Brain II 2nd edition

EMOTIONS, STRESS AND HEALTH: MODULE 21

ALLISON ANIMATION
Lighted Brain Model

George Page (V\O):
Today, we know that the beautiful, complex interactions within the brain can be upset by the tiniest chemical changes, changes caused by emotions, environmental pressures, and stress. These [illegible]iscule changes can lead to significant shifts of behavior. But how feelings and emotions work and how exactly behavior is affected by chemical changes is still largely unknown.

INT. DR. BLOOM'S LAB
Scripps Clinic and Research Foundation, La Jolla, CA

Dr. Bloom (O\C):
Anxiety and stress are the buffers between an event in the world I must interpret and the way I am going to respond to it.

INT. DR. WEISS' OFFICE
Rockefeller University
New York, NY

Dr. Weiss (O\C):
In all probability, what stressful stimuli do is they don't produce any qualitatively different...responses in the brain. What they do is they change the quantity and balance of the ongoing responses that are occurring...

MS DR. WEISS
VIDIFONT 3
Dr. Jay Weiss
Rockefeller University
New York

INT. DR. WEISS' OFFICE

Dr. Weiss (O\C):
Stress is not some physical event which occurs to the animal or to the human. It is in fact--that is a relatively minor part of the stress event. It starts...It sets the stage for the stress response. But the stress response is going to be critically determined

BBC HUMAN BRAIN FOOTAGE
Show #6-Fear
Nature Shots

FROG
SNAKE/FROG
FROG
SNAKE

Dr. Weiss (V\O):
by the nature of the environment in which that physical, stressful stimulus is embedded and what the organism can or cannot do in response to that stressful stimulus.

George Page (V\O):
In the animal kingdom, stress reactions are essential for survival. Approaching danger triggers the so-called "fight-or-flight" reaction, making new energies available for the big get away.

ALLISON ANIMATION

George Page (V/O):
Under stress a neurotransmitter is released by the hypothalamus, which causes the pituitary gland, the adrenal glands, and the locus coeruleus to release chemicals which keep the organism in a constant state of excitation.

EXT. AIR TRAFFIC CONTROL CENTER
Montreal, CANADA

George Page (V/O):
An air traffic controller comes to work at the Montreal Air Traffic Control Center.

George Page (V/O):
His name is Claude Bizzaro.

INT. AIR TRAFFIC CONTROL CENTER

George Page (V/O):
Airports depend on controllers like Claude bizzaro.
Air traffic controllers are subjected to high levels of stress on the job.

CLAUDE BIZZARO READING MEMOS

George Page (V/O):
At the start of every shift Claude Bizzaro has to read and acknowledge the day's memos. Bizzaro, 40, is a married man with two children and he's a loner. Already the inevitable routine has set up a conflict between his feelings of independence and the knowledge that he'll be spending several of the next hours an hour on, an hour off, earning his daily bread in a large, windowless cavern.

INT. AIR TRAFFIC CONTROL CENTER
Montreal, CANADA

George Page (V/O):
Claude Bizzaro spends his work day surrounded by high technology, guiding unseen pilots to and from Montreal's Dorval Airport. Working in both French and English only adds to the stress.

MS BELVAL BUYING CIGARETTES

George Page (V/O):
Claude Belval, 40 with two children and a third due any day is a friend and colleague of Bizzaro. Belval makes several pilgrimages a day to purchase packets of his favorite stress resistor from the machine in the cafeteria.

INT. AIR TRAFFIC CONTROL CENTER

George Page (V/O):
But even during the most boring moments, there is always the fear of losing track of one of the airplanes stacked up on the board.

AIR TRAFFIC CONTROLLER BOSS

George Page (V/O):
And watching over them all is the new, young boss, another inescapable source of stress. You can't fight your boss. Nor can you flee your job. No one can predict when an airplane will have a problem.

INT. AIR TRAFFIC CONTROL CENTER
CU BELVAL ON PHONE

Claude Belval (O/C):
Twenty-nine five. He reported a level of twenty-four on my frequency.

MS BELVAL/BOSS

George Page (V/O):
And the messages keep coming, phone messages, boss messages, plane messages.

CU BELVAL ON PHONE

Claude Belval (O/C):
Seventy, seventy-five, Montreal. Will you confirm that you're level 240? He says he's level 24, Toronto. He's coming on 3563.

Radio (V/O):
Like to referral 3S345.

Claude Belval (O/C):
Roger, 70-75. Call the Toronto Center on our frequency, at 356.3 and go ahead.

Claude Belval (V/O):
You're passing radial from end please.

CU BELVAL WORKING

George Page (V/O):
Unrelenting low level stress keeps the messages from the limbic system flowing to the frontal cortex. The physiological reactions to stress are kept constantly at a low boil.

ALLISON ANIMATION

George Page (V/O):
In the world of the air traffic controller, the constant stress means that the locus coeruleus is frequently active, releasing the neurotransmitter norepinephrine in the brain. "Fight or flight" signals move ceaselessly from cell to cell. As more messages cross the **synapses**, the brain is activated again and again, keeping the organism revved up for fight or flight.

CU CLAUDE BIZZARO

Claude Bizzaro (O/C):
I get stomach problems, yes I do. Maybe not ulcers, but I get...very often gastritis and I'm, you know, I'm sick...my stomach is sick.

INT. DR. WEISS' OFFICE
Rockefeller University
New York, NY
MS DR. WEISS

Dr. Weiss (O/C):
There certainly are the physiological responses which would lead to ulcers, heart disease, and cancer.

INT. DR. BLOOM'S OFFICE
Scripps Clinic and Research Foundation, La Jolla, CA

MS DR. BLOOM

Dr. Bloom (O/C):
One gets to a place, under that kind of severe prolonged stress, that your normal, regulatory mechanisms are unable to cope with the demands that you're putting on them.

ALLISON ANIMATION

George Page (V/O):
If stress is prolonged--if the brain has no chance to renew itself--the initial adaptation of the organism can be followed by exhaustion, disease and even death.

INT. DR. WEISS' OFFICE
Rockefeller University
New York, NY
CU DR. WEISS
INT. AIR TRAFFIC CONTROL CENTER
Montreal, CANADA
CU CLAUDE BELVAL

Dr. Weiss (O/C):
The occurrence of that New physical aggravating stimulus simply sets the stage for the stress response, that the stress response is then going to be determined by the environment in which it is embedded and what the organism can or cannot do about it.

PLANE TAKING OFF
CU BELVAL ON PHONE

Claude Belval (O/C):
You're unreadable, try it again.
I'm sorry, I just can't make you out, you're unreadable.

PLANE TAKING OFF

Roger, I finally got you.

AIRPLANE CRASH STOCK FOOTAGE
Sherman Grinberg
INT. AIR TRAFFIC CONTROL CENTER
Montreal, CANADA

Claude Belval (O/C):
5984, I'm not getting your ident feature.

CU BELVAL ON PHONE

Try again.

INT. AIR TRAFFIC CONTROL CENTER

Claude Belval (O/C):
5984, you're radar contact.
Okay.

AIRPLANE CRASH STOCK FOOTAGE
Sherman Grinberg

Claude Belval (O/C):
I'm sorry 537, I can't make you out. Try it again.

CU BELVAL ON PHONE

Radio (V/O):
How is the spacing, 537?

Claude Belval (O/C):
Spacing. You're spaced according to standardized IFR.

Radio (V/O):
I just want to know if we're getting close to something.

Claude Belval (O/C):
Well, the first carrier is on the...just landing now in Rouen. As soon as you're well clear of traffic... there, we'll be able to give you lower...

ALLISON ANIMATION

George Page (V/O):
The unceasing alert signals from the limbic system eventually overwhelm the frontal cortex. The ability of the locus coeruleus and the rest of the stress network to cope is exhausted. The balance between the limbic system and the cortex goes to pieces, leading to erratic behavior.

INT. AIR TRAFFIC CONTROL CENTER
Montreal, CANADA

MS BELVAL

George Page (V/O):
Finally the radar comes back on; all the airplanes are still in the air.

Dr. Weiss (V/O):
The ability of the cortex to communicate with the limbic system

INT. DR. WEISS' OFFICE
Rockefeller University

VIDIFONT 6
Dr. Jay Weiss

Dr. Weiss (O/C):
and in fact, with the rest of the brain in an ordered manner depends critically on inhibition. Otherwise, you get random messages firing off at once.

INT. AIR TRAFFIC CONTROL CENTER
MS BELVAL

Claude Belval (O/C):
It was getting out of hand. The radar failed on me and I had a few aircraft that...I was using radar separation and all of a sudden I couldn't use it anymore because no more radar.

ALLISON ANIMATION	George Page (V/O): Belval survived the intense stress of his radar crisis largely thanks to a neurotransmitter called GABA. GABA inhibits cells from firing, diminishing the excitatory messages reaching the frontal cortex.
INT. DR. BLOOM'S LAB Scripps Clinic and Research Foundation, La Jolla, CA MS DR. BLOOM VIDIFONT 7 Dr. Floyd E. Bloom	Dr. Bloom (O/C): What GABA seems to be able to do is to lower the excitability level of the cell that's about to receive incoming information.
ALLISON ANIMATION	George Page (V/O): But if the stress is prolonged, GABA's ability to block the passage of messages decreases. Soon the usual process by which signals are rated for priority breaks down and the frontal cortex is literally bombarded.
INT. AIR TRAFFIC CONTROL CENTER Montreal, CANADA	Claude Belval (O/C): Most of the time when I'm...When I'm tired, after a painful session, I feel tired. Must be mentally too.
BOTTLES OF MEDICINE	George Page (V/O): Many stress victims are helped by the benzodiazapine family of drugs which include Valium.
INT. DR. BLOOM'S LAB Scripps Clinic and Research Foundation, La Jolla, CA MS DR. BLOOM	Dr. Bloom (O/C): Valium is a member of a class of drugs that seems to work by improving the effectiveness of GABA transmission.

ALLISON ANIMATION

George Page (V/O):
Valium addiction can occur, but the drug helps most people suffering from stress by enhancing GABA's inhibiting action. It prevents too many excitatory messages from reaching the frontal cortex. And where are the receptor sites most affected by Valium?

BBC HUMAN BRAIN FOOTAGE
Copenhagen Street Scene/Lab

George Page (V/O):
Researchers in Copenhagen suspected they were concentrated in the parts of the brain most involved in our emotions. Their research helped establish that benzodiazapine receptor sites are concentrated in the limbic system. The receptors are seen as white specks.

INT. DR. WEISS' OFFICE
Rockefeller University
New York, NY
MS DR. WEISS

Dr. Weiss (O/C):
If the major lesson of 20th century biology is anything, it is that...that most neural tissue is involved in inhibition. In a sense, if you take away most of our brain, our behavior becomes disordered not because we are turned off, but because everything is more or less turned on at once.

Brain I & II - 1st & 2nd Editions same

STRESS, LOCUS OF CONTROL AND PREDICTABILITY: MODULE 22

INT. DR. WEISS' LAB
Rockefeller University
New York, NY
RAT EXPERIMENT

George Page (V\O):
Rat experiments have taught us that changing circumstances alter the impact of stress, and this knowledge has helped many human victims.

Dr. Weiss (V\O):
This is an experiment

MS DR. WEISS

Dr. WEISS (O\C):
illustrating the effects of control in a stressful situation.

INT. DR. WEISS' LAB CONTINUED
CU RATS

Dr. Weiss (V\O):
What you see here are two animals. One able to control the stress stimulus delivered to its tail, whereas the second animal receives exactly the same stress stimulus.

MS DR. WEISS

Dr. Weiss (O\C):
This stimulus will occur every 60 seconds

CU RAT

Dr. Weiss (V\O):
unless the animal you see here in control rotates the wheel on the front of its apparatus. And if it rotates the wheel after the stimulus has occurred, it will terminate this stimulus. This animal, therefore, has control over the stimulus.

MS DR. WEISS

Dr. Weiss (O\C):
The animal in the other cage next to it

CU RAT

Dr. Weiss (V\O):
receives exactly the same stress stimulus except that animal does not have control over it. That animal receives the stimulus at random depending on the behavior of this animal. And what this experiment is designed to study

MS DR. WEISS

Dr. Weiss (O\C):
are the physiological and neurochemical differences that occur in these animals because one has control as opposed to one having no control. We now have pretty well established that the animal that does not have control over the stressful stimulus

INT. DR. WEISS' LAB CONTINUED
CU RAT

MS DR. WEISS

Dr. Weiss (O\C):
is by and large in much greater danger of developing stomach lesions

CU RAT

Dr. Weiss (V\O):
or ulcers than does the animal that's in control.

INT. DR. WEISS' LAB
Rockefeller University
New York, NY

Dr. Weiss (V\O):
Another very important factor in stress situations is the factor of predictability.

CU RAT

MS DR. WEISS

Dr. Weiss (O\C):
The animal that has predictability develops far less pathology and has far less of an adverse reaction, so to speak, than does the animal that cannot predict.

CU RATS

Dr. Weiss (V\O):
The maximally beneficial

MS DR. WEISS

Dr. Weiss (O\C):
situation to be in is one in which one not only has an effective coping or control response

CU RAT

Dr. Weiss (V\O):
but one also has very good predictability.

MS DR. WEISS

Dr. Weiss (O\C):
We can relate that to human situation and we can simply say that in general, one is better off, one is going to develop less pathology, have a greater sense of well-being, show fewer of these neuro-chemical changes we've identified with either, stress or depression, if one has both control and

Dr. Weiss (V\O):
predictability.

Brain II - 2nd Edition

MULTIPLE PERSONALITY: MODULE 23

TONY WALKING

EXT. STREETS
Prospect, CT

MS TONY

TONY'S FEET
CU TONY

INT. TONY'S LIVING ROOM
Prospect, CT
CU TONY

ECU TONY

INT. DR. HOWLAND'S OFFICE
New Haven, CT

Tony (V\O):
Being multiple, it's...

I'm trying to find a word-It's hard. There's days where you wonder how things even got done, days you just lose yourself.

George Page (V/O):
Tony suffers from multiple personality disorder. He has at least 53-among them: Tony the Original, the Impostor, the

Controller. Dede, who remembers everything. Richard, a cousin who died of a brain tumor a decade ago.

Tony (O\C):
When Richard talks to me, it's a different sound... Tony the Impostor-basically the same as myself. Dede like I say, he's real different...It's -it's unbelievable. But they're all different. They've all got their own voices. It's not where, you know, we're all the same.

Dr. Howland (V\O):
Tony is a fairly fragmented multiple,

Dr. Howland (O\C):
who, instead of having that sort of nicely free-

MS DR. HOWLAND

flowing consciousness-which is a series of kind of normal, natural transitions from one state into another-is a person who believes that he's sharing his body with a whole lot of people. And the problem with that is that he has no control of when the other person is going to come out and take consciousness away from him.

VIDIFONT 3
Dr. Frances Howland
Yale University School of Medicine

ECU TONY

Tony (O\C):
No matter what I did, to be myself, there's days I can't control. Where they'll just take over.

INT. TONY'S LIVING ROOM
CU ROBERTA

Roberta (O\C):
He's in too many pieces, he's you know, just too many selves to deal with. But at least I'm able to talk with them now. They acknowledge their names to me, which is something. You know, it's a big change in him. He never did that before.

VIDIFONT 4
Roberta (Tony's wife)

INT. DR. HOWLAND'S OFFICE
New Haven, CT

Dr. Howland (V\O):
How do you know this woman?

THERAPY SESSION
DR. HOWLAND/TONY/ROBERTA

Tony (O\C):
Mmmmmmm...no.

Dr. Howland (V\O):
You want to ask her who she is?

Tony (O\C):
Who are you?

Roberta (O\C):
Roberta

Tony (O\C):
Good.

MS TONY

Dr. Howland (V\O):
Does that mean anything to you?

Tony (O\C):
No.

Dr. Howland (V\O):
Did you know that Tony's married?

Tony (O\C):
Yeah, I know.

Dr. Howland (V\O):
This is who he's married to.

CU TONY

Tony (O\C):
Beautiful.

George Page (V\O):
A therapy session. Tony's personalities are drawn out. Each is probed for its secrets.

Dr. Howland (V\O):
You don't really believe me.

ECU TONY

Tony (O\C):
That's his wife. That's not my wife.

Dr. Howland (V\O):
Are you married?

Tony (O\C):
Nope.

ECU TONY

Dr. Howland (V\O):
Do you have a girlfriend?

Tony (O\C):
No.

George Page (V\O):
A personality change can be subtle or wrenching. A cough, a hand to the head, a movement of the eyes.

Dr. Howland (V\O):
You doing all right ?

Tony (O\C):
Huh?

Dr. Howland (V\O):
Are you doing all right?

CU TONY

Tony (O\C):
I think so. Why? Why? I'm not doing that right?

Roberta (V\O):
You're doing all right.

ECU TONY

Dr. Howland (V\O):
Do you know all of these people? Why don't you let that little boy come out? It's all right; let him come out. That's okay. Hello. Anthony? Anthony?

MS ROBERTA\TONY

Don't be frightened. It's okay. Do you know this lady?

Tony (O\C):
Yeah.

INT. DR. HOWLAND'S OFFICE

Dr. Howland (V\O):
This is Roberta.

MS TONY/ROBERTA

Roberta (O\C):
Don't be scared. It's okay. I'm here.

Dr. Howland (V\O):
Are you about five years old?

CU TONY

Is there...would that little boy like to tell me why his hand is trembling so?

Tony (O\C):
What do you want?

Dr. Howland (V\O):
Richard.

Tony (O\C):
What?

Dr. Howland (V\O):
How are you doing? Those lights really are getting to you.

Tony (O\C):
Yeah.

Dr. Howland (V\O):
Richard, do you know that little boy that was just out, that little boy whose hand shakes like that?

Tony (O\C):
No.

Dr. Howland (V\O):
You sure?

Tony (O\C):
What'd I just say?

INT. DR. HOWLAND'S OFFICE
ECU TONY

Dr. Howland (V\O):
Do you know the story about the little boy?

Tony (O\C):
No.

Dr. Howland (V\O):
Why does your head hurt so badly?

Tony (O\C):
I don't know.

MS DR. HOWLAND

Dr. Howland (O\C):
Lot's of in and out, huh? Are you the original?

ECU TONY

Tony (V\O):
Yeah.

Dr. Howland (O\C):
Are you sure?

Tony (V\O):
Sure.

Dr. Howland (V\O):
Is there anybody inside you who knows everything about everyone, a so-called memory trace?

Tony (O\C):
Probably Dede could remember everything.

George Page (V\O):
There are at least three Dede's-7 years old, 14, 37. Tony's illness began in childhood, when most cases of multiple personality begin. Most are triggered by the need to flee psychologically from real physical or sexual abuse; nobody yet knows what triggered Tony's.

INT. DR. HOWLAND'S OFFICE
ECU TONY

Tony (O\C):
No, there's only one Dede.

ECU TONY

Dr. Howland (V\O):
Who are you?

Tony (O\C):
You're learning too fast.

Dr. Howland (V\O):
Am I?

Dr. Howland (V\O):
I think the multiple...in a way it's a kind of paradox, because simultaneously he has an exaggerated ability to focus. That is, he focuses out existence altogether...

MS DR. HOWLAND

Dr. Howland (O\C):
and substitutes an alternate existence. But is also unable to focus volitionally on anything he wants to focus on at the moment.

INT. TONY'S GARAGE
Prospect, CT

MS TONY

Tony (O\C):
If the different selves don't in turn tell me, say Hey, we did this or we did that, I'm lost. I have no recollection of what happened. It's like we went to a wedding and I swore to God that I wasn't at the wedding. I had no memory of it. The Impostor took over, blanked me out the whole night. And there I am, you know a couple of days later going around asking people, "Did you see me there?" "Was I there?"

MCU TONY

George Page (V\O):
How can the brain completely suppress one so-called "self" and focus on another? Research into multiple personality disorder is so new that we do not yet know.

MS TONY WALKING

Tony (V\O):
When it really hit me was when I was down in Bethesda, Maryland.

INT. TONY'S GARAGE
MS TONY

Tony (O\C):
I said, well you know I was hoping that I would prove 'em wrong, because I think mainly the reason I went down there was, well, let me go and prove these people wrong. These people ain't right.

INT. DR. PUTNAM'S OFFICE
St. Elizabeth's Hospital
Washington, DC
CU DR. PUTNAM

Dr. Putnam (O\C):
What we know is that the brain is all the time generating electrical signals, electrical activity. If you put an electrode on the skull or on the head, you can measure spontaneous electrical activity from the brain. Now if you stimulate that person with a flash of light, or a sound, or an electric shock, for example, you get an evoked electrical spike and that's what we call an evoked potential to distinguish it from the spontaneous electrical activity that's going on all the time, which is known as the EEG or electroencephalogram.

VIDIFONT 7
Dr. Frank Putnam
National Institute of Mental Health
St. Elizabeth's Hospital
Washington, DC

CU DR. PUTNAM

CU PET SCANS-EVOKED POTENTIALS

George Page (V\O):
Putnam and his colleagues were searching for differences in brain activity among the personalities of multiples. They matched a group of normal individuals, who were asked to mimic, or fake, new personalities. THen they tested the evoked

potentials of both groups-the multiples for three of their personalities, the controls for three personalities they invented. Among others, they tested Tony.

PET SCANS OF THREE OF TONY'S PERSONALITIES

Dr. Putnam (V\O):
In Tony's case, we had three of his alternate personalities tested and

MS DR. PUTNAM

Dr. Putnam (O\C):
we tested each of these personalities for a number of days and what you can see is that Tony, Dede and Richard showed differences in the mapping of those evoked potentials across the brain.

CU TONY'S PET SCAN

Tony (V\O):
Frank finally came into the room,

INT. TONY'S GARAGE
Prospect, CT

Tony (O\C):
and I looked at the papers and he said, "This is your brain." And I says, "Yeah?" And he said, "Well,

CU DEDE'S PET SCAN

Tony (V\O):
this is Dede's brain.

CU TONY

Tony (O\C):
This is Tony's brain.

CU TONY'S PET SCAN
CU RICHARD'S PET SCAN

Tony (O\C):
And this is Richard's brain.

MS TONY

Tony (O\C):
There is a Dede that lives inside of you. There is a Richard. There is Tony the Original." I got so upset...and I felt like I was just...Everything just

came out of me. I had to get out of the room.

QUADRANT SCAN

Intriguing biological differences like these among alter personality states in multiple personality patients continue to be reported by investigators. For example, Putnam and colleagues have found stable differences on repeated testings. ~~On measurements~~ of visual acuity, ocular function, heart rate, galvanic skin response, respiratory rate and regional cerebral blood flow. This suggests that there may in fact be some real bodily changes that occur when the alternate personalities are out.

TONY DRIVING

George Page (V\O):
Together, these different forms of data indicate that multiple personality disorder is a valid psychiatric ~~disorder~~ that provides an important scientific window into the organization of personality and consciousness.

came out of me. I had to get out of the room.

QUADRANT SCAN

Intriguing biological differences like these among alter personality states in multiple personality patients continue to be reported by investigators. For example, Putnam and colleagues have found stable differences on repeated testings of visual acuity, ocular function, heart rate, galvanic skin response, respiratory rate and regional cerebral blood flow. This suggests that there may in fact be some real bodily changes that occur when the alternate personalities are out.

TONY DRIVING

George Page (V\O):
Together, these different forms of data indicate that multiple personality disorder is a valid psychiatric condition that provides an important scientific window into the organization of personality and consciousness.

WILDLIFE STOCK FOOTAGE
(Survival Anglia)
GORILLA

EAGLE KILLING RABBIT

ELEPHANTS

GEOFF HOYLE (mime)

Aggression and violence: clearly fundamentals of the animal world. But from where in an animals's brain does such behavior emanate? And, if we found such a site,

in an animal could this volatile area also be located in the animal part of the human brain?

BULL EXPERIMENT
Jose Delgado Stock Footage

MATADOR/BULL IN RING

IMPLANTING ELECTRODES

C/U RADIO TRANSMITTER

MATADOR/BULL

DR. ALLAN SIEGEL'S LAB
New Jersey Medical School

C/U CATS

C/U SWITCH TURNED ON

C/U SWITCH TURNED OFF

George Page (V/O):

An early experiment to locate the whereabouts of animal rage was performed on a bull in a Spanish bullring. This strange archival film tells the story. In the 1960's Professor Jose Delgado took a normally hostile bull and implanted electrodes into its brain - electrodes that could be activated by a radio transmitter. His objective was to see if stimulation of the bull's mid-brain could short-circuit the rage signals, stopping the bull before it reached the matador... After the bull had recovered from the implantation and in mid-charge, the button was pressed; the bull's agression ceased instantly... or so it seemed.

George Page (V/O):

A clearer experiment was performed with cats. In this classic example, the hypothalamus - the rhythm maker - was implanted with electrodes. Could it be responsible not just for rhythms but also for rage? The switch is turned.. Then the switch is turned off...

So, indeed, the hypothalamus does control certain types of agression,

CU SWITCH TURNED OFF

George Page (V/O):
Now how could one possibly confirm this startling finding in human beings?

INT. MARK LARRIBUS'DEN
Stockton, CA

George Page (V/O):
Meet Mark Larribus.

Mark Larribus (O/C):
My name is Mark Larribus. I feel that I'm a pretty easy going guy, try to get along with circumstances as best as I can.

VIDEO NEWS FOOTAGE
KCRA-TV CHANNEL 3
Sacramento, CA

Woman demonstrator (O/C):
He's still a menace to society!

WOMEN PROTESTING

George Page (V/O):
In the Sacramento Criminal Court, Mark Larribus was accused of assaulting and almost killing his girlfriend's 2 and a half year old daughter.

INT. MARK LARRIBUS' DEN
Stockton, CA

Mark Larribus (O/C):
It's hard to remember, it's been quite a while about the incident itself, with the child. But I remember her crying. And I

INT. - MARK LARRIBAS' DEN cont'd

C/U MARK LARRIBAS

Mark Larribas (O/C) cont'd:

was, I was layin' on the couch, and then all of a sudden it just really got to me. And I rushed into her, and I remember hitting her, but I don't know why. I could never, I could never pinpoint why. I mean, nobody just goes up to a child and just starts beating on 'em for no reason like that even with my own daughter, if she cries, I try to ask her why she's crying. Or, in a sense, in a baby, you check 'em and see if they're wet, or if they're hungry... But this time it just really made me explode.

VIDEO NEWS FOOTAGE
KCRA - TV Channel 3
Scaramento, CA

MARK/POLICEMEN

TV Newscaster (V/O):

Mark Andrew Larribas, the man accused of molesting and almost killing a 2 year old girl was to have a date set today for his preliminary hearing but Larribas is in the University Medical Center where doctors have discovered some sort of tumor or growth in his brain.

INT. - DR. JOE TUPIN'S OFFICE
U.C. DAVIS MEDICAL CENTER
Sacramento, CA

C/U DR. TUPIN

VIDIFONT 6
Dr. Joe Tupin
University of California
Davis Medical Center

Dr. Tupin(O/C):

I first met Mark about three days after the assault. He had became depressed and even suicidal, and was admitted to our hospital

INT. DR. JOE TUPIN'S OFFICE cont.

Dr. Tupin (O/C):
to the psychiatric unit. This allowed us to begin a diagnostic study of what might have caused the change in Mark's personality.

INT. DR. ALIA KARIM'S OFFICE
U.C. Davis Medical Center

Dr. Karim (O/C):
He couldn't understand how this act could have occurred, how he could have been responsible for this kind of behavior.

VIDIFONT 7
Dr. Alia Karim
University of California
Davis Medical Center

And yet, as we reviewed his history, it was evident that he had been having more and more outbursts and it had been more difficult for him to control his emotional responses to tense situations in the several weeks prior to his admission.

CU MONICA LARRIBUS

Monica Larribus (O/C):
At first, he was very sweet, kind and very considerate, you know, a perfect gentleman. And then slowly but surely, things-he would be getting upset all the time. It was just-it would go like six months, then three months, then every month, every two weeks, every week, and then it was every day. So it was just kind of like a gradual change, but it just kept getting worse and worse.

CU MARK LARRIBUS

Mark Larribus (O/C):
I could never figure out about me losing my temper so quick. I could never understand it.

CU MONICA LARRIBUS

Monica Larribus (O/C):
He'd walk in the door and just look at me and start throwing things all over the house, come at me and strike me.

CU MARK LARRIBUS

Mark Larribus (O/C):
I never thought about
that I might
have something wrong inside
my brain.

INT. - DR. JOE TUPIN'S OFFICE
U.C. DAVIS MEDICAL CENTER
Sacramento, CA

CAT SCAN X-RAYS

M/S DR. TUPIN

C/U TEMPORAL LOBE

C/U DR. TUPIN

ALLISON ANIMATION
Mark Larribas' Cyst (shot #11)

CAT SCAN PICTURES

Dr. Tupin (V/O):

We began a series of routine series for conditions of this sort. One of those was an X-ray called a CAT scan. In this study we were able to demonstrate

Dr. Tupin (O/C):

the fact that there was a shadow, here, at the end of the temporal lobe on the right side.

Dr. Tupin (V/O):

This kind of finding suggests a tumor.

Dr. Tupin (O/C):

We couldn't be sure from the initial finding what kind of tumor this was, but its locatic and shape at this point suggested that it was a cyst. A cyst is like a balloon, and it slowly can fill with fluid over a period of years, increasing the pressure on the structures that are adjacent to the tumor itself.

George Page (V/O):

The tumor was located in an area of the brain where pressure was being exerted through the amygdala against the hypothalam parts of the brain thought to be involved with agression.

INT. - DR. JOE TUPIN'S OFFICE cont'd

C/U CYST

George Page (V/O):

Five weeks after his arrest, Mark Larrabas' tumor was surgically removed.

Mark Larrabas (V/O):

When I woke up from the anesthesia everything seemed more real to me for some reason I could handle myself a lot better.

INT. - MARK LARRABAS' DEN

Mark Larrabas (O/C):

the world seems a whole lot better for you.

C/U MONICA LARRABAS

Monica Larrabas (O/C):

He could control his temper so much better I mean, I hadn't seen him control it as good before as he did afterwards. And he was really willing to try to work things out between me and him.

C/U MARK LARRABAS

Mark Larrabas (O/C):

I never thought it could be that good for me, even though I was goin' through a criminal trial.

MARK/MONICA/DAUGHTER

George Page (V/O):

Mark Larribas is now back with his family. His own daughter is nearly 5 years old, and his wife is expecting another child. Mark has resumed work with his former employer. Those closest to him have now relegated his violent behavior to the past. In a sense, Mark Larribas' bout with rage was an experiment that nature caused to happen. His actions demonstrate the dynamite charge the hypothalamus can detonate. While most explosions of violence cannot be dealt with by surgery, Mark's tragic experience illustrates how our animal brain invades our human days

Module 25: The Story of Phineas Gage

B\W STILL PHOTOGRAPH
"Railroad Construction"
Bettman Archives

PHINEAS GAGE DRAMA SCENE
RR CONSTRUCTION CREW WALKING

George Page (O\C):
September 13, 1848,
near Cavendish, Vermont

Benjamin (O\C):
Just because a woman agrees to have her toes stepped on for one dance doesn't mean she's in love with you James.

James (O\C):
I suppose you're after her thinkin' that she's taken by yourself.

Benjamin (O\C):
Well, I'm takin' her out tonight. I'll ask her for you.

James (O\C):
You liar. I happen to know that she's visiting her parents tonight.

Benjamin (O\C):
And how do you know that may I ask?

James (O\C):
Because she can only see me tomorrow night.

Benjamin (O\C):
I don't believe it.

James (O\C):
Well, you can ask her yourself tonight.

Benjamin (O\C):
I asked her myself last night.

JAMES/BILLY FIGHTING

James (O\C):
Filthy liar.

Phineas Gage (O\C):
James...James...One more like that James and I'll go after this Dorothy myself.

George Page (V\O):
This is Phineas Gage.

Phineas Gage (O\C):
Eh...eh...c'mon now, get up there and you start cuttin down that brush.
Benjamin, get over here and start levelin' off this timber and hop to it.
C'mon you louts.
What are you lookin' at ? Got a lot of yards to make today.
Time is money, so get in there Billy.

RR CONSTRUCTION CREW WORKING

George Page (V\O):
Gage is an intelligent, well-balanced man.

Phineas Gage (O\C):
Feeling better now James?

James (O\C):
Yeah...

Phineas Gage (O\C):
That's my boy.

MS PHINEAS GAGE WORKING

George Page (V\O):
He's a modest and reliable person.
He's in charge here because he can make careful, well-informed decisions.

ALLISON ANIMATION
Head/brain model

George Page (V\O):
All parts of a healthy brain work together. The "red" emotional limbic system passes on its messages to the blue "intellectual," frontal cortex, the part of the brain which assigns priorities to the messages.

PHINEAS GAGE DRAMA SCENE
BILLY/PHINEAS GAGE WORKING

Phineas Gage (O\C):
Everything ready Billy?

Billy (O\C):
Yup.

Phineas Gage (O\C):
Good...give it lots of sand Billy Boy. Lots of sand.

JAMES/BENJAMIN FIGHTING

Worker (O\C):
Give it up James!!!

Phineas Gage (O\C):
James...Get back to your post at once! That's if you want to be working here tomorrow...

George Page (V\O):
Normally the two brain systems keep thought and emotion in equilibrium.

MS PHINEAS GAGE

Phineas Gage (O/C):
James...James. Yeah good.

Billy (O\C):
There's no sand... (EXPLOSION)

PHINEAS GAGE INJURED ON GROUND

Benjamin (O\C):
He's still alive.

Billy (O\C):
Come on.

James (O\C):
Sorry.

Phineas Gage (O\C):
I'm o...I'm okay...

James (O\C):
I'm sorry. I'm sorry.

RR CONSTRUCTION CREW CARRYING GAGE

Benjamin (O\C):
C'mon lads, let's get him to the village.

George Page (V\O):
Almost a century and a half after Gage's accident,

ALLISON ANIMATION
Brain Model

George Page (V\O):
we can guess that his limbic system, frontal cortex and the connections between the two were damaged by the passage of the tamping iron through his brain. The limbic system is now free to fire emotional messages.

Passing of tamping iron

PHINEAS GAGE DRAMA SCENE
RR CONSTRUCTION CREW CARRYING GAGE

George Page (V\O):
without the restraint exercised by the frontal cortex. But why did Gage feel so little pain?

ALLISON ANIMATION

George Page (V\O):
Normally, pain signals move up the spinal column to stations in the brain which pass on the messages to the frontal cortex.

Neural Network

George Page (V\O):
At the microscopic level of the neural net, information is passed on from cell to cell; it's through this system that the pain messages reach the frontal cortex.

George Page (V\O):
The passage of pain messages occurs partly through a chemical called "substance P" which is projected across the tiny gap--the synapse--from one cell to the next.

George Page (V\O):
If enough of the chemical reaches the receptors of the next cell, the cell fires

PHINEAS GAGE DRAMA SCENE

George Page (V\O):
and the pain messages continue. Often when pain or stress occurs,

ALLISON ANIMATION
Synaptic Gap

George Page (V\O):
endorphins are released. Endorphins are the natural morphines of the brain; Gage's pain was probably lessened by endorphins diminishing the transmission of substance P across the synaptic gap.

RR CREW SUMMONING DOCTOR

Worker (O\C):
Hurry Doctor...Fast.

Dr. Williams (O\C):
I'm coming.

George Page (V\O):
The young Edward Williams, a former railroad man himself, was the first doctor summoned.

Worker (O/C):
Can you walk?

Phineas Gage (O\C):
Yes...

Worker (O\C):
Let us through. The man's hurt.

Worker (O\C):
Pull back...pull back.

Billy (O\C):
The tamping iron went right through his head.

GAGE ON HOTEL STEPS

George Page (V\O):
Science's great interest in Phineas Gage was in how the severing of his frontal cortex from his limbic system completely changed his behavior and character.

Benjamin (O\C):
Come on Phineas; let's take you up to bed.

Phineas Gage (O\C):
Oh no. Leave me alone, I just wanna stay outside.

Benjamin (O\C):
Phineas, you'd be better inside.

Phineas Gage (O\C):
I'm staying right here.

James (O\C):
It's Doc Williams.

Phineas Gage (O\C):
Who?

James (O\C):
Doc Williams

Phineas Gage (O\C):
Doc Williams...Here's work enough for you Doctor.

George Page (V\O):
Gage's words were prophetic; his historic case sparked wide-spread curiosity into how physical changes in the brain affect behavior.

Dr. Harlow (O\C):
Oh...God Gage...

Dr. Williams (O\C):
Okay, enough of this nonsense, Phineas. Let's get you off to bed right now. C'mon. Lift him up.

Phineas Gage (O\C):
Oh no...oh no...Samuel. Go back to work boys, okay?

Worker (O\C):
Easy...easy...

DR. WILLIAMS CARRYING GAGE INTO HOUSE

Dr. Harlow (O\C):
In the house. Come on, easy.

DR. PROBING INTO GAGE'S HEAD

Dr. Williams (O\C):
Think I've got the last piece of bone. Just wanna see what else is down there.

Phineas Gage (O\C):
Oh...

Dr. Williams (O\C):
My right hand is touching my left hand clear through his head.

ALLISON ANIMATION
Whole Brain Model Slide

George Page (V\O):
Once the connections between the frontal cortex and the limbic system are gone, the limbic system is free to fire its messages of emotion uninhibited by the frontal cortex, and behavior becomes erratic.

PHINEAS GAGE DRAMA SCENE
EXT. RR CREW DIGGING

George Page (V\O):
and unpredictable.

EXT. HOTEL
GAGE WALKING ACROSS TOWN CENTER

George Page (V\O):
Against all odds... Gage survived physically.

Phineas Gage (O\C):
Oh...Hello!

George Page (V\O):
But he never did regain his emotional and intellectual self-control, balance and judgment.

INT. WARREN ANATOMICAL MUSEUM
Harvard, MA

George Page (V\O):
Gage died 12 years later, still unbalanced. At the Warren Museum in Harvard, the tamping rod and Gage's skull are preserved, a monument to research into how physical changes in the brain affect behavior.

DAMASIOS' LABORATORY
University of Iowa Neurology Lab.
Drs. Hanna and Antonio Damasio

George Page (V/O):
Utilizing the most modern tools of brain science investigation, Drs. Hanna and Antonio Damasio at the University of Iowa Neurology Laboratory have studied Phineas Gage's skull and the tamping rod and have been able to anatomically determine which areas of his brain were the most seriously damaged.

REVOLVING SKULL AND ROD

George Page (V/O):
Their investigation has revealed major damage to both prefrontal cortical areas, more extensive on the left side. This prefrontal region is reciprocally connected with subcortical nuclei that involve emotional processing in the amygdala and hypothalamus. When the prefrontal region is damaged in this way, an individual may not be able to control the emotion that originated from

George Page (V/O):
these subcortical structures. This was profoundly evident in Phineas Gage.

Brain II - 2nd Edition

SCHIZOPHRENIA: MODULE 26

INT.-ST. ELIZABETH'S HOSPITAL
GRAND ROUND ROOM, Washington, DC

VIDIFONT 1
National Institute of Mental Health
St. Elizabeth's Hospital
Washington, DC

MS DR. LLEWELLYN BIGELOW
AND GERALD S.

Nurse (V\O):
Gerald S. is grossly delusional and thought disordered.

He is currently on the following medications: Haloperidol, 32 mg daily, benzotropine B, 4 mg daily.

Dr. Bigelow (O\C):
Please sit down. How are you doing?

Gerald S. (O\C):
I'm not doing so hot. I think and feel as though people have called me here to electrocute me, judge me, put me in jail... or kill me, electrocute me, because of some of the sins I've been in.

Dr. Bigelow (O\C):
Is this a new feeling for you?

Gerald S. (O\C):
The main thing is don't get excited, but the thing is...is...it's not a new feeling, no. I...I'm scared of people.

Dr. Bigelow (O\C):
It must be very frightening for you, then. If it...

Gerald S. (O\C):
Yes, it is.

Dr. Bigelow (O\C):
...feels like you're about to get killed?

INT. ST. ELIZABETH'S HOSPITAL
GRAND ROUND ROOM

Gerald S. (O/C):
...It's so scary, I could tell you that picture's got a headache.

CU GERALD S.

Dr. Bigelow (V/O):
Can you tell me more about that; the picture...has a headache? Could you...

Gerald S. (O/C):
Do you want to know?

Dr. Bigelow (V/O):
Yes, I do.

Gerald S. (O/C):
Okay, when a sperm and an egg go together to make a baby, only one sperm goes up in the egg, and when they touch, there's two contact points that touch before the other two, and...then it's carried up into the air. And when they fuse, it's like nuclear fusion but it's human fusion;

CU DR. BIGELOW
VIDIFONT 2
Dr. Llewellyn Bigelow

Gerald S. (V/O):
there's a mass loss of the proton; one heavy abstraction goes up into the electron, spins around,

CU GERALD S.

Gerald S. (O/C):
comes back down into the proton to form the mind, and the mind could be reduced to one atom.

INT. ST. ELIZABETH'S HOSPITAL
GRAND ROUND ROOM continued

Dr. Kirch (V/O):
Gerry,...in one patient at one time, shows almost every one of the major features of schizophrenia;

INT. DR. DARRYL KIRCH'S OFFICE
St. Elizabeth's Hospital

Dr. Kirch (O/C):
his thinking is disorganized, the thoughts are loosely connected, he has...formed delusional ideas; some of those delusions are grandiose; some of them are paranoid. He has disturbances in his mood. His mood is...in some cases, almost absent, and in other cases, is totally inappropriate, and his behavior is disordered; it's unusual. He has mannerisms that...are inexplicable. He has purposeless, aimless behavior around the ward...he's a textbook case. He combines all those things in one person.

VIDIFONT 3
Dr. Darryl Kirch

INT. ST. ELIZABETH'S HOSPITAL
GRAND ROUND ROOM-Washington, DC

C/U GERALD S.

Dr. Bigelow (V/O):
At this point, what would you like us to do for you?

Gerald S.(O/C):
I'd like you to get me off of cigarettes, get me dried out, cleaned up, so I can go home and get a job in a bakery and go to medical school.

INT. DR. DANIEL WEINBERGER'S OFFICE
St. Elizabeth's Hospital

Dr. Weinberger (O/C):
I guess the way that I think of schizophrenia is that schizophrenia is an illness' it's a total picture. It's not like a peculiarity of behavior; it's not

M/S DR. WEINBERGER

Dr. Weinberger (O/C):
as if somebody has this sort of idiosyncrasy or has some peculiar way of doing things or thinking things. Schizophrenia is an...is an involvement of a personal illness. There is ..there is abnormalities of behavior, there are abnormalities of thinking. There are abnormalities of feeling. There are abnormalities of the way people move across a room. There are peculiarities in what people perceive. There seems to be a very global impairment of what we think of as the highest psychological functions, the most intricate, sophisticated, complex psychological functions people have.

VIDIFONT 4
Dr. Daniel Weinberger

INT. ST. ELIZABETH'S HOSPITAL
HALLWAY WARD 7-D

M/S DR. E. FULLER TORREY

Dr. Torrey (V/O):
In order to understand the kind of patients that we have on this ward, you've got to remember that schizophrenia breaks down into the rule of quarters. A quarter of the people who get the disease will get well and not get sick again. Another quarter will get relatively well on medication and be able to live independently. A third quarter will be able to live in a group facility on medication and the

Dr. Torrey (V/O):
other quarter will do very poorly. 10% of the people, in fact, will suicide within 10 years, and 15% won't respond to medication at all.

VIDIFONT 6
Dr. E. Fuller Torrey
National Institute of Mental Health
St. Elizabeth's Hospital

Dr. Torrey (O/C):
Are you going to be going home this weekend?

Patient (O/C):
Yeah, I'm going home.

Dr. Torrey (O/C):
You are?

INT. ST. ELIZABETH'S HOSPITAL
WARD 7-D

Dr. Torrey (V/O):
Chronic schizophrenics, when they've had the disease for more than a few years almost

SHOTS OF PATIENTS

C/U DAVID

Dr. Torrey (V/O): certainly have some brain damage from the disease, the same kind of biochemical, physical processes that cause the disease, cause some damage to the brain. It's sad because you have people who look normal for the first 15, 17, 20 years of their life. And then you have this devastating illness so that there is a kind of disconnect between the way they start their lives and then the way many of them spend the rest of their lives.

Mod. 27

MODULE 27: SCHIZOPHRENIA: ETIOLOGY

HEATHER STARIN AND FAMILY ARRIVING IN CAR

George Page (V/O):
About 1 person in 100 suffers from schizophrenia, the most debilitating of all psychological disorders. Schizophrenia affects males and females equally, and it occurs in all countries and in all ethnic groups. It is usually first diagnosed in young adults in their teens or early twenties; however, family members typically describe the patient as having been different, unusual or having had a mild thought disorder at an early age. Long-term institutionalization, with occasional home visits, is required for about one-fourth of afflicted individuals.

HEATHER CU

HEATHER WITH COFFEE

Heather S. (O/C):
Okay, so that's the problem isn't it? That's the complaint, right? Well...I've got kryptonite in me. You know what that is don't you? Kryptonite? And...so if I have kryptonite in me and I drink coffee and

Heather S. (O/C):
soda, and no one else knows what to eat. I mean did you ever have raw eggs? Did you ever have raw eggs? Do you eat raw eggs? When I was pregnant, I think boys get pregnant and girls don't. Yeah, it's true. But I ate raw eggs, but...do you eat raw eggs?

HEATHER'S MOTHER

Mrs. Starin (O/C):
When it comes time to take her back to the hospital...she's you know reluctant to go back. And then I say to myself is it possible...is it possible that I could keep her home? No. And then I

Heather S. (V/O):
Do you want to go pernox shopping? Do you want to go pernox shopping?

MRS. STARIN TALKING TO HEATHER

Mrs. Starin (O/C):
Heather, we are going to have to go back. You know that.

Heather S. (V/O):
Yeah. I know that.

Mrs. Starin (O/C):
Well we don't have to go back right away.

HEATHER

Heather (O/C):
No.

HEATHER

Heather S. (O/C):
Well you're not rough with me. Wait till they come here with the strait jackets.

Mrs. Starin (O/C):
No Heather, they're not going to do that.

Heather S. (O/C):
If they don't do that then I don't have to go back. Mrs. Deloca, Mrs. Barnes, told me in the morning that I am not welcome back. She said we're not coming after you. They said that.

Mrs. Starin (O/C):
Well they shouldn't come after you, we're not going to have them come after you.

Heather S. (O/C):
I do nothing and that's all I want to do, nothing.

HEATHER AND FAMILY

Dr. Scheibel (V/O):
To bear a child who is that different is a tremendous load for a family to carry. To learn from the psychiatrist, that this difference, this awful difference, may very well have

DR. ARNOLD SCHEIBEL
UCLA MEDICAL CENTER

Dr. Scheibel (V/O):
been due to the way the child was nurtured. A disease of nurture if you will, is quite an awful thing to carry. It generates an awful lot of guilt in loving parents.

Dr. Scheibel (O/C):
It's interesting how the feelings about this disease have changed over the last century. When schizophrenia, as a concept, was first developed, about a 100 years ago, most of the investigators and physicians felt that is was a brain disease and were quite certain of it. No one could ever determine what that disease was made up of, and the research such as it was at that time was quite confusing. About 50 or 60 years ago with the coming of psychoanalysis, and the ideas about the power of the environment, it became an article of faith that schizophrenia was a disease due to the environment and more specifically to the family orientation, the family interactions for the

Dr. Scheibel (O/C): young person. I was taught this when I was in medical school and in the few years that followed that this is the basis on which we try to treat patients. And it was a very terrible time because we had no specific treatments, and the parents had to carry an enormous load of guilt, the possibility that they had made their child schizophrenic. As a matter of fact, a term that was in common use then was the "schizophrenigenic mother," the mother who generates schizophrenia in her own youngster. And you know parents have enough to be guilty about as they work to produce fine young people, to think that they had produced this devastating disease, was a terrible load to carry.

DR. DANIEL WEINBERGER

Dr. Weinberger (O/C): At the turn of the century, every neuroscientist that was interested in schizophrenia was convinced that this was a brain disorder. There was no skepticism about that. It was only as that sort of stagnated and people really couldn't make much of the findings that they had at the turn of the century, that people began to...raise this notion of psychogenesis that somehow either bad mothering caused schizophrenia or that bad neighborhoods caused schizophrenia, or drugs, or some peculiar school experience or some major psychic trauma of some kind caused schizophrenia, for which there is absolutely no scientific evidence whatsoever to this day.

DR. SCHEIBEL

Dr. Scheibel (O/C): In the last 30, 35 years, it's become increasingly clear that schizophrenia, the group of schizophrenias, are indeed organic diseases, and that one aspect of the

Dr. Scheibel (O/C): schizophrenic reactions are genetically induced. The whole disease is unquestionably not a genetic phenomenon because if you have identical twins, one of whom is schizophrenic, the other has only a 50% chance of being schizophrenic, so clearly other factors are involved. We know that if there is a schizophrenic reaction somewhere in the family, sibling, parent or even grandparent, then the young person has about a 10-12% chance of having the disease. And if there is no discernible disease in the family, then the incidence is about 1 or 1.5 %. So quite clearly it is a kind of final common denominator disease in which a number of factors, genetic, organic, developmental and perhaps to some extent environmental are all involved.

GRAPHIC OF HIPPOCAMPUS

George Page (V/O):
Dr. Scheibel and his colleagues have been studying the neurological basis of schizophrenia focusing on the hippocampus and prefrontal cortex. The hippocampus is located in the temporal lobe region, deep within the brain. It plays an important role in memory, emotions, and moment to moment evaluations of real world experiences.

DR. SCHEIBEL

Dr. Scheibel (O/C):
With the coming of the major tranquilizing drugs, the neuroleptics, it became increasingly likely that there was a very strong chemical, molecular problem at the base of some schizophrenias. And that of course also pointed toward organic disease. And we started to work in the area in the middle 1970's, and after doing work with a part of the brain known as the hippocampus at the base of the temporal lobes, we found that there are some very clear cut organic, pathological changes, changes in

Dr. Scheibel (O/C): the orientation or organization of the nerve cells. In most of us, you and me, the nerve cells are lined up very nicely like slats in a picket fence. In many schizophrenics, not in all of them, they are every which way, like a fence that's falling apart. As a matter of fact, I have here, some illustrations which show quite clearly what the normal looks like as compared to the abnormal.

DIAGRAM OF CELLS

In this picture, we show the two patterns that we found in normal hippocampus and in the hippocampus of the schizophrenic patient. These are just two different methods of visualizing or staining the cells. Here we have normal cells; the cells are lined up very nicely, and their processes which are called dendrites, are very, very nicely organized like slats in a picket fence. Here the cells are all awry. They point in every which

Dr. Scheibel (O/C):
direction and as a result their extensions, these dendrites also point in every which way. This must do rather drastic things to the connections, and since again it is the hippocampus which helps us in a sense appreciate and digest moment to moment reality, we can sort of infer that this must do some pretty, pretty remarkable things to the way the individual sees the world.

IN UTERO FOOTAGE OF FETUS

George Page (V/O):
During the second trimester of fetal development, the brain produces new brain cells at the rate of 100,000 every second. It is suspected that some forms of flu virus could disrupt the migration of cells to their proper destination in the formation of the cortex.

DR. SCHEIBEL

Dr. Scheibel (O/C):
One of the things that these cells have to do is to eventually leave the place, the central place, along the neural

SKETCH OF CELL MIGRATION

Dr. Scheibel (O/C):
tube where they're generated and they have to migrate out into their final location in the cortex or cerebellum or what have you. This migration is a very critical thing, and it occurs primarily during the second trimester of pregnancy.

Dr. Scheibel (V/O):
all right. This drawing shows what we think is happening in the normal developmental process and the schizophrenic process. In normal development, after the millions and billions of cells finish their dividing, their mitosis down here, they have to migrate into their final position in the nervous system. They migrate up these guide cells that are almost like rope ladders and they come to the point where they have to get off the guide cell and make actual layers. This is what makes the layers that characterize our brain, especially our cerebral cortex. In the case of the

Dr. Scheibel (V/O): schizophrenic, it appears as though the molecules, the chemicals, that hold the cell to the guidewire here, don't relax their grip when the cell comes to the right position. As a result, they begin to pile up and make these unusual lumps. The cells then get disoriented and go all awry. We think that this then may be the mechanism for the unusual pathology that we found in the hippocampus. It points again to the importance of the second trimester in pregnancy when almost all of this migration would normally occur, and in this case, abnormally occurs. And we believe that this is due to changes in the molecules that make these stick and those changes in part can be related in part to mother having the flu during that period.

DR. SCHEIBEL

Dr. Scheibel (O/C): It turns out that the flu virus is one of a very small number of viruses that have a special

Dr. Scheibel (O/C): enzyme in the capsule of the virus. It's known as a neurominadase. And the neurominadase, specifically, among the other things it does, specifically affects the adhesiveness, or stickiness, of these molecules that allow this to happen. And so it's very possible that these nerve cell adhesion molecules are somehow disturbed by the flu virus, and there may be other factors that disturb it too, and this eventually leads to this clumping and abnormal positioning of cells. And we think that there is a causal relationship between abnormal cellular position and the way an individual experiences the world which of course then may lead to a schizophrenic process.

BRAIN VISUAL

Dr. Scheibel (V/O): We've spoken primarily about the hippocampus, but that by no means limits the range of brain areas that are involved.

DR. SCHEIBEL

Dr. Scheibel (O/C):
There's strong evidence that the prefrontal cortex, the part of the brain that essentially makes the executive decisions, helps us think about the future, that this is very much involved. As a matter of fact, many schizophrenics, when they're challenged to use this part of the brain in certain tests, this part is found by PET scans to be less vascularized and less active so it definitely is not working right.

PET SCAN

DR. SCHEIBEL

Near the hippocampus in the temporal lobe, other parts of the temporal lobe turn out to have fewer cells or a different distribution of cells. And even the ventricles, these fluid-carriers that are deep in the hemisphere, in most, not all, but in most schizophrenics, they're enlarged.

CT SCAN SHOWING VENTRICLES

DR. SCHEIBEL

Dr. Scheibel (O/C):
So there is a kind of both diffuse and focal pathology in so many parts of the brain.

HEATHER AND MOTHER

Mrs. S. (O/C):
But we do have to go back so that you can come here again and stay longer and stay overnight. You know that Heather, we're going to have to leave, and then you'll come home again Heather.

Heather S. (O/C):
Why not go to Washington?

Mrs. S. (O/C):
We're just waiting for the paper work to get through.

Heather S. (O/C):
Did you ever have a complex? A president of the U.S. come up to me and says I'm retarded, you know. No. That does nothing, I'm retarded. Right I'm an idiot, a moron.

Mrs. S. (O/C):
You're not Heather, you're none of those things Heather. You're none of those things.

Heather S. (O/C):
I'm a boss...I'm a boss, I'm an orderer, a dictator, no?

Mrs. S. (O/C):
You're not retarded Heather.

Heather S. (O/C):
Do I...could we buy pernox on the way... Do you have to go back to Manhattan today? Where do you live in Manhattan?

DeWitt Sage (V/O):
Central Park West

Heather S. (O/C):
Central Park. Near the St. Moritz?

DeWitt Sage (V/O):
Yeah.

George Page (V/O):
We are now beginning to understand the multiplicity of factors which lead to schizophrenia. It is clear that schizophrenia should be thought of as a neurological disorder with emotional and cognitive symptoms. As such, the symptoms of schizophrenia may be relieved by medication which attempts to normalize brain chemistry. Environmental factors may also play a role in the onset of symptoms. In combination with medications, environmental factors can influence the ability of the schizophrenic to function independently.