Is neurochemistry cure for the mind's ills?

by Brad Stuart
Staff Writer

Will neurochemistry make possible the cure of mental retardation, of senility, the increase of intelligence in normal people, the transmission of behavioral tendencies or even memory itself through extracted or synthetic chemicals? Scientists at UNC and elsewhere are trying to find out.

Research into the relation of chemicals to learning and memory has recently generated considerable excitement within the scientific community. Scientists have come closer to attaining an understanding of the neurological processes which make possible learning, memory, even awareness itself.

The discovery of the role of DNA and RNA in heredity has led to ideas and theories concerning the possible role of these and other chemicals in neurological processes.

Experiments with flatworms and, more recently, with mice, have led some to believe that learning may actually be transferred through the injection of complex neural chemicals, although scientists at UNC reject this notion.

Chemical changes accompanying learning and memory have been researched for seven years at UNC's Memorial Hospital in Chapel Hill. Research has been directed by Dr. Edward Glassman and Dr. John Wilson.

Dr. Adrian Dunn, a British research associate in the project, says research here is "some of the foremost in the world." As a result of research here and elsewhere, Dunn predicts "within 10 to 20 years, learning deficiencies such as senility and mental retardation will be alleviated and the intelligence and capacity of normal people will be increased through neurochemistry . . . This could be of very great significance for the human race."

The researchers here are involved in the analysis of chemical changes that are correlated with learning in mice. According to Glassman, the changes now under scrutiny are "related to RNA and to proteins located in the nucleus." This summer, with the arrival of Dr. Phillip Lanfield from California, research will begin on the relation of RNA metabolism to the production of brain waves.

In the experiments here, two mice are injected with radioactive uridine previous to training. They are then placed into opposite compartments of a small box divided by a partition. The floor of this box is a metal grid which may be electrified. A buzzer is placed above the box. At timed intervals the buzzer sounds for five seconds, after which a painful electric current is sent through the grid floor.

The mouse in the right compartment is provided a shelf onto which he can jump to escape the grid. The mouse in the left compartment, the control subject, has no shelf. In a short time, the mouse on the right learns to jump upon the shelf upon hearing the buzzer, thus avoiding the shock.

The control mouse who has no shelf does not learn any consistent or effective escape behavior. Its responses include running about the cage, squeeking and emitting other mouselike behavior characteristic of fear and pain.

After the mice undergo these trials for 15 minutes, both are removed from the box. Their brains are then removed and examined. Newly synthesized chemicals, particularly RNA and related proteins, are identified by the presence of radioactive uridine incorporated into their structures. More radioactivity is found in the brain of the experimental mouse which undergoes learning than in the brain of the control mouse.

In addition to isolating and analyzing changes in RNA metabolism in brain cell nuclei, Wilson says the researchers are working on "behavioral analysis to determine what in the learning situation is causing these chemical changes. We are interested in the environmental as well as neuroligical factors producing these changes."

That the amount of RNA in brain cells increased during and immediately after training of animals was first reported by a Swedish biochemist, Dr. Hyden, in 1960.

Since RNA codes the structure of all proteins and thus is an intermediate in their synthesis, it was hypothesized that increased RNA would be correlated with increased production of proteins in the nucleus of brain cells. These proteins are thought to be involved in the consolidation of memory, the formation of long term memory that is retained longer than the period immediately after acquisition.

The fact that not all learning is consolidated is responsible, says Glassman, for "the necessary process of forgetting, without which our minds would be cluttered with useless and unimportant details. As it is, much learning is short term and quickly forgotten."

If the proteins responsible for the consolidation of memory are isolated and the factors related to their function and formation are understood, a major advance in our knowledge of the brain will have been achieved. Understanding will be better understood.

To say that a researcher is studying chemicals involved in processes of memory is not to say that he is studying memory itself. "The processes of memory involve chemical changes," says Dunn. "But the formation of memory is complex and one does not necessarily conceive of memory as chemicals."

Glassman goes further, stating, "The memory is not the chemical. The chemical does not store the memory. Memory is stored in neural pathways, complex systems of cells interconnected by synapses that transmit electrical impulses. The chemicals we are studying are not memory, nor are they involved in the primary acquisition of learning. They act to consolidate memory. When a person learns something, a series of synapses are changed forming a new neural pathway. No protein synthesis is involved here.

However, these pathways will break down very quickly unless consolidated by the action of certain proteins and RNA. The synthesis of these chemicals is triggered by a learning deemed important enough to be remembered by the organism."

Wilson illustrates the importance of protein synthesis by citing experiments in which RNA and protein synthesis was suppressed by drugs. The animals given these drugs could acquire learning at a near normal rate, but forgot it shortly after training.

Chemical transfer of specific learning has not been attempted in the labs here. Experiments in this area have stirred up much controversy, however, and are of interest to the UNC researchers.

According to Time Magazine, a neurochemist at Baylor University, Dr. Georges Ungar, announced recently he had transferred chemically a specific learned response between mice. The response was fear of the dark and was established by shocking mice when they entered darkness.

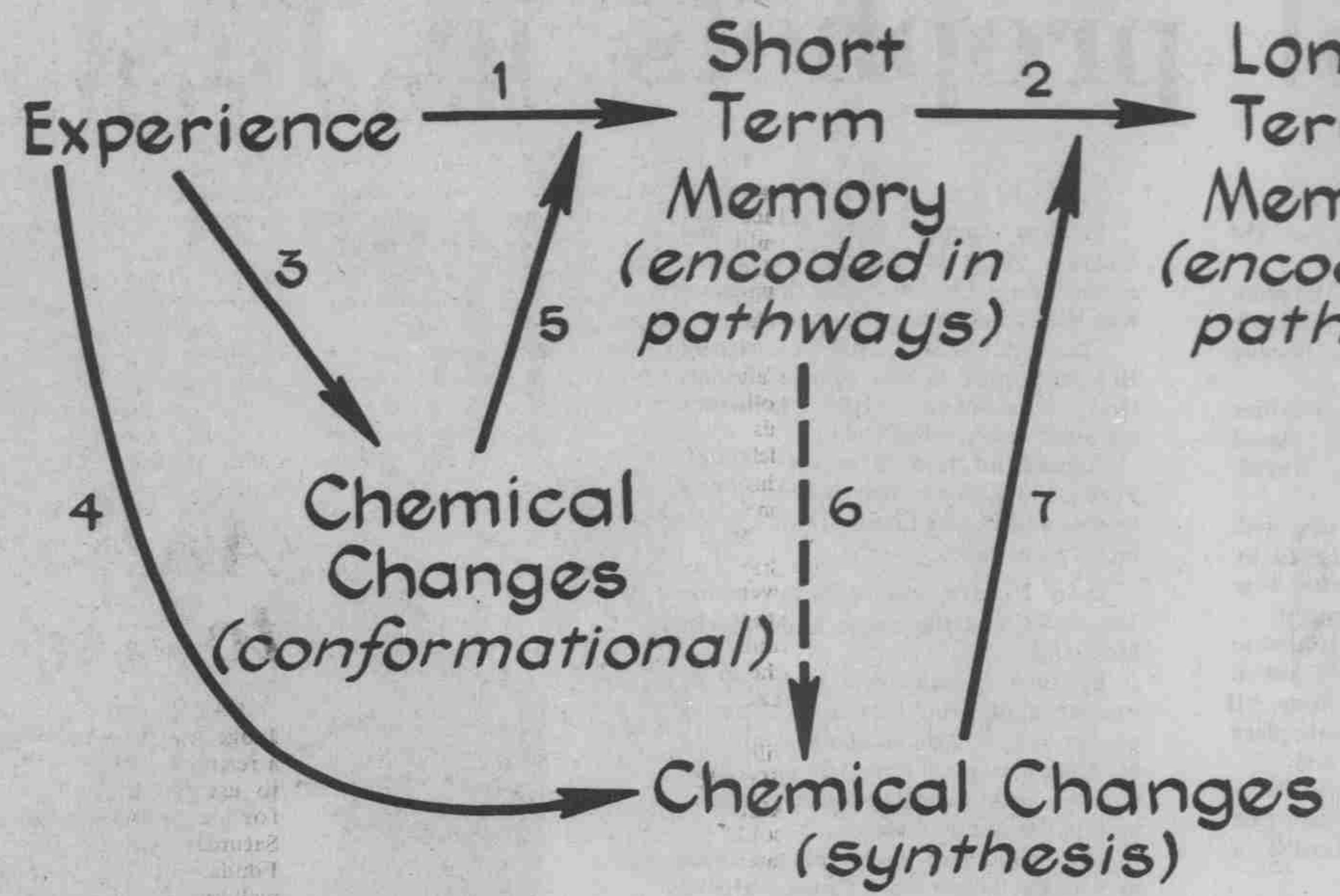
This fear was reportedly transferred when a "brain broth" from the brains of the trained mice was injected into untrained mice who normally are attracted by dark places. After injection, the untrained mice would not enter dark areas.

Ungar isolated a peptide protein which he felt was responsible for the change in behavior. He then synthesized the protein, which he called "scotophobin," and injected both the synthetic and extracted varieties of this chemical into untrained mice. These mice, Ungar reported to react with fear of darkness.

UNC neurochemists are skeptical of Ungar's work. "I do not altogether accept Ungar's findings," states Glassman, "on the basis that researchers in other labs have not been able to duplicate Ungar's results. Also, even if one accepts the results as valid, his experiments are not so well designed as to rule out explanations other than "memory transfer."

Ordinary chemicals are known to affect behavior. Rather than directly transmitting memory, scotophobin may be acting as a drug or a hormone. I do not believe that chemicals can transmit memory. Scotophobin may be bringing out tendencies which already exist, which are already coded in the neural pathways."

Science may never completely understand the neurological basis of the human psyche. And, most certainly, the student should not look forward to taking his next Shakespeare course through introvenous injection. But research in this area has profound implications.



This diagram shows the kinds of chemical changes involved in the formation of neural pathways that store short and long term memory. Conformational changes refers to structural alteration in chemicals already present in the cell. Synthesis refers to the formation of new chemicals. Researchers here are studying processes 4 and 7 in hopes of discovering ways to increase memory storage in human beings.

Profits go for trip

Choir releases record

by Jim Minor
Staff Writer

The Carolina Choir of UNC has released a long-playing record of memorable performances from 1968 to 1970.

Profits from the sale of the album will go toward financing the choir's trip to the Southern Convention of the Music Educators National Conference where they have been invited to present the opening Honors Concert. The convention will be held in Florida.

One thousand records have been printed. Five hundred of these must be sold before any profits are realized.

The albums will be on sale in 212 Hill Hall from 12-1 and 2-4 Monday through Friday. The price is $5.

The recording features Benjamin Britten's cantata "Rejoice the Lamb," sung by the 1968-69 choir. The text is taken from Christopher Smart's poem. The album's brochure says, "The main theme of the poem is the worship of God by all created beings and things, each in its own way. It is, over-all, a revelation of faith and hope transcending 'man's inhumanity to man.' "

Other selections on the album are: "Ave Maria," "No Man Is An Island," "Allelulia" (from "Psalmo Brasiliero"), "Crossing the Han River," "Pueri Hebraeorum," "Carol of the Drums," and "Christmas Encores."

Dr. Lara Hoggard, director of the choir, said Wednesday, "If we sell all of the albums we will be half-way toward financing the trip. If the albums do not sell, we may not be able to go."

Hoggard said the choir has been forced to decline some invitations this year because of a lack of funds.

SL gets budget requests

Continued from page one

which represent the University should be funded by the administration.

"What do we do when they ask us for money?" asked Grady.

His committee must also decide whether to appropriate the money on the basis of how much participation the organization has or how much the organization needs.

"Activities like the exchange program are expensive and directly affect fewer students than organizations such as the Rugby Club," Grady said.

His committee established the mechanism for graduate departments to receive their funds this semester.

"Each department should present us a budget which we will approve or reject, with the Student Legislature having veto power," Grady said.

A bill will be introduced to appropriate $200 to finance a UNC delegation to the State Student Legislature (SSL).

"This organization allows the youth of North Carolina a voice in the laws which govern them," said Capps, who will introduce the bill. "Each bill passed by SSL will be sent to the N.C. General Assembly. More than 50 per cent of the bills SSL has enacted have passed the Assembly."

Each accredited college can send delegates and present bills. The 25 UNC delegates were chosen recently by interviews in Raleigh.

Other bills to come before SL would place a ballot box in Craige, allow class officers to fill vacancies in their executive committees and decide how SL will vote its share of GM stock.

Nurses to hold tea

The nurses of Morrison Residence College will hostess an informal tea Sunday honoring the nursing faculty and all nursing students on campus.

The tea will be held at 3 p.m. Sunday in Morrison Lounge. Open discussions will be held on the nursing curriculum as well as plans for next year's freshman class.