems and Brain Sciences. This is an explicitly interdisciplinary program for pre- and post-doctoral fellows. Its goal is to produce a different

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Photo by William Watkins, FAU

The Center for Complex Systems at Florida Atlantic University



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kind of brain scientist, one who can blend mathematics and computation with hands-on experimental research in neuroscience and behavior.

**Q.** There are other centers of similar name, no?

**KELSO:** Yes. Someone told me there are about 17 around the United States by identical or similar name, some of them in major universities. Five years ago there weren't many, if any. There has been a lot of talk recently for a 'reintegration of the sciences' under the umbrella of a science of complexity. Interdisciplinary linkage has often been promoted at universities — administrators love it — but the disciplinary boundaries can be too high and thick. The FAU Center was interdisciplinary from its conception. People were brought in specifically for that purpose. It wasn't a matter of recruiting existing faculty from different departments to form a Center. That can be very complicated and doesn't always pan out. I wanted to create a group of bright young people that would work together from the beginning, sharing ideas and doing research. It's been fantastic for our students, in psychology, for example, to be exposed to different fields.

Another unique feature is that the FAU Center, through the NIMH training program, is the hub of a national network that includes four other distinguished universities: Berkeley, Cornell, UC-San Diego, and the Medical College of Pennsylvania. This network complements our existing international collaborations, most notably with Professor Hermann Haken, Chair of Theoretical Physics at Stuttgart University and Co-director of this Center, and Hiroshi Shimizu, Professor of Biophysics, from the University of Tokyo, whose group has interacted with ours through our international exchange program.

**Q.** Has the "Decade of the Brain" figured in the Center's success?

**KELSO:** Without a doubt. In fact, Japan also passed a similar national resolution, the Human Frontier Science Program, that is endorsed by the seven major Western nations to coordinate international, large-scale basic research on behavior and the brain. We are hopeful that this will promote our international exchange program.

## Microscopic and Macroscopic

**Q.** What about your specific research interests?

**KELSO:** I've collaborated for eight years with Haken and his group on how complex, biological systems containing very many components generate coordinated, spatiotemporal patterns of behavior. The coordinated movements of humans and animals are an example. Keep in mind the number of *potential* degrees of freedom involved is enormous, *a priori* . . . over 700 muscles, 100 joints,  $10^{14}$  neurons and neuronal connections in the brain. So, regardless of what level of description you choose, there is complexity. Nevertheless, one of the most fundamental, but least understood, features of living things is the high degree of cooperation among the system's many parts. There are always *patterns* which means that the interaction among the components is not arbitrary but is coordinated somehow.

I'm interested in the form that the interactions take more than the material composition of the components themselves. Of course, the only way to understand the cooperative dynamics is to study specific experimental model systems. This is why an explicit theory-experiment relation is so crucial.

**Q.** Can you elaborate?

Well, Haken and others had shown that in a large number of physical and chemical systems, nonequilibrium phase transitions are at the core of pattern formation. The patterns are formed in a self-organized fashion. Unless one's a vitalist, one has to believe that biology and behavior are self-organized. I was interested in whether nonequilibrium phase transitions are present in behavior, and that requires the invention of experimental model systems.

To do that, I had to devise a particular experimental system, demonstrate the existence of phase transitions, and then develop specific theoretical models. I emphasize here the importance of a dialogue between theory and experiment. So, I did the initial experiments that later involved students (especially John Scholz, now at the University of Delaware) and the theoretical work was done in collaboration with Haken and his associate, Schoner. In recent years, nuclear physicist DeGuzman, has elaborated and modified

the theoretical picture significantly.

**Q.** Nonequilibrium phase transitions? Self-organization?

**KELSO:** Working at Haskins Labs with Michael Turvey and Peter Kugler in the late 70s, we realized that this language might be central to understanding coordinated behavior. The word 'synergy' has been around the field of motor neurophysiology and neurology at least since Sherrington, and Haken coined the related term 'synergetics' in the 70s to define an interdisciplinary field to study cooperative phenomena in nature. The task was to see if synergetic concepts were relevant to human behavior. Nonequilibrium? . . . let's just say we are open systems — that is true of any living system. The science

Photo courtesy of Boca Raton New



Scott Kelso wearing helmet designed to provide visual feedback of speaker's vocal track events.

problem is to characterize the generation of the dynamic patterns of these systems.

Most behavior involves a spatiotemporal pattern of some sort. There's an orderly relation among the components that when measured continuously yields beautiful dynamic patterns. How do you capture the essence of these patterns? Through nonequilibrium phase transition theory. Theory has shown over and over that near transition points, where patterns are formed or changed spontaneously, there is an enormous reduction of degrees of freedom. Thus, very high dimensional systems form patterns whose dynamics, however, are low dimensional.

But another crucial piece of this is these low dimensional dynamics — simple equations of motion for the patterns — turn out to be nonlinear. The behavior patterns generated thus can be simple (



extremely complex depending on the equation parameters. Thus a theme emerges for all living things: Materially complex systems, as long as they are open and not at equilibrium, form self-organizing patterns. The laws that describe the pattern formation are simple, but because they are nonlinear, they generate behavioral complexity. Thus, we journey from material complexity to behavioral complexity through the laws of nonequilibrium phase transitions and the mathematical language of nonlinear dynamics.

**Q.** How do you tie this to human behavior?

**KELSO:** You can see analogous phenomena throughout biology and psychology. Animal locomotion is a case in point — you have different gaits, ordered spatiotemporal patterns among the legs (walking, trotting, pacing, galloping). And, although not all behavior is rhythmic, that's where the foundation of all behavior rests, and we must have experimental windows into principles of ubiquitous biological self-organization and rhythmical behaviors like locomotion.

So, I decided to look at coordinated human finger motion. Schoner and I discovered that when humans are asked to move their fingers rhythmically at the same frequency, only two forms of coordination are performed stably: In-phase motion (homologous muscles contracting together) and anti-phase motion (homologous muscles contracting alternately). We discovered a phase transition (sometimes called a bifurcation) as the frequency of movement increased. The anti-phase pattern loses stability and spontaneously switches to an in-phase pattern. An essential point is that the pattern formation and spontaneous change occur through the change of a single, non-specific parameter, the oscillation frequency.

What variable captures the ordering relations among the actively moving components? Research by us and others shows that in a large number of cases in a variety of systems, the phasing relation is the 'order parameter,' or collective variable. *En route* to transitions, all of the predicted features of nonequilibrium phase transitions were seen experimentally. So we may have the first demonstration of the most primitive form of self-organization in human behavior, a phase transition.

Thus, in an article published in *Science* [25, March, 1988, 239, pp. 1513-1520] we showed that once patterns are characterized at the neural (microscopic) level it is possible to link them lawfully to patterns at the behavioral (macroscopic) level. We claim that the long-sought link between neuronal activities and behavior may reside in collective effects, the formation of a pattern at the microscopic level that creates macroscopic order (and disorder). Thus, our theoretically and experimentally based operational approach to study finger motion allowed us to link the different levels (kinematic, electromyographic, and neuronal) by means of stochastic nonlinear dynamic modeling.

The stability and change (i.e., patterns) of behavior are predicted successfully by nonequilibrium phase transition theory, synergetics. The parameters of the system that govern the qualitative change from order to chaos or vice versa can be described, thus, by focusing on the phase transitions, the point at which the patterns evolve.

**Q.** Neuronal-level investigations alone are insufficient to explain these transitions?

**KELSO:** We showed experimentally that transitions occur at the neuromuscular level as well. But the key point is to use phase transitions as a way to demarcate collective variables for patterns of activity at whatever level of description you choose. When you find these bifurcations, you can map the observed patterns onto attractors of a dynamical model. Then you can derive the pattern dynamics by cooperative (nonlinear) coupling among the active components, thereby effecting your micro- to macro- relation. Again, it's at the transition point that self-organization becomes apparent: different patterns arise as stable states of the coupled nonlinear dynamics. But if you don't know the pattern dynamics (the laws at the pattern level), you don't know what to derive! So, once the patterns are characterized at the neuronal level, it is possible to link them lawfully to behavioral-level patterns.

I stress that evidence supports more and more that the neuronal level of description is no more or less fundamental than the behavioral level. No single level of analysis has ontological priority over any other. Neuronal pattern generation research shows the same kind of phenom-

ena as my finger research and as recently and beautifully demonstrated by Schmidt, et al. [*JEP: HP&P*, 1990, 16, p. 227] with coordinated motions between two people.

I argue that the linkage across levels is by virtue of shared dynamical laws of coordination not because neurons are more basic than joints. Fundamentally, elements on all levels interact and interactions generate behavioral patterns. The dynamics of these patterns are nonlinear, so you see a rich diversity of behavior, including bifurcations, hysteresis, multistability, intermittency, even chaos. The patterns generated in a wide variety of systems, from invertebrates to hippocampus and visual cortex, often take the form of phase attraction and frequency synchronization. There is the strong impression that no matter where you look in complex biological systems, many of the degrees of freedom are suppressed and only a few (though, not too few) contribute to behavior. Only a few degrees of freedom are needed to sustain the vital mix of stability and adaptability necessary for many biological and behavioral functions. We live near the edge of chaos, so to speak, but not in it. That's where we can learn, adjust to the environment, and

SEE FAU ON PAGE 48

**Editor's Note:** Space limitations regrettably preclude an exhaustive review of research activity of the Center. The Center also relies on the special expertise of FAU faculty in electrical engineering, computer science, ocean science, mathematics, physics, chemistry, and biology departments.

What follows is a list only of those FAU resource faculty associated with the Center who have ties to the psychology department: David Bjorklund (cognitive development), Wilson G. Bradshaw (neuroendocrinology of sexual behavior), Steven Bressler (human brain physiology), Howard Hock (vision), Ingrid B. Johanson (developmental psychobiology), Phillip S. Lasiter (neuronal/developmental aspects of gustatory regulation), Arnold Mandell (biological dynamics), Allan J. Nash (electropsychophysiology), Gary W. Perry (neural regeneration/development), Lewis Shapiro (neurolinguistics), Betty Tuller (speech perception/production), Robert P. Vertes (brainstem and forebrain, and sleep), and David L. Wolgin (psychopharmacology and brain damage recovery).



# The APS Convention Remembered

**Editor's Note:** On this and the next three pages readers can catch up on a few more of the many interesting presentations given at the Second Annual APS Convention in held this past June in Dallas, Texas . . .



John Cacioppo

## Social Psychology and Psychophysiology Under One Roof?

by Don Kent

DALLAS, TX - Are social psychological and psychophysiological approaches incompatible?

The "contrariness" of typical texts and treatises of the two subfields would make one think they have little in common, John Cacioppo of Ohio state University told an APS convention audience.

Now, however, major technical problems are being overcome that for years have hampered researchers trying to use the two approaches together, he said.

"There is emerging evidence that social psychological and psychophysiological approaches, if properly mixed, can constitute a powerful lens through which to view attitude processes and social influence," Cacioppo said.

He described research operations using a combination of the two approaches to investigate attitudes and persuasion (e.g., advertising) and to get results not obtainable by using either approach alone. He warned, however, that the principles are

appropriate for a restricted assessment content.

He focused his research, therefore, on verbal persuasion, since, as he argued, persuasion is an inherently social process and because the purpose of persuasion is to influence attitudes. In addition, attitude phenomena, he said, are uniquely suited to studying psychophysiological processes due to the fact that attitudes merge cognition, affect, and behavior both at the antecedent- and consequence-levels of attitude processes.

### Special Preparations

There can be problems "when there isn't a careful mixture of psychophysiology and social psychology," he said. "But that isn't such a problem when you realize that medical tests . . . are less complicated than

asking what is the psychological significance of a peripheral physiological event. Yet with medical tests we often must use very special preparations. Interpretation of a glucose tolerance test, for instance, presumes that you have fasted for eight to 12 hours before you get the glucose challenge — otherwise the physiological events that unfold are uninformative . . .

"I am suggesting that as social psychologists who are interested in psychological processes, physiological signals have a great deal to tell us. But we have to be sophisticated about how those questions are asked." Using the electromagnetic spectrum as an analogy, Cacioppo said that like visible light, observable social psychological phenomena may explain most of the variance in behavior, but the larger non-visible portion of the

CONTINUED ON NEXT

### MARK YOUR CALENDAR !

**1991 APS Convention  
June 13-16, 1991**

**Sheraton Washington  
Washington, DC**

John Cacioppo is Professor of Psychology, Social Psychology, and Psychobiology and is a member of the Neuroscience Program and the Center for Biomedical Engineering at Ohio State University. Among several awards, he recently received the prestigious Troland Research Award from the National Academy of Sciences for his contributions to understanding psychophysiological correlates of attitudes, cognition, and emotion and for his use of noninvasive physiological measures to resolve basic theoretical questions regarding psychological processes. Significantly, he is the first psychophysiologicalist and the first social psychologist to receive this award.



# Blacks Are Undervalued In the Classroom

by Don Kent

DALLAS, TEXAS - American learning environments seem to presume that black children are not able to succeed. Black students internalize this presumption, said Claude Steele in an invited address at the

APS convention. Thus the students dis-identify from education. The results are reflected in numbers from the first years of school onward.

"Black kids begin elementary school pretty much on a par with white kids — there is a difference, but not much, in

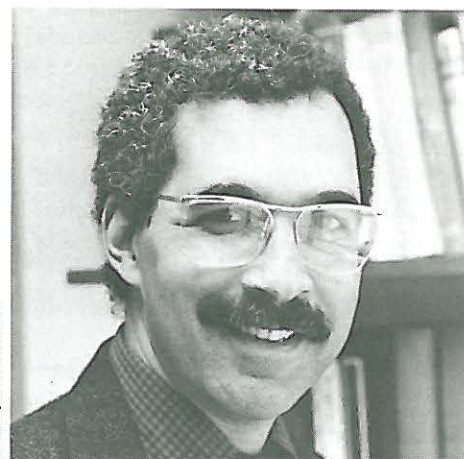


Photo by Bob Kaimbach

Claude Steele

spectrum, psychophysiological processes also account for an important portion of the variance.

Psychophysiological approaches may also "uncover more general organizational principles of behavior," he said, but added "I don't want to suggest that psychophysiology in any sense is any better than a well-designed experiment in behavioral measures . . . . My suggestion instead is that by using instruments that allow us to get outside information that is not redundant with self-report, for example, we can obtain a better handle on self-reports," he said.

## Obstacles

The great promise of psychophysiology to reveal underlying psychological states was recognized a century ago, Cacioppo said, but several major obstacles hindered progress. One of the obstacles was the problem of multiple determinants.

"Facial expressions, for example, are multi-message, multi-signal systems . . . . Knowing that a certain psychological operation leads to a [facial] physiological event doesn't imply that there is an associated psychological process. You substantiate certain emotions and look to see if you can substantiate certain physiological patterns, but those can be wildly asymmetrical. This warns us to be careful when trying to derive psychological experience from physiological events because of what might be called a base rate problem."

Another obstacle, the response threshold or sensitivity problem, has been one of the greatest frustrations of social psycholo-

gists who want to index attitude processes, he said.

He illustrated the problem saying, "If attitude objects did not evoke autonomic arousal, does it mean that there wasn't an effect, that there wasn't an attitude present? No, behavioral data suggests it's just that there is a threshold limitation on the autonomic response."

## New Tools

Sophisticated new concepts and tools are now at the disposition of psychologists, he said. Sensitivity threshold problems are now being overcome by developments in non-invasive physiological measurements, data acquisition, signal representation, parameter extraction, statistical analyses, and digital processing techniques for extracting the signal from background noise.

The multiple determinant problem is being overcome by developments in physiological measurements, specific paradigms, and better conceptualizations of psychophysiological events and relations, he said.

## Exemplary Research

Cacioppo described his human subjects research on classical conditioning of familiar and unfamiliar verbal stimuli (with an aversive stimulus) to demonstrate a major thesis: People are more persuadable (i.e., are less stimulus-bound and are more associatively flexible), on topics about which they have limited or little prior information or experience. Cacioppo's research supported this hypothesis. ♦

standardized test level," Steele said. "But the longer they stay in school, the larger that difference gets. There is a 10- to 50-percentile gap between black and white students by the time they are in sixth grade, a two school-year gap in achievement at that point, on the average.

"If we move to college campuses, the dropout rate for black students is 58 percent. For black males on predominantly white college campuses the dropout rate is about 75 percent. "For those who do finish, there is a big performance difference. There is a two-thirds of a point difference in the grades of graduating blacks and graduating whites.

"Of course, with low undergraduate averages you don't get into graduate school; but for those blacks who do, we see a replication of this underperformance — it takes longer to get degrees, fewer get degrees. "The trend is worsening: In 1979 there were 684 Ph.D.'s awarded to black males in the United States, and in 1989 there were only 317, Steele said. "The crisis is a broad crisis, from kindergarten through professional schools."

## Why Psychology?

In spite of obvious social and economic explanations for these trends, Steele believes there are reasons to take psychological explanations seriously, as well. The first is that intervention programs, even in the worst neighborhoods, can produce dramatic achievement in these

CONTINUED ON NEXT PAGE



# Psychology Telecourse, Premiering This Fall

by Don Kent

DALLAS, TEXAS - Psychology is a very interesting subject, but it is seen on television in only two forms: Freud and the brain. And the staff of Public Broadcasting Station WGBH, Boston, thought the time was right to try to overcome television's often simplistic representation of the science of psychology.

All WGBH needed was someone to write the grant proposals for the \$2 million needed to produce the series it envisioned, and someone to do the "treatments" for the programs and host them. To top it off, one of the major requirements was that the final products had to have enough appeal to successfully compete for a Boston audience interested in "Twin Peaks" and reruns of "Hill Street Blues."

Philip Zimbardo became the someone

chosen to do all of the above and much more besides. Bit by bit, the Annenberg/PBS Project provided money — first for a pilot program and then \$2 million for the entire series of 26 half-hour television programs, "Discovering Psychology." The series constitutes a full telecourse whose individual multipurpose programs can be used with many different audiences (e.g., remote site students, teaching assistants).

This Fall the series will air nationwide and perhaps overturn the Freud/brain stereotype and help give the fruits of scientific psychology away to the public. APS convention attendees had the opportunity to preview 11 of the 26 half-hour programs and discuss with Zimbardo the films' potential applications. Viewers

studied them for possible use as what Zimbardo called "Made-for-TV Psych." For example, certain subsets of the series could be used for second-level courses; may be valuable in training teaching assistants or as overviews of psychology for anyone who is very good in a narrow area but needs broader background.

The ghost of Hitler seems to have had a major role in pushing the series along the road to production, Zimbardo said. At first, Annenberg committed only to a pilot program on social psychology that an independent evaluator sent to schools for a minute-to-minute "interest analysis." The program began with the story of where social psychology itself starts, coming

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kids. We know from experience that achievement can happen," Steele said. And, data on black college students show the achievement problem persisting even in situations where finances, resources and even socialization, aren't compelling explanations, according to Steele. Data indicate that blacks are not underachieving because they're poorly prepared. The problem afflicts well-prepared blacks as well as the underprepared.

## Unvalued Clientele

Steele maintains that the basic fact of school life for American black children is that they are treated like unvalued clientele in the classroom. Even when people mean better, black students are not inherently treated seriously in their prospects for education.

"They carry a vulnerability. If they raise their hand to answer a question and get it wrong, they confirm not only that they are bad at calculus or whatever, but they also confirm the hypothesis of intellectual inferiority that hovers over them like a specter waiting to interpret their behaviors. All these things converge

in that domain of life. From the beginning all the way through law school, it is difficult for the black student to identify with this business. If I do identify, I'm at tremendous risk. My global self-worth is exposed to tremendous risk in the American educational system."

## Dis-Identification

"To protect their self-esteem, they dis-identify. They devalue school work and the abilities needed to do it. We call this a protective dis-identification with the domains of life that persistently bring them devaluation. Once this form of demoralization begins it can become a group norm very quickly. Anyone who is black knows that this touches on one of the central identity conflicts in black American life — the tension over how much to identify with mainstream society.

"How to overcome it? Somehow the learning environment has to create in black students the conviction that they can succeed. Such an environment is what we call a "wise" environment. It makes a special effort to both nullify the impact of what the society in general has taught black students about their abilities and prospects, and builds a conviction that they can do well.

## Demonstration Programs Helping

"A number of demonstration programs are doing this. James Comer's program at New Haven takes a flexible, custom-tailored approach to each child: when start to evidence needs, usually of an esteem sort, Comer tries to design something that actually meets those needs — and once that issue is put aside, they can identify with, internalize, the school environment.

"At UC Berkeley, Urie Triesman has another project that has produced high calculus achievement in black students getting it actually higher than for white and Asian students. It's based on an honorific recruitment program, one that essentially tells black students, "You're honors material. You're smart." Once the issue of "Can-you-make-it?" is convincingly put aside for these people they tend to do very well.

Successful programs must address the barrier society has set up to make black students believe they can't do it, Steele stated. "The error most minority programs make is to put remediation and skill-building first. They don't try consciously to nurse identification with education. "wise" environment reverses that prior scheme. You've got first to get them wanting to identify with education." ♦



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of World War II, with psychologists trying to understand how Hitler could transform rational individuals into blindly obedient masses.

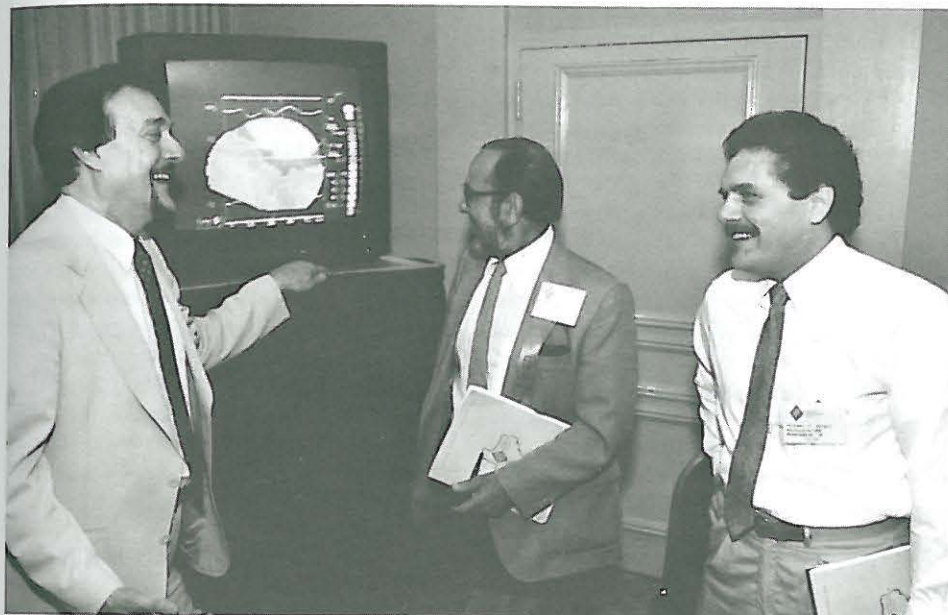
"Hitler got the highest 'interest ratings,'" Zimbardo said. "He carried us over. We had to get an 80 percent interest

Milgram's studies and the Stanford prison study."

### Three Audiences

"What made it hard to produce was the fact that there are three audiences for the programs," Zimbardo said. "Annenberg's mission is to fund media-based programs for what they call remote learners, people who are non-traditional students. But the

or brain that we can't directly visualize.... Take one of my areas, attitude change. We couldn't put that on television, we could put on only a very little bit. And we also couldn't have a disclaimer that says 'Let me tell you all the things we are not going to show you.' So some people will say, 'Look at all you haven't presented.' My answer to that is: 'That's what the teacher is supposed to do.'" ♦



Left to right: Philip Zimbardo, Advisory Board Member Michael Wertheimer, and Annenberg/CPB Project Officer Michael Strait take pleasure in the successful previewing of the 11 films at the APS Convention.

level, and he got us up to 81. Then Annenberg agreed to support treatments for all the programs." Zimbardo then wrote the treatments in coordination with an advisory board.

"Tom Freedman of WGBH transformed the treatments into scripts. Then we went around trying to convince colleagues to be in the series. That may seem glamorous, but it really meant you'd spend from two to seven hours being interviewed only to have it boiled down to zero to two minutes of television time. Seventy people agreed to participate — we have some wonderful interviews from psychologists, educators, and others . . .

"It took about three years to produce the first set of programs which was then evaluated by the advisory board for accuracy, sexism, and, for example, the need for ethical disclaimers about

main audience for WGBH is the average intelligent citizen who watches PBS. And my concern was neither of those — I wanted an exciting supplement for traditional teaching. A problem throughout the production was the need to balance educational and entertainment values," Zimbardo said.

### Unseen on TV

"Moreover, in TV, what drives the message is a visual image, and if you can't translate a concept into a visual image it doesn't work in this medium. If you're taking about functionalism versus structuralism and you talk on for more than a minute people glaze over. And so you begin to realize that there are a lot of areas in psychology where the most important thing about it is the unseen — what is happening in the person or animal's mind

### For More Information

Check local TV schedule listings for broadcast days and times.

Videocassettes of "Discovering Psychology" are available at \$29.95 for each containing two consecutive programs, or \$350 for the series, in 1/2" VHS or BETA, \$500 for 3/4" U-MATIC. Call 1-800-LEARNER to order or call 1-800-ALS-ALS8 for license information.

## Changing Your Address?

**Be sure to notify the Membership Officer at APS Headquarters:**

**APS**  
**1511 K Street, NW**  
**Suite 345**  
**Washington, DC 20005-1401**

Include a copy of your mailing label to speed processing.



# Organizational Profile

## Society for Computers In Psychology

### PURPOSE:

The Society has as its primary purpose to increase and diffuse knowledge of the use of computers in psychological research. It is a non-profit organization of interested researchers, with membership open to any person who has an academic degree and who is active in scientific applications of computers to psychological research. Over the past several years the organization has set a special goal of aiding psychologists in using microcomputers in their teaching and research. We have also encouraged consideration of the psychological aspects of hardware and software development and design.

### MEMBERSHIP:

Current membership is 350.

### FUTURE PLANS:

On November 15, 1990, the Society for Computers in Psychology will hold its twentieth annual conference at the New Orleans Hyatt Regency Hotel.

### Officers:

Cynthia McDaniel, Past-President  
Northern Kentucky University

Michael Levy, Program Chair  
University of Florida

David Eckerman, President  
University of North Carolina-Chapel Hill

Sarah Ransdell, Program Chair  
New College

Jonathan Vaughan, President-Elect  
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N. John Castellani, Proceedings Editor,  
Indiana University

Paula Goolkasian, Secretary-Treasurer  
University of North Carolina-Charlotte

### Steering Committee:

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New York University

Walter Schneider  
Learning Research and Development Center

Susan Chipman  
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Joseph Young  
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Douglas Eamon  
University of Wisconsin-White Water

Nancy Duncan  
Hampton University

Michael Levy  
University of Florida

Darrell Butler  
Ball State University

Cynthia H. Null  
College of William & Mary

### BACKGROUND:

The first meeting of the Society was called the National Conference on the Use of On-Line Computers in Psychology, and it was held on November 10, 1971 in St. Louis. The Society has met every year since then, and in 1982 adopted the present name of Society for Computers in Psychology.

*Research Methods, Instruments, and Computers.* A Student Award is given each year to an outstanding paper by a graduate or undergraduate student.

### DUES:

A portion of the annual dues help support the Washington office of the Federation of Behavioral, Psychological and Cognitive Sciences.

Membership in the Society is \$10.00 per year.

### ANNUAL MEETING:

The annual meeting is arranged to occur in the same location as, and on the day before, the annual meeting of the Psychonomic Society. Proceedings of the annual meetings are published in the March or April issues of *Behavior*



# Announcements

## MEETINGS ANNOUNCED

The Society for Studying Unity Issues in Psychology (SUNI) was founded in 1986 to provide an organization for psychologists interested in discussing whether the science of psychology is at a state of development that is conducive to the exploration of a unifying paradigm. SUNI has elected officers, an annual business meeting, and publishes a newsletter entitled *International Newsletter of Uninomic Psychology*. The annual membership fee is \$5.00 (U.S. currency). In the past, SUNI members have presented symposia and invited addresses at APA conventions under the support of Divisions 1 and 24. SUNI is interested in expanding its affiliation to other units of organized psychology and especially welcomes members of APS to join. For more information, please write to: Elaine Heiby, SUNI, Department of Psychology, University of Hawaii, Honolulu, HI 96822. To join SUNI, please include a check for \$5.00 made payable to University of Hawaii Department of Psychology Foundation.

**SIXTH ANNUAL MEETING of The Society for Traumatic Stress Studies**, entitled, TRAUMA STUDIES: Contributions to Life Sciences and Humane Policy: October 28 - 31, 1990 HOTEL INTER-CONTINENTAL, NEW ORLEANS, LA. Over 150 institutes, case presentations, posters, workshops, panels and discussion groups will be offered that reflect the ways in which studies of trauma serve to inform both life sciences and humane policy. Several distinguished speakers and experts in the field of trauma studies will also be a part of the program. Additional information and/or registration materials can be obtained from: STSS Headquarters, 435 N. Michigan Ave., Suite 1717, Chicago, IL 60611, 312/644-0828.

**THE 13TH ANNUAL NATIONAL INSTITUTE ON THE TEACHING OF PSYCHOLOGY**, co-sponsored by the University of Illinois Department of Psychology and the University of South Florida Department of Psychology, will be held January 3-6, 1991, at the TradeWinds Hotel, in St. Petersburg Beach, FL. Poster session proposals must be submitted by December 7, 1990. Featured speakers include Bruce Abbott,

LaRue Allen, Ludy T. Benjamin, Jr., Kathleen Stassen Berger, Douglas Bernstein, Martin Block, Kenneth Bordens, Perrin Cohen, Frank Costin, Stephen Davis, Valerian Derlega, Sandra Schweighart Goss, Robert Hendersen, David Holmes, Karen Huffman, Mark Leary, Elizabeth Loftus, John C. Ory, Robert R. Pagano, Louis A. Penner, John P.J. Pinel, Lester M. Sdorow, Randolph A. Smith, Judith Stevens-Long, Carol Tavis, and Barbara A. Winstead. A preconference workshop on "The theory and Practice of Psychology Exam Item Writing," which will present practical suggestions for writing classroom examinations will be held on Thursday, January 3. The conference program includes poster sessions, problem-solving sessions, participant discussion sessions, in addition to the presentations of the 26 distinguished speakers. The conference fee is \$225, which will include meals (except dinners) and evening receptions. For more information, write to Douglas A. Bernstein, Department of Psychology, University of Illinois, 603 East Daniel Street, Champaign, IL 61820, or call the conference coordinator, Joanne Fetzner, at 217/333-4731 or 217/398-6969.

**The XIth Biennial Meetings of the International Society for the Study of Behavioural Development (ISSBD)** will be held in Minneapolis, Minnesota, from July 3 through July 7, 1991. Delegates from more than 50 countries are expected to attend. Discounted registration fees are available until January 30, 1991. Information about the conference and registration materials can be obtained from Dr. Willard W. Hartup, General Chair, Institute of Child Development, University of Minnesota, 51 E. River Road, Minneapolis, MN 55455-0345 (FAX 612-624-6373).

The New England Psychological Association will meet October 12-13, 1990, in Worcester, MA, and October 18-19, 1991, in Portland, ME. For information, write to:

June B. Higgins  
Arts and Sciences  
Central Connecticut State University  
New Britain, CT 06050

## CALLS FOR PAPERS

Papers are invited for a special issue of the *Leadership Quarterly* on "Political Leadership: Perception, Personality and Performance." APA-style manuscripts not exceeding 20 pages should be submitted in triplicate. Deadline is January 1. Contact: Dean Keith Simonton, Department of Psychology, University of California, Davis, CA 95616-8686.

*Behavioral Sciences and the Law* announces a special issue on *Religion and Cults*. The deadline for receipt of manuscripts is July 1, 1991. Manuscripts should be twenty to thirty double-spaced pages adhering to the style of the *Publications Manual* of the American Psychological Association or the *Harvard Law Review*. They should contain a 150-word abstract and be submitted in triplicate to James R. P. Ogloff, J.D., Ph.D., Guest Editor, Department of Psychology, Simon Fraser University, Burnaby, British Columbia, CANADA V5A 1S6. Jeffrey E. Pfeifer, Law/Psychology Program, University of Nebraska-Lincoln, Lincoln, NE 68588-0308, will also be a Guest Editor for the issue. Inquiries may be directed to either Dr. Ogloff or Mr. Pfeifer.

The *International Journal of Conflict Management*, which is published in January, April, July, and October, is soliciting manuscripts for its 1991 volume. The journal publishes original empirical and conceptual articles, case studies, and simulation and book reviews in the following areas:

1. Organizational conflict
2. Communication and conflict
3. Mediation
4. Arbitration
5. Negotiation
6. Bargaining
7. Procedural justice and law
8. International conflict and peace
9. Conflict in the public sector
10. Social psychological conflict

Manuscripts must be prepared according to the latest edition of the *Publication Manual* of the American Psychological Association and will be reviewed by a double-blind review process. Manuscripts should not ordinarily exceed 45 pages. Four copies of the manuscript and requests for other details should be sent to:

Afzal Rahim, Editor  
*International Journal of Conflict Management*  
Department of Management  
Western Kentucky University  
Bowling Green, KY 42101, USA  
Phone: (502) 745-2559/2499/5408  
Phone & Fax: (502) 782-2601

ANNOUNCEMENTS  
CONTINUED ON NEXT PAGE







## FAU FROM PAGE 21

switch from one action to another.

### Bridging the Levels of Analysis

**Q.** You're working toward an "Esperanto" for neuroscience and behavior?

**KELSO:** There is a language barrier (much like the disciplinary barriers) among scientists who observe complex systems at different scales of analysis. As Poincare said, that's because we tend to study things rather than the relations among them. Psychology, as a behavioral science, hasn't done a very good job of identifying dynamical laws of behavior. Often we resort to other levels of description rather than obtain an adequate description at the level we are observing. A much richer language is available now, and if we develop it, maybe the gap between brain and behavior will narrow. But, remember, the issue is not matter versus process, reductionism versus wholism, or even rampant emergentism! Rather, the issue is to find an adequate level of description to enable us to abstract the essential, lawful aspects of the system under study.

**Q.** Well, I'm certainly fascinated.

**KELSO:** In humans, at least, fundamental behavioral functions like vision, audition, speaking, learning, remembering, making choices, have to be understood on their own terms. Single neuron

studies won't help. Neuroscientists need to know about the orchestration of many neurons distributed throughout the brain. Again, there is always cooperativity, and the people that come to the Center want to understand its nature. To paraphrase our MacArthur Fellow, Arnold Mandell, "Tell me about the brain that hates my mother-in-law and not this point-to-point, ankle bone is connected to the knee bone stuff."

**Q.** This sounds like it might be called an "everyday" level of analysis!

**KELSO:** Mandell has expressed concern about the insufficiency of reductionistic approaches to understanding complex and irregular systems. We need a higher level of information, as I've described today, to understand how such systems behave as a whole.

**Q.** Are you also investigating perception?

**KELSO:** Yes, and we have found identical phase transition phenomena as in motor processes. A most fascinating area is perceptual instabilities, for example the Necker Cube phenomenon, and detection of motion in random-dot kinematograms. We are hoping to do some functional brain imaging (magnetoencephalography) work on perceptual dynamics.

### Research Applications

**Q.** What about applications?

**KELSO:** Well, we're doing similar work in speech production and perception, and have discovered a wonderfully intimate

coordination between temporal changes in articulators and speech perception. As part of the work, we have developed a helmet designed to present, to the wearer, graphical display of lingual dynamics and positioning during speech. It has enormous potential for speech rehabilitation in stroke victims and other persons with speech deficiencies. Our work may lead to designing realistic speech recognition systems.

### Human Learning

**Q.** Do these principles of pattern formation hold for human learning processes?

**KELSO:** We have some beautiful data on manual learning and intentional learning supporting the notion that there are system stabilities and instabilities operating that cause differential ability to learn tasks that have differing phase relationships to the person's intrinsic monostable phase dynamics, or attractors, in a mathematical sense. Postdoctoral researcher Pierre Zanone of Switzerland and I have modeled this. Our work has the advantage of using the single subject as the unit of analysis and allows predictions of learning rate based on the person's intrinsic constraints.

The same ideas may apply to cellular learning: the temporal pattern dynamics turn out to determine whether long term potentiation or depression is observed in the hippocampal pathway. ♦



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