02D090I

IQP-PY-TAS-9164 – 43

Understanding Genetics, Environment, and Behavior

An Interactive Qualifying Project

Submitted to the faculty of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Introduction

How we understand the world is influenced by how we perceive the world. This in turn is influenced at least in part by our physiology, along with our past experiences. The fundamental question of nature versus nurture is at the heart of what this IQP is trying to address: “To what degree are we products of our biology? To what degree are we products of our environment?”

Often times the two views of genetic versus environmental determinism have been presented as being mutually exclusive viewpoints. What we will try to suggest here with this report is that the two ideas are *not* mutually exclusive, but in fact compliment each other to present a more complicated and fundamentally truthful viewpoint of behavioral development. Intertwining the debate between free will and determinism with the attempt to understand how environmental and genetic influences make themselves felt confuses the issue at hand. It arbitrarily places value judgments into an arena where they do not belong.

The question that is more fundamental, more topical to ask is this: “To what degree are we self determining and to what degree are our thoughts and actions determined by context?” This in turn would involve a more rigorous definition of what is meant by the word “context”. Often times, context has been understood to mean only environmental influences on human development. In making the two ideas (environmental and contextual influence) interchangeable, a subtle philosophical statement is made through the choice of language. What is

needed is a careful incorporation of a number of ideas: how do genetic influences make themselves felt within the confines of environmental influences in the definition of 'context'?

In an attempt at understanding an answer to this question, the etiology of a number of behavioral disorders will be analyzed from two viewpoints, that of the molecular biologist, and that of the behavioral psychologist. In terms of understanding how behavioral disorders arise, the language of psychology becomes one of predisposition and susceptibility. Both genetic and environmental influences are required to initiate such disorders. It is the exploration of these types of factors that result in such disorders, and how they are understood to work phenomenologicaly, that will be the focus of this IQP.

Narrative

The biology behind how the brain works is very complex. We will present a careful summary of the current understanding of how molecular and cellular biological development at one level is believed to be responsible for the functioning of higher order brain structures at another level. This background is crucial for the reader to understand physiological explanations of what may be going wrong in such behavioral disorders as schizophrenia, bipolar disorder, depression, and alchoholism, as well as others. Primary literature articles from professional scientific journals were sampled for a broad coverage of a number of topics being currently intensely researched in laboratories internationally. A

collection of summaries will be made to give the reader a sense of the overall current understanding of what is happening in these fields.

How the environment affects the progression of disease is also very complex. The nature of the interaction between the individual and his environment in the context of the progression of mental illness or various behavioral disorders will also be addressed in this IQP. Specifically, ADHD, depression, alchoholism, bipolar disorder, and retardation and how these conditions are understood to respond to environmental influences will be explored, with an emphasis on a number of key points:

Does ADHD stem primarily from environmental or genetic variables? If the condition is fundamentally biological in origin, do conventional therapies work as opposed to medication? Does depression stem primarily from genetic or environmental variables? Does depression operate in concert with other disorders to further exacerbate issues such as alcoholism? Do the therapeutic regimens often implemented to treat depression have a quantifiable physiological effect as well as a behavioral one? These questions, as well as others, will be addressed within the scope of this IQP in the hopes of finding an overall pattern, a contextual link between origins and outcomes. The many questions posed here are designed to get at the root of a larger philosophical issue: Are we indeed the architects of our own destinies? Or are we merely the products of contextual influences of both genetic and environmental origin.

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Molecular Biology

The most thing to understand with respect to molecular biology is the nature of information flow. Information travels from DNA to RNA to proteins. In order to understand how genetic mutations lead to physiological - and hence psychological – problems, it is important to have a clear grasp of what is actually occurring at the molecular level.

DNA structure is important to understand. At the lowest level it is composed of sequences of nucleotides. There are four common kinds of these nucleotides – adenine, thymine, cytosine, and guanine. Each strand of DNA is arranged in a double helix, with the two strands being complementary to one another. One strand is the coding strand and one strand is the template strand. Adenine will only pair with thymine (or uracil in the case of RNA) and cytosine will only pair with guanine. The adenine and guanine nucleotides are *purines* and the cytosine, uracil, and thymine nucleotides are *pyrimidines*. These labels are based on their chemical structure and a purine can (usually) only pair with a pyrimidine. This purine-pyrimidine pairing is what gives rise to the helical structure of DNA, hence contributing to the stability of the molecule (see fig. 1) (Raven 1999).

DNA ultimately encodes for proteins in a triplet code. That is, three base pairs of DNA encode for one amino acid. However, there are 4^3 or 64 possible

combinations of nucleotides within a given triplet and only twenty common amino acids. Therefore, for a given amino acid there may be multiple triplets that encode for it (see fig. 2). Also, certain triplets signal the beginning or end of an open reading frame (ORF) (Raven 1999).

In addition to these nucleotides, there are distal and proximal flanking sequences that encode for sites that allow certain DNA binding proteins to attach to the DNA. These DNA binding proteins form transcription platforms that channel RNA polymerase (an enzyme that transcribes messenger RNA from DNA) to the sites where transcription is desired to take place (Raven 1999).

These regulatory elements are what controls when where, and to what degree DNA is expressed. At the beginning of each gene are sequences of about sixty base pairs called promoter sites. These sequences are not transcribed themselves, but rather signify where transcription should begin. At the end of the gene are the terminator sequences that tell transcription to stop. In addition to these regions where RNA polymerase literally binds the DNA, there are many other regulatory elements that allow the binding of certain hormones, proteins, enzymes, and so forth to further regulate transcription. These regulatory elements have been over 100,000 base pairs distal from the site of the literal promoter itself (Raven 1999).

The fact that most amino acids have multiple corresponding codons is very important in reducing errors from mutations. If the base pair at the end of the codon is changed, it probably will still encode for the same amino acid, producing no change. These are referred to as silent mutations. If a change in one of the end base-pairs results in a different amino acid, the mutation is referred to as a point mutation. Some point mutations lead to a similar amino acid, leading to a small change in the shape of the protein, hence not altering the essential function too greatly. Other mutations lead to much more dramatic changes in protein shape, essentially ruining the function of the protein. Sometimes this may be harmless. Many somatic mutations have no phenotypic effect at all, for the simple reason that the cell in question does not endogenously express that particular gene. Geneticists estimate that there may be roughly 30,000 genes within the human genome. Of those, perhaps a hundred are expressed in all cells all of the time. These are referred to as housekeeping genes. They are usually responsible for the maintenance and upkeep of the cell, performing metabolic functions, and so forth. Perhaps as few as 10-20 genes within a specific somatic cell are active in that cell and no other. Often, the body will try to use redundancy as much as possible to conserve space within the genome (Raven 1999).

Some thought should also be given to protein structure in order to address the question of information flow completely. Proteins are composed of amino acids. As stated earlier, there are about twenty common amino acids. The simple

string of amino acids translated from the messenger RNA transcript is referred to as the primary structure. The primary structure of the protein will spontaneously form certain geometrical shapes, such as alpha helices or beta pleated sheets. Polypeptides can be denatured from secondary structure into essentially a string again, and when allowed to cool will spontaneously reform the shapes which were formed to begin with (Raven 1999).

From there, protein structure arranges itself into secondary, tertiary, and ultimately quaternary structures. The tertiary structure arises from the assembly of various secondary structures. The quaternary structure comes from the assemblage of separate polypeptides into the final protein structure (see fig. 3) (Raven 1999).

It is important to have a sense of scope in terms of how large the human genome is in the context of a give particular gene. In any given chromosome there are hundreds of millions of nucleotides. When DNA replicates, there are millions of points for the replication to go awry. Fortunately, the body has many different mechanisms for preventing this, but they aren't foolproof. Sometimes, the information stored in a gene will change for various reasons. This change in information is called a mutation (Raven 1999).

However, despite this and other protections available, mutations can and do occur. One example of a kind of mutation that can occur is called a point

mutation. A point mutation occurs when one triplet becomes altered so that the amino acid it encodes for changes. The change of a single amino acid may or may not significantly alter the geometry of a given polypeptide in such a manner as to disrupt the function of the resulting protein. Another example of a kind of mutation that can occur is a frameshift mutation. Within a given open reading frame, a specific sequence of nucleotides encodes for a specific sequence of amino acids. A frame shift occurs when one or two nucleotides are added or deleted to this specific sequence. The result is to knock the triplets that occur after the insertion or deletion out of frame. For example, consider the sentence THE FAT CAT ATE THE RAT. Deleting the "F" from the sentence yields the meaningless message, THE ATC ATA TET HER AT. In a gene, this will result in a completely different sequence of amino acids (see figure 4). And since each gene contains millions of codons, there is a very high probability that a stop codon will appear somewhere in the gene. The resulting protein will be completely different than the one that was supposed to be synthesized, resulting in a loss of function (Raven 1999).

DNA is organized into specific sequences with some regions having specific well-understood functions. In addition to the open reading frames (ORFs) that are the DNA sequences that specifically encode for the mRNAs that ultimately encode for translated proteins, there are distal and proximal promoter elements whose sequences control when, where, and to what degree DNA is expressed in a given environmental context (Raven 1999).

Cellular Biology

Now that a basic overview of how information travels from DNA to proteins has been covered, an overview of how information travels from cell to cell can begin. A good example might be the simplest eukaryote, S. cervisae (yeast). To initiate sexual reproduction, yeast secret small signaling peptides called *mating factors* . These factors alert other yeast of the opposite mating type that the cell is ready for mating (Raven 1999).

Cellular signaling in multicellular organisms is much more complex than that of yeast and other single-celled organisms. The cells in a multicellular organism use not only peptides as signals, but also individual amino acids, larger proteins, and steroids. Some signaling molecules are secreted from the cell and float in the extracellular space while others remain attached to the cellular membrane (Raven 1999).

Every cell in the human body is exposed to a constant stream of signals. At any given time, there can be hundreds of signaling factors in the extracellular environment. This gives rise to the question: “How do cells determine which signals to process and which to ignore?” Every cell contains receptor proteins, usually embedded within the cell membrane. Each receptor has a three-dimensional shape that conforms specifically to the shape of a specific signaling

molecule (see fig. 5). When a cell comes in contact with a signal that it has a receptor for, the signal will bind with the receptor and the cell will process it. Hence, only signals that have a matching receptor on a cell will get a response, and all of the others will continue to travel until they find a receptor (Raven 1999).

There are four basic types of cell signaling: direct contact, paracrine signaling, endocrine signaling, and synaptic signaling. Direct contact signaling is fairly simple to explain. When cells are close enough, certain proteins on their membranes bind to one another and they interact. Paracrine signaling is when the signals being secreted by a cell are quickly removed in some way from the extracellular fluid. This gives them short-lived, local effects. Endocrine signaling is when the released signals enter the circulation system and have very widespread effects. Horomonal signaling is an example of this type of pathway. Synaptic signaling happens between the cells of the nervous system. This synaptic signaling is the most pertinent to understanding how genetics can affect behavior, and also the most complex (Raven 1999).

Neurobiology

In order to have a better understanding of what synaptic signaling is, an introduction to the structure and function of neurons and neurotransmitters is necessary. A neuron can be broken down into three basic parts – the receiving end (dendrites), the cell body or soma, and the transmitting end (terminal boutons) (see fig. 6). Dendrites are usually very short (they rarely extend more

than 2mm in length). They act as antennae for the neuron, receiving incoming signals being broadcast from the transmitting end of another neuron, usually in the form of neurotransmitters. Binding of the neurotransmitter to a receptor on the dendritic surface initiates the propagation of an action potential down into the soma via the opening of chemically gated ion channels. These action potentials travel down into the cell body, where cell maintenance is controlled and some signal processing takes place. The rest of the signal processing takes place in the axon hillock, a large bulge in the region just before the axon proper within a neuron. The axon is the transmitting end of the neuron, a long thin structure designed to carry an electrical signal (action potential) quickly and efficiently a long space. Axons end in terminal boutons, specialized structures designed to convert the action potential signal into a chemical signal which gets transmitted to the next neuron by the release of neurotransmitter into the synaptic cleft between the neuron that first received the signal to the next neuron in the chain (see fig. 7) (Bear 2001).

A word should be said here about membrane biophysics and action potentials. Much like a telephone transmits an electrical signal down a metal wire, neurons transmit electrical signals down the lengths of axons. However, unlike telephone wires, the electrical signal in axons is being carried by ions as opposed to electrons. The consequence of this is that axons carry signals at a much slower rate than electrical wires can. Having an ionic charge carrier as opposed to having the charge carrier being electrons means more energy is

required to get the charge moved from one place to another (because ions are so much heavier, by roughly five orders of magnitude). In addition, the fluid surrounding the axon is very conductive and a passively conducted current (i.e. the kind generated by electrical induction of current used by modern electronics) would leak out very quickly (Bear 2001).

Action potentials are generated in pulses or waves, in contrast to passively conducted current, and are of a fixed size and duration. The neuron is designed in such a manner as to propagate the signal in such a manner as to not allow it to diminish over time (the signal gets periodically 'recharged' as it travels down the axon, insuring correct transmission.) Normally, the cytosol within the neuron is negatively charged with respect to the extracellular fluid. This generates a charge difference between the inside and outside of the cell. An action potential is the rapid reversal of this charge difference. What distinguishes action potentials is their frequency and pattern (i.e., it is this alteration in timing rather than in character or magnitude that carries the information) (Bear 2001).

There are three basic phases to an action potential. During the first portion, or rising phase, the membrane is rapidly depolarized until the potential between the inside of the membrane and the outside of the membrane reaches about 40 mV. The next portion of the action potential is the falling phase, where a rapid repolarization of the membrane takes place, until the potential difference is even more negative than at rest. After this period comes the final phase of an

action potential, where the resting potential of the neuron is restored back to normal. This whole process takes about 2 milliseconds to complete (see fig. 8) (Bear 2001).

A careful examination of how synapses are thought to work mechanistically is key to understanding the functions of neurotransmitters. It is this area biochemically that is most often targeted by drug therapies. In order to induce an action potential, Na^+ ions enter through chemically gated ion channels and make the potential difference between the inside and outside of the membrane less negative. Neurotransmitters act as the gatekeepers in this system. They are the ligands that bind the chemically gated ion channels in order to induce the change of conformation within the protein that allows the ions to flow through the membrane. Once this depolarization reaches a certain threshold, called generator potential, an action potential is induced (Bear 2001).

Neurotransmitters are simply extracellular signals which neurons use to coordinate an incredibly complex series of interactions that result in the functioning of the human brain. Most neurotransmitters fall under three basic categories: amino acids, amines, and peptides (see fig. 9). Amines and amino acids are small molecules that contain a nitrogen atom and are stored in and released from synaptic vesicles. Amino acids are abundant in the cells of the body. Amines, however, are only synthesized by the neurons that use them. The enzymes used for their synthesis are sent to the axon terminal to create

enough neurotransmitter to be packaged, and ultimately released, into the synaptic cleft. Once synthesized, the transmitter is stored in synaptic vesicles. Peptides are large molecules that are secreted in the form of granules, usually also from the axon terminal. Peptide neurotransmitter synthesis is actually quite different from amino acids and amines. For these, amino acids are strung together in the rough endoplasmic reticulum of the neuron and stored in secretory granules. Because of their longer synthesis time, peptide signals tend to be slower, and longer lasting in their effects than other kinds of neurotransmitters (Bear 2001).

The release of neurotransmitter into the synaptic cleft by the terminal boutons is induced by the action potentials being generated from the proceeding axon. When an action potential reaches the terminal bouton, it causes voltage-gated calcium channels – just like the voltage-gated sodium channels discussed previously, to open, which in turn causes Ca^{2+} ions to flood into the cytoplasm of the terminal. This cytosolic increase in concentration of Ca^{2+} ions signals the release of neurotransmitter into the synaptic cleft (Bear 2001).

Other kinds of cellular signaling pathways exist. They carry in type and design according to function. Some are designed to have faster, more short lived effects (i.e.neurotransmitters) while others are designed to have longer lasting, but more slowly induced effects (i.e. hormones). An example of another type of receptor that induces slower but longer lasting change is the G-protein-coupled

receptor. This transmitter action has three steps. First, the neurotransmitter molecules bind to the receptors in the postsynaptic membrane. The receptor activates small proteins, called G-proteins. These proteins activate 'effector' proteins. These 'effector' proteins can be G-protein-gated ion channels or they can be enzymes that synthesize second messenger molecules. Second messengers then activate additional enzymes that regulate ion channel function and alter cellular metabolism. Because these G-protein-coupled receptors can trigger widespread metabolic effects, they are also called metabotropic receptors (Bear 2001).

Neurotransmitter regulation is essential to proper brain functioning and mood balance. One important neurotransmitter is in the amine group and is called serotonin, which is derived from the amino acid tryptophan. It is interesting to note that the amount of serotonin that is synthesized is limited by the amount of tryptophan in the body, which in turn varies with the amount of carbohydrates available within the body. Thus, a person's diet can affect their mood and behavior. In fact, abnormalities in brain serotonin regulation are believed to be factors in anorexia and bulimia (Bear 2001).

One category of drugs that are known to affect behavior are called serotonin-selective reuptake inhibitors or SSRIs, such as Prozac. Serotonin is released by a diffuse modulatory system that originates in the brain stem. It is

used by G-protein-coupled receptors and the duration of its signal is controlled by how long it remains within the synaptic cleft, which in turn is controlled by its reuptake into the axon terminal. SSRIs are molecules that prevent this reuptake and thus allows serotonin to remain in the synaptic cleft longer, allowing them to have amplified effects. However, SSRIs can take weeks to induce these effects as their activity is cumulative in nature. Also, it takes time to get the drug to cross the blood brain barrier to get into the places where it can begin to be effective. This ultimately results in a positive mood enhancement, which is most likely not a direct response to the administration of the drug, but rather an adaptation to the sustained elevated levels of serotonin in the brain being induced by the drug. This adaptive response also has interesting effects in the hippocampus (Bear 2001).

The hippocampus is a specific piece of the cerebral cortex (see fig. 10). This, along with the pituitary and adrenal glands from what is known as the HPA axis, which is mediates certain responses in humans, including stress response. The hippocampus contains glucocorticoid receptors that respond to cortisol relased from the adrenal gland in response to the HPA axis. If the hippocampus is continuously exposed to cortisol (which happens during chronic stress), hippocampal neurons tend to have shorter life spans, and a neuropathology consequently develops. Studies have shown a decrease in the volume of the hippocampus in humans who suffer from post-traumatic stress disorder. One of the responses to SSRIs is an increase in the glucocorticoid receptors, which can

enhance feedback regulation and dampen anxiety. It is this effect that also has a helpful effect on anxiety disorders (Bear 2001).

Another common drug is lithium. When in solution, it diffuses through sodium channels into the neuron itself. Inside it acts to prevent the generation of second messenger molecules from G-protein-coupled receptors. It also interferes with the generation of cyclic adenosine monophosphate (cAMP) and glycogen synthase kinase (GSK), which is important for cellular energy metabolism. Like SSRIs, lithium requires prolonged use in order for its activity to take effect. Often, patients subjected to therapies don't have the patience to continue to take the medication in the hopes that it will alter their mood. This may be due to a number of contributing factors. Often times, these medications can have uncomfortable side effects, such as insomnia, headache, nausea, dizziness, drowsiness, and so forth. Also, there can be a social stigma with the taking of medication for behavioral disorders, where people don't feel as though they should need to take a drug in order to change their 'attitude' or 'mood' (Bear 2001).

A comprehensive understanding of all of these concepts is difficult to acquire in such a short period of time, but it can be helpful in the understanding of the etiology of behavioral disorders. A brief summary of a number of behavioral disorders follows, along with a case presented from both the biological perspective (body over mind) and the psychological perspective (mind over

body). To what degree is either influence responsible for the development of any of these disorders? It is hoped that the following will help shed light on this question.

Behavioral Disorders

Overall these data suggest that discrete physiological events result in the onset of mental illness. These physiological events may have a number of etiologies, those in turn being patient dependent. No matter what the etiology, consistent physiological patterns are found in the brains of those suffering from specific disorders. These must in turn reflect a response to some discrete event that is occurring ultimately at the genetic level within these individuals. It is suggested that some of this response may be due to a genetic predisposition towards a particular physiological condition, and some due to an environmental influence. The following sections will describe the most current research findings with respect to a variety of diseases, along with an explanation of the current thoughts regarding these conditions from the psychotherapeutic community. An attempt will be made to unravel the origins of these problems physiologically, as well as environmentally. The goal of these efforts is to make these behavioral disorders easier to understand, and perhaps in the process, partially reveal something about the dynamic interactions that take place between the body and the mind, the genes and the environment.

One point that must be kept in mind when reading scientific papers is to keep a skeptical mindset. For example, with many of the papers that were reviewed for the purposes of this IQP, the data was gathered by taking brain samples from dead patients who were selected due to their having suffered form

the disease in question during life. It is quite difficult to perform the assays described in these papers, and it is also difficult to find a large number of samples of people suffering from an approximately similar illness. Hence, a relatively small sample size is a problem consistent throughout many of these studies. Whether or not the pathological finding within these papers is something that can be extrapolated to everyone suffering from these types of illness is uncertain. There is a significant difference between correlative and causative data. There are many common themes that run through schizophrenia, bipolar disorder, and depression. These are illnesses which are prevalent throughout a significant portion of the population (Schizophrenia for example, has a worldwide lifetime prevalence of 1:100) are a source of significant social problems and thus high medical expenditures. These diseases are such that their etiologies are not well understood. It seems as though the symptoms may arise due to any one of a number of reasons.

Autism

I. Introduction

1. *A total of six (or more) items from (a), (b), and (c), with at least two from (a), and one each from (b) and (c):*

    a. *qualitative impairment in social interaction, as manifested by at least two of the following:*

        1. *marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction*
        2. *failure to develop peer relationships appropriate to developmental level*
        3. *a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)*

    b. *qualitative impairments in communication as manifested by at least one of the following:*

        1. *delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)*
        2. *in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others*
        3. *stereotyped and repetitive use of language or idiosyncratic language*
        4. *lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level*

    c. *restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:*

        1. *encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus*
        2. *apparently inflexible adherence to specific, nonfunctional routines or rituals*

3. *stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)*
4. *persistent preoccupation with parts of objects*

2. *Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.*

3. *The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.*

(Diagnosed Criteria, Autistic)

II. Evidence for Genetic Influences

Autism is a disease that is currently poorly understood. The label 'autism' has been applied to an entire category of patients who present in a certain manner. Since this classification is based not on etiological considerations but symptomatic ones, it necessarily involves putting a group of individuals suffering from a variety of diseases into one lump category. Certainly, some neurological deficits have been found to correlate in some cases with autism, but not enough to comprise a statistically significant enough correlation to start making categorical claims about the nature of autism.

Abnormalities were observed to be present in the AMPA-type glutamate receptors and glutamate transporters in the cerebellum in autistic patients when compared to levels present in normal controls. Gene chip arrays were used to initially identify those genes whose levels of expression deviated significantly from the normal controls, and RT-PCR was used to quantitate the actual levels (Purcell et al., 2001).

Four regions of interest were studied, the fusiform gyrus, the inferior temporal gyrus, middle temporal gyrus, and the amygdala, and haemodynamic responses were recorded in a sampling of autistic patients and compared to those of normal controls. Weak to normal activation of the FG was observed to take place in autistic patients compared to normal controls. The amygdala was also found to be significantly smaller in autistic patients than in normal controls. None of the neuronal circuitry ordinarily associated with face recognition was activated in the autistic children. Instead a unique collection of other neuronal structures for each patient seemed to be activated instead (ex. Frontal cortex, primary visual cortex, etc.) This suggests that experiential factors do indeed play a role in the development of fusiform face area (Pierce et al., 2001).

III. Evidence for Environmental Influences

Autism is a very interesting situation. At this point there is almost no question that this disease is genetic in nature, however there is more to this disease than that. While the causes of this disease are genetic the course that it takes seems to be highly influenced by environment. ~~Meaning tha~~t what may separate some low level autistic's from high level college graduating autistic's is simply the way that their disease was handled when they were children. Sadly there is not a great deal of information on this particular area of autism so it cannot be explored in any real depth in this paper.

Downs' Syndrome

I. Introduction

Incidence *Down's syndrome is one of the most common chromosomal abnormalities, occurring in about 1 out of 800 live births overall. But its frequency, like that of other chromosomal defects, varies a lot according to the age of the mother. The rate is only 1 in 2,000 for women 20 years old, but it rises steeply as women reach their mid-thirties. In those 40 or older, it is 1 birth in 100. For this reason, prenatal testing for chromosomal abnormalities is most often offered to pregnant women aged 35 years or over.*

Symptoms you are likely to notice *Individuals with Down's syndrome usually have a very distinctive look. At least some of these visible characteristics are likely to be evident at birth:*

- *Small head, flattened in the back.*
- *Broad, flat face, with low brow ridges above the eyes, cheekbones, and nose.*
- *Relatively small eyes, turned up at the outer corners, and often having a crescent-shaped fold of skin at the inner corner.*
- *Oversize tongue in a small mouth.*
- *Simian crease a deep, single horizontal line across the palm, instead of the usual "head" and "heart" lines.*
- *Short stature, with short limbs and stubby fingers.*

("Down's Syndrome", 1)

II. Evidence for Genetic Influences

Downs' Syndrome doesn't really fit in with this grouping of other behavioral disorder diseases. It is a disease of genetic origin, whose consequences on development are severe, but the state of a patient suffering from Downs' Syndrome, while they might be described as legally incompetent, is not the same as mental illness per se. Individuals presenting with Downs' Syndrome often suffer from mild to severe retardation, as well as a number of other physiological disorders. One of the variables that can determine the severity of the disease is the environment. As children, patients suffering from

Downs' Syndrome that receive stimulation designed to help them learn develop much more successfully. These handicaps often dramatically reduce the patients' quality of life and ability to function within society. Although from a broader genetic perspective the mechanics behind why people suffer from Downs' Syndrome have been known for some time, many of the more fundamental processes behind the consequences of this disorder are unknown.

Determining the pathology of a loss of a single gene can take the work of hundreds of researchers, years of work, and tens of millions of dollars. Determining the pathology of the addition of an entire extra chromosome, and the resultant consequences on the regulation of gene expression for the thousands of genes therein, requires the development of a whole category of fields of study, and is not a simple task.

In individuals with Downs Syndrome, failure for chromosome 21 to segregate properly during the meiotic process results in children who suffer from a variety of developmental problems whose etiology up till now has been somewhat unclear. PET scans show normal brain metabolism but suggest reduced functional connections between brain circuit elements. These defects in turn result not from mutations of functional genes but from alterations in gene expression which result from having to many pairs of a given chromosome around in the cells, results in altered patterns of gene expression. There were no

differences in passive electrical membrane properties in animal models, but there were differences in active electrical and biochemical properties (duration of action potential and its rates of depolarization and re-polarization, altered kinetics of Na(+), Ca(2+) and K(+) currents, altered membrane densities of NA(+) and K(+) channels. Other animal models have reduced long-term potentiation and increased long term depression, suggesting reduced synaptic plasticity in the CA1 region of the hippocampus. It is suggested that the defects observed in the animal models result in poor functioning of several signal transduction pathways including the phosphinositide cycle, protein kinase A, and protein kinase C (Galdzicki et al., 2001).

III. Evidence for Environmental Influences

As stated above Downs' Syndrome is a completely genetic disease in origin. Only through the developmental process can the environment have an influence on afflicted patients. These environmental stimuli can only hope to adjust the effects of Downs' Syndrome rather than eradicate them.

Schizophrenia

I. Introduction

> ***Characteristic symptoms****: Two (or more) of the following, each present for a significant portion of time during a 1-month period (or less if successfully treated):*
>
> 1. *delusions*
> 2. *hallucinations*
> 3. *disorganized speech (e.g., frequent derailment or incoherence)*
> 4. *grossly disorganized or catatonic behavior*
> 5. *negative symptoms, i.e., affective flattening, alogia, or avolition*
>
> ***Note****: Only one Criterion A symptom is required if delusions are bizarre or hallucinations consist of a voice keeping up a running commentary on the person's behavior or thoughts, or two or more voices conversing with each other.*

(Diagnosed Criteria, Schizophrenia)

II. Evidence for Genetic Influence

Patients who suffer from schizophrenia suffer from a variety of symptoms, including delusions and hallucinations, as well as cognitive deficits. There is growing evidence that the schizophrenic brain has larger ventricles and cortical sulci than that of normal controls, indicative of reduced cortical volume (Shelton et al., 1987). Much of the evidence recently has pointed towards an error in the prenatal development of the cerebral cortex of schizophrenic patients.

In humans, corticogenesis begins in the sixth embryonic week and continues through the seventeenth embryonic week of fetal life. Special radial

glial cells direct the deposition of neurons by neuronal stem cell progenitors. These glial cells form long string like bridges between the ventricular surface and the plial surface of the developing cerebrum. As the neuronal stem cell progenitor proceeds along this long string like projection, neurons are deposited in a structurally specific manner, forming the developing cerebral cortex. Based upon the histological patterning found within samples extracted from schizophrenic patients, it is currently believed that in many of these patients, an error is occurring in this developmental process, where an excess of cells is deposited on the ventricular surface and a deficit of cells is found along the plial surface. This patterning is found within a significant number of samples drawn from schizophrenic patients. The nature of how the brain develops is very complex and specific details with respect to the molecular biology of growth and development are not required in order to make the essential point here: an error in the developmental organ patterning is occurring within the brains of schizophrenic patients leading to a pathology of incorrect cortical wiring (Shelton et al., 1987).

This pattern is found not only with the distribution of the neurons themselves within specific regions of the brain, but also with respect to the NMDA (N-methyl-D-aspartate) receptor subunits in the schizophrenic cerebral cortex. NMDA is a neurotransmitter, and its receptor is composed of several types of subunits which are assembled within the neuronal cell body and exported to the cell surface along the synaptic cleft in a highly regulated, directed

manner. Significant alterations between normal controls and schizophrenic patients have been found with respect to the nature of this receptor in a region specific manner, again within the prefrontal regions of the cerebral cortex. This is particularly interesting in light of the fact that NMDA antagonists can produce schizophrenic like psychoses in normal individuals. A graph representing the likelihood of developing schizophrenia with respect to familial relationship can be found in appendix 1 (Shelton et al., 1987).

III. Evidence for Environmental Influence

While research has been done attempting to link schizophrenic behavior to environmental influences, the amount of significant results have been limited. The correlative research linking causes includes birth models and the influence of smoking. More time and energy has been spent researching the influences on environment after the onset of schizophrenia.

Bipolar Disorder and Depression

I. Introduction

A. Presence (or history) of one or more Major Depressive Episodes.

B. Presence (or history) of at least one Hypomanic Episode.

C. There has never been a Manic Episode or a Mixed Episode.

D. The mood episodes in Criteria A and B are not better accounted for by Schizoaffective Disorder and is not superimposed on Schizophrenia, Schizophreniform Disorder, Delusional Disorder, or Psychotic Disorder Not Otherwise Specified.

E. *The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.*

(Diagnosed Criteria, Bipolar disorder)

II. Evidence for Genetic Influence

Disorders of mood, such as bipolar disorder and depression, are called affective disorders, as opposed to disorders of intellect, such as schizophrenia. Depression is the most common affective disorder, accounting for about 50% of all psychiatric hospital admissions. It is also responsible for about 10% of regular hospital admissions, where the patient's depression masquerades as a variety of physical complaints, including headache, anemia, and chronic pain syndromes. Due to the success of a number of antidepressants in terms of relieving the symptoms of depression, including tricyclic antidepressants, monoamine oxidase inhibitors, seretonin reuptake blockers, lithium, reserpine, and others, much of the current research posits depression to be the result of a failure in the long

term regulation mechanism of a variety of neurotransmitters (these mechanisms being what is known to be affected by the medications in question). A graph of probability of developing bipolar depression with respect to familial relationship can found in appendix 2 (Shelton et al., 1987).

In a number of the studies that follow, a variety of assays and techniques are used in order to extract certain kinds of information. A word should be said here about some of the more prominent ones. For example, in many of these studies, patterns of expression were characterized in the brains suffering from a variety of behavioral disorders using in situ hybridization. Here, a radioactive probe is designed that will bind specifically to the molecule of interest (in these cases, specific mRNA transcripts). The more bound probe observed, the stronger the signal. This allows researchers to measure levels of expression of a variety of genes of interest. What must be kept in mind is that in order to perform this assay, which is very technically difficult and expensive to do, samples must be taken from the brains of dead patients. This limits the sample size of the population being studied, and so the conclusions that can be drawn from these studies are limited at best. In addition, all these experiments only demonstrate correlative data, not causative data. There is a big difference between proving that defect A causes disease B and merely demonstrating that in many of those who suffer from disease B, defect A is observed post-mortem.

Another kind of assay used in a number of these studies involves gene chip array technology. Here, for the cost of a few thousand dollars, thousands of genes can be monitored at once to measure levels of expression before and after treatment with some kind of ligand, extracellular signal, etc. Its specifics are not important, but there are questions as to the accuracy and repeatability of their use in a number of cases.

In one study, asymmetries in mRNA expression of the $NMDAR_1$ (N-Methyl-D-Aspartate Receptor subunit 1) were found in the brains of patients suffering from a variety of behavioral disorders. Less expression was detected on the left side of the brain (by in situ hybridization), specifically in the hippocampus in this study, than in the right hand side. These patterns were consistent and most strong in schizophrenic patients, although the same pattern was found to a lesser degree in bi-polar, and to an even smaller degree, in depressed patients, when compared to normal controls (Law et al., 2001).

In another study, the pre-frontal cortical lobes of schizophrenic, bipolar, and depressed patients were compared with normal controls to determine differences in a number of characteristics, including neuronal plasticity, neurotransmission, signal transduction, inhibitory neuron function, and glial cell populations. The most pathologic issues were found in schizophrenics, fewer with those patients suffering from bipolar disorder, and the least were found

within patients suffering from depression, when compared with normal controls (Knable et al., 2001).

Brodmans Area 9 had a higher degree of [3(H)]flumazenil binding to the benzodiazepine (i.e.prozac) binding site on the GABA(A) receptor in subjects with bipolar disorder than in either subjects with schizophrenia or normal controls. There was no difference in [3(H)]muscimol binding to the GABA(A) receptor or in the density of the seritonin (1A), seritonin (2A), ionotropic glutamate, or seretonin transporter receptors. There was also an age related decrease in the NMDA receptor density in control subjects that was absent in both schizophrenic and bipolar subjects. This study involved a small sample group and thus may not reflect the permutations observed in a larger population. An increase in benzodiazepine receptor binding but not [3(H)] muscimol binding was demonstrated to exist in the brodmans area 9 in bipolar disorder. This strongly suggests that a change of assembly of the receptor subunits of the GABA(A) receptors may be involved in the neuropathology of bipolar disorder (Dean et al., 2001).

Distinct alterations in the cellular architecture of the dorsolateral prefrontal cortex distinguish schizophrenia from major depressive disorder, whereas the cellular architecture of bipolar disorder patients hadn't been studied previously. Dorsolateral prefrontal area 9 (Brodmans area 9) was analyzed in normal and bipolar patients. Area 9 was characterized by reduced neuronal density in layer

III (16%-22%) and reduced pyramidal cell density in layers III and V (17%-30%). A 19% reduction in glial density was found in sublayer IIIc coupled with enlargement and changes in shape of glial cell nuclei spanning multiple layers. What is distinct about bipolar disorder as opposed to the schizophrenic or major depressive disorder patients in terms of their cellular pathology is the decreased neural and glial density associated with glial cell hypertrophy. The reductions in cell density more resemble those in major depressive disorder than schizophrenia (Rajkowska et al., 2001).

Gene chip arrays were used to study the pattern of gene expression from patients with bipolar disorder with respect to normal controls. There was a significant difference in the magnitude of gene expression in a number of genes when compared to normal controls (>35%). These selected targets were in turn analyzed by RT-PCR for more quantitative analysis. A decreased expression of TGF-ß 1 mRNA, and an increase in caspase-8 precursor and transducer of erbB2 (Tob) expression was observed in comparison to normal controls. The TGF-ß result is interesting as it conveys a neuroprotective role by inhibiting apoptotic pathways. Thus the decreased expression observed may reflect the neurotoxic insults observed to exist with respect to etiology of bipolar disorder (Bezchlibnyk et al., 2001).

The ventricular lobe, the cerebral lobe, and the Sylvian fissure size were measured in both patients with schizophrenia and bipolar disorder. Auditory

event related potentials were also measured in both patient populations. What distinguishes this article is that familial history was also taken to observe correlations that were to be observed there. A significant correlation between familial history and auditory P200 amplitude was observed. The schizophrenic and bipolar patients with or without a familial history had larger Sylvian fissures and smaller P200 amplitude than normal controls (Tabares-Seisdedos et al., 2001).

Glial cell abnormalities in the cerebral cortex are often associated with depression and schizophrenia. Glial cells have important roles in a number of processes, including neuronal migration, the inflammatory response, providing trophic support to neurons, neuronal metabolism, the formation of synapses and neurotransmission. Astrocytes provide the energy requirements for neurons and abnormalities observed in schizophrenia and depression with respect to imaging studies can partly be explained by deficient astrocyte function. It is suggested that elevated glucocorticoid levels due to illness related stress or to hyperactivity of the hypothalamic-pituitary-adrenal may down regulate glial activity and thus predispose or exacerbate psychiatric illness through enhanced excitotoxicity. (Cotter et al., 2001)

III. Evidence for Environmental Influence

The environmental research surrounding bipolar disorder is extremely correlative in nature. While there exists much research in the field of environmental treatments of this disorder, research on the environmental factors which affect the development of this disorder is limited. However research does exist on the environmental effects of birth seasonality and parental affection.

Much of the research on birth seasonality has its origins in schizophrenia. Originally, research was performed relating birth seasons of schizophrenic patients to that of stillbirths. Recently, research has related bipolar disorder birth seasonality to the birth seasonalities of other mental disorders. This research attempts to find a connection between disorders and then determine the reason for said determined connection; therefore this research is correlative by design.

One study by the Schizophrenia Research Institute attempted a comprehensive study of birth seasonality of paranoid schizophrenia, process schizophrenia, major depression, and bipolar disorder. The experiment included a comparison of birth seasons of diagnosed patients with birth records population wide for four states: Ohio, Pennsylvania, Virginia, and North Carolina. Statistics were compiled over a twenty-year period, 1950-1970. The difference between the actual number of recorded births per mental disorder was compared to the expected numbers; where expected numbers were determined based upon average number of births per month per state.

The resulting percentages had many statistically significant results. The most statistically significant result was a 5.8% increase in bipolar disorder births during the four-month period, December to March. The frequency of bipolar births was most closely related to major depression while the actual birth rates were most closely related to paranoid schizophrenia. These results could lead to the hypothesis that these diseases are etiologically related. However, basing a hypothesis on these results alone ignores inherent assumptions of this experiment (Torrey, 145).

One such hypothesis is the "conception" hypothesis. The conception hypothesis speculates "parents who are genetically predisposed to this condition have an idiosyncratic conception pattern leading to an excess of winter births in their offspring" (Torrey, 147). However, this hypothesis is flawed for many reasons, the most striking of which is the lack of support for sibling births during the same season. Other possibilities to consider when analyzing the birth seasons of a set of individuals with similar mental disorders are codependent factors of the birth season; if a trend exists for individuals born in the winter, the first trimester was during the summer, the second during the fall, the third during the winter, with the early development of the infant in the spring. Therefore, to look for common factors or environmental influences only during the winter season is without base.

Factors which may affect development of mental disorders, particularly bipolar disorder, include temperature, nutritional differences during the gestation phase, sunlight exposure, and virus activity. Due to the low amounts of scientific data relating bipolar disorder to birth seasonality, any current hypothesis of a relationship is unsupported at best (Torrey, 148).

Another researched environmental factor of research in depression is the relationship of depressed adolescents with their parents. A study of Australian adolescents from 1992 to 1995 set to study this relationship. The studied group was sampled six times using a two-phase analysis.

The first phase was a computer-based test designed to detect potential depressive episodes. Students whom displayed depressive tendencies through the computer test were submitted first to a parental questionnaire, with separate maternal and paternal questions, then to an interview with a qualified child psychologist. This two-phase process occurred twice each year through out the sampling period. The mean age of the adolescents changed from 14.5 to 17.4 years.

The data returned indicated a general trend towards depression from parents with either a high amount of control or a low amount of affection. Children with a maternal affection in the lowest quartile were at four times the risk of depression where the lowest quartile of paternal affection resulted in three times the risk (as compared to the mean affection for both maternal/paternal

respectively). Comparing the highest quartile of paternal control to the mean resulted in five times the risk where the highest quartile of maternal control resulted in only three times the risk.

While at face these numbers may seem significant there are many factors which are being ignored. The correlation which seems to appear between depression and parental control/affection is not strictly independent of the testing/selection procedures. Adolescents which take screening tests during a depressive period are more likely to report parental insecurities than post-depressive period subjects.

The multi-phase approach over a prolonged period (three years) was chosen specifically to deter a large effect on the gathered data. Also, the correlation between parental control/affection and adolescent depression is a psychologically accepted phenomenon; low care leads to insecure attachment styles which leads to diminished interpersonal skills (Patton, 479).

The studies above seem to show two sides to psychological research. The research in to birth seasonality provides a statistically relevant view into the development of bipolar disorder. This research attempts to reveal psychological ideas which may be further researched. The research about the influence of parental control/affection, on the other hand, attempts to back up pre-existing psychological ideas. While both types of research may be meaningful, they do not provide the same insight into developmental onset of bipolar disorder.

Obsessive-Compulsive Disorder and Attention Deficit Hyperactivity Disorder

I. Introduction

We chose to combine both ADHD and OCD. Both diseases have similar symptom patterns but seemingly different sources. Here is the medical definition of OCD:

A pervasive pattern of preoccupation with orderliness, perfectionism, and mental and interpersonal control, at the expense of flexibility, openness, and efficiency, beginning by early adulthood and present in a variety of contexts, as indicated by four (or more) of the following:

1. *is preoccupied with details, rules, lists, order, organization, or schedules to the extent that the major point of the activity is lost*
2. *shows perfectionism that interferes with task completion (e.g., is unable to complete a project because his or her own overly strict standards are not met)*
3. *is excessively devoted to work and productivity to the exclusion of leisure activities and friendships (not accounted for by obvious economic necessity)*
4. *is overconscientious, scrupulous, and inflexible about matters of morality, ethics, or values (not accounted for by cultural or religious identification)*
5. *is unable to discard worn-out or worthless objects even when they have no sentimental value*
6. *is reluctant to delegate tasks or to work with others unless they submit to exactly his or her way of doing things*
7. *adopts a miserly spending style toward both self and others; money is viewed as something to be hoarded for future catastrophes*
8. *shows rigidity and stubbornness*

(Diagnosed Criteria, OCD)

and here is the medical definition of ADHD:

ADHD, Attention Deficit Hyperactive Disorder, is "a Disruptive Behavior Disorder characterized by the presence of a set of chronic and impairing behavior patterns that display abnormal levels of inattention, hyperactivity, or their combination." (Diagnostic, 4) ADHD is a neurobiological/psychological disorder that is diagnosed based upon the diagnosis criteria DSM-IV. These criteria map three types of ADHD:

1. *ADHD with the combined characteristics of hyperactivity, impulsivity, and inattention,*
2. *ADHD with inattention as the primary characteristic, and*
3. *ADHD with hyperactivity and impulsivity as primary characteristics. ("What is", 1)*

II. Evidence for Genetic Influences

Psychiatry can often be a difficult specialty for physicians. Often times, they feel as though there is little that they can do to effectively treat their patients conditions, sometimes for no other reason that that the brain is currently so poorly understood. Obsessive-compulsive disorder (OCD) stands out as a disease that can be currently treated with extreme effectiveness. The difference in patients' lives before and after treatment is considerable. They *know* how they are behaving, but there isn't anything that they can do to stop it, and they can observe the differences within themselves after the medication. Obsessive-compulsive disorder is often compared to Tourettes syndrome, insofar as both diseases involve a loss of impulse control. There is considerable evidence to suggest that (1) impulse control involves the ventromedial prefrontal cortex and that (2) drug treatments have there affects felt in this portion of the brain. The evidence for these observations comes largely from (1) observations from patients suffering brain damage to this region (they lose impulse control) and (2)

Magnetic Resonance Imaging (MRI) studies of patients before and after drug treatment.

Certain patients with OCD appear similar to patients with damage to the ventromedial prefrontal cortex. The hypothesis that this area is involved with OCD is also confirmed by neuropsychological findings. 34 pateints with OCD were sampled along with 34 normal patients as a negative control and 19 patients with panic disorder. The patients were made to perform a neuropsychological task that is sensitive to frontal lobe function. Significant differences between the normal subjects and the OCD subjects were observed, strongly indicating the presence of a decision-making deficit in patients with OCD. Comparison of the group of OCD patients with the most deficit found that they were the ones who responded least to anti-obsessive drug treatment (Cavendini et al., 2002).

III. Evidence for Environmental Influences

The above criteria describe the symptoms of "as many as 1 in 6 U.S. children-or some 12 million children." A rise in the diagnosis of ADHD in both children and adults has resulted in an increase of ADHD related medical research. Particular topics of interest include both the root causes of ADHD and possible treatments for this disease.

From the many possible environmental variables which can affect the development of ADHD the three most relevant are: sleep disturbances, misdiagnosis, and an increasingly rapid fire culture. Through careful study of these topics one can greatly influence the development of ADHD.

Sleep disturbances commonly affect the population of the United States. One study suggested that 25 to 43% of children in the U.S. suffer from sleep disturbances. The cause of sleep disturbances range from chemical imbalances causing narcolepsy and insomnia, to environmental traumas which prevent sleep or make it less restful. Symptoms also vary from person to person; these symptoms include: "difficulties in falling asleep, difficulties in awakening, and difficulties in maintaining adequate alertness for daily activities (excessive daytime sleepiness)." (Brown, 2)

One common result of sleep disturbances is inattentiveness during wake hours. This inattentiveness often leads to the development of ADHD type symptoms. Whether or not ADHD symptoms induced by sleep disturbances are actually ADHD is a debatable topic. The distinguishing difference is whether or not ADHD tendencies existed before the sleep disturbances began. If these disturbances begin in infancy, the relationship of these two disorders is impossible to discern. However if ADHD tendencies exist before the onset of sleep disturbances, the onset will expedite the development of ADHD.

Proof of the relationship of ADHD to sleep disturbances has been accrued through the scientific study of ADHD diagnosed patients. One study reports that "moderate to severe sleep problems occurred at least once a week in nearly 20% children with ADHD compared to 13.3% of psychiatric controls, and 6.2% of pediatric controls." (Brown, 2) Other studies report numbers as high as a 50% correlation between ADHD patients and those with sleep disorders. The result of these studies is the belief that good sleep hygiene is a key factor to both the cause and cure of ADHD.

ADHD is often diagnosed based upon the appearance of symptoms obvious to family members, friends, and teachers. The most outward of ADHD symptoms include learning disabilities and other functional impairments. These symptoms lead to a male dominated diagnosis of ADHD. Currently there exists a ten to one diagnosis bias towards males. However it is speculated that the numbers should actually be a 50/50 split between male/female diagnoses. (Bierderman, 36)

The major difference between males and females with ADHD is the symptoms which they exhibit. Males are more likely to have associated learning disabilities and exhibit problems in school. Females are more likely to be predominately inattentive. "The lower likelihood for girls to manifest psychiatric, cognitive, and functional impairment than boys could result in gender-based referral bias unfavorable to girls with ADHD." (Bierderman, 36)

Post diagnosis biases also exist between genders. Girls are "less likely to receive pharmacotherapy … and psychotherapy." (Bierderman, 38) Possibly related is the statistic that girls have a higher risk factor for substance use disorders. While girls with ADHD are less likely to have associated behavior disorders and fewer school problems, they in general scored lower on full-scale IQ tests.

The above gender issues have resulted in the misdiagnosis of many females whom have ADHD. Through research awareness levels have been raised and over the course of the next few years the imbalance in gender diagnosis should be reconciled.

As a society, Americans are constantly surrounded by an ever-changing technological world. The result is a faster and faster paced daily life. The affects of these changes on the human existence are just starting to surface in a visible manner. The link between ADHD and quickening pace of our daily lives is often made. A 1971 survey found that "one in five adults surveyed said they felt always rushed. By 1992 this number had jumped to more than one in three." (DeGrandpre, 19) This increasingly rapid culture has lead to what many describe as a pseudo-ADHD.

Pseudo ADHD has many of the same affects on individuals as clinical ADHD. These affects include: high levels of impulsivity, an ongoing search for high stimulation, a tendency towards restless behavior and impatience, a very active and fleeting attention span. The point at which ADHD symptoms, which exhibit themselves in pseudo ADHD, becomes a clinical case of the mental disorder known as ADHD is still reputable. To fully understand the roots of ADHD one must investigate the technological revolution which has forever changed the lives of millions of individuals.

The most significant technological changes relating to the development of ADHD are those which affect how we communicate. Taking the step from mass production information distribution with the advent of the printing press (1445) to the invention of the electronic telegraph (1844) took nearly four hundred years. The leap to wireless information distribution with the advent of the radio came eighty years after that. Soon after the radio the American Nation had the infrastructure for a national telephone system which allowed instant cross country communication. In only fifty years since the use of the rotary phone we now are surrounded by cell phones, pagers, emails, and instant messages. The result is a rapid-fire culture constantly wired in, awaiting stimuli.

This rapid increase in communication has bread a society which places great importance on the technological development. The result is a consumer population constantly desiring the newest technology regardless of function. A rise in materialism is noticeable throughout the decades. A 1997 study found that "57 percent of women and 42 percent of men said they were more excited by the idea of an unlimited shopping spree than the idea of sex." (DeGrandpre, 21) Working towards understanding the root desire to keep up with ever increasing technological developments will bring understanding to the increase of ADHD symptoms among the American society.

Alcoholism

I. Introduction

A. Alcohol abuse: A destructive pattern of alcohol use, leading to significant social, occupational, or medical impairment.

B. Must have three (or more) of the following, occurring when the alcohol use was at its worst:

1. *Alcohol tolerance: Either need for markedly increased amounts of alcohol to achieve intoxication, or markedly diminished effect with continued use of the same amount of alcohol.*

2. *Alcohol withdrawal symptoms: Either (a) or (b).*

   (a) Two (or more) of the following, developing within several hours to a few days of reduction in heavy or prolonged alcohol use:

   - *sweating or rapid pulse*
   - *increased hand tremor*
   - *insomnia*
   - *nausea or vomiting*
   - *physical agitation*
   - *anxiety*
   - *transient visual, tactile, or auditory hallucinations or illusions*
   - *grand mal seizures*

   (b) Alcohol is taken to relieve or avoid withdrawal symptoms.

3. *Alcohol was often taken in larger amounts or over a longer period than was intended*

4. *Persistent desire or unsuccessful efforts to cut down or control alcohol use*

5. *Great deal of time spent in using alcohol, or recovering from hangovers*

6. *Important social, occupational, or recreational activities given up or reduced because of alcohol use.*

7. *Continued alcohol use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely*

to have been worsened by alcohol (e.g., continued drinking despite knowing that an ulcer was made worse by drinking alcohol)

(Diagnosed Criteria, Alcoholic Dependency)

Overall, these data suggest that the response to the alcohol stimulus may be largely environmental, but also genetic. The relationship between the onset of mental illness and alcoholism is unclear. Of course, the choice to begin drinking is clearly influenced entirely by environmental factors. The choice to *continue* to drink, on the other hand, is influenced by a host of physiological factors. Addictive mechanisms exist in individuals suffering from certain types of alcoholism that appear to be absent in those not suffering from the disease. A distinction can be made from those suffering from psychological addition versus physiological addiction. In addition, certain pathologies within the brains of those suffering from alcoholism may interact within the developmental pathologies involved with the onset of certain other behavioral disorders, although little is currently known about such interactions.

II. Evidence for Genetic Influence

Light alcohol consumption stimulates the release of opioid peptides from the endogenous opioid system in brain regions that are associated with reward and reinforcement. Hence light alcohol consumption induces further alcohol consumption through positive reinforcement. Heavy alcohol consumption induces

a central opioid deficiency, which results in symptoms similar to opioid withdrawal. Hence heavy alcohol consumption induces further alcohol consumption through negative reinforcement (Gianoulakis et al., 2001).

Alcoholism and anxiety disorders have a complex interaction with each other. P300 event-related potentials were examined in normal controls, alcoholic controls alone, anxiety disorder patients alone, or in patients who were both alcoholic and suffered from alcoholism. This last group had been observed to have diminished alpha amplitude in the resting EEG. As expected, auditory and visually stimulated P300 potentials were significantly reduced in patients with alcohol use disorders and significantly increased in patients with anxiety disorders alone. The auditory P300 amplitude levels were lowest in patients with both anxiety disorders and alcohol use disorders, contrary to the expected outcome. The visual P300 amplitude levels followed the same trends but typically were not significant (Enoch et al., 2001).

III. Evidence for Environmental Influences

Alcoholism is very poorly defined in mass culture. What is alcoholism? What makes someone an alcoholic? What makes them become addicted to alcohol?

Specifically what are the environmental conditions that effect the development of alcoholism? Anything from childhood abuse, sexual trauma,

unstable home environment to heavy parental drinking can encourage an individual to grow into an alcoholic.

Let us start our examination of alcoholism by looking at the children of current alcoholics. It is always assumed that a child with an alcoholic parent will be far more likely to become an alcoholic themselves, so let's see if it is the truth. As it turns out these children are at higher risk of developing alcoholism later in life. Children who have a drinking parent have a likelihood of alcoholism that is five to ten times the rate for the total population. Male children have a likelihood of 25% compared to a 3%-5% risk that exist in the general population. The increase for female children is far greater rising to 5%-10% from 0.1%-1%. These are significant increases in the level of alcoholism over the general population.(Johnson, Leff, 4)

Now the important step to take is to determine why these children are at a greater risk. Is it simply that they are exposed to alcohol consumption and alcoholism is simply a learned behavior? This maybe true in part; however, what appears to cause the major increase in the level of alcoholism among children of alcoholics is the increase in other risk factors when one parent is an alcoholic. Studies show that in households where at least one parent is an alcoholic, there is a lower level of family cohesion, discipline and structure while there is an increase in the occurrence of family conflict, disruption and abuse. These are all factors that are risks for all children, whether they grow up in an alcoholic

household or not. Therefore it seems a shaky claim to make that the reason children of alcoholics are at more risk is the alcoholic parent themself. (Felitti,2)

So at this point perhaps we can say that alcoholism does not appear to be simply passed on through the example of an alcoholic parent. Rather it is the affect that the alcoholic parent on the structure of the family and home life, that causes children with alcoholic parents to be at such a higher risk of turning into alcoholics themselves. The alcoholic parent is exerting an indirect force on the child more then a direct one.(MacPherson, 1)

Let us now examine some of the risk factors that are often present in alcoholic families, but also pose a risk for those that do not grow up with an alcoholic parent. Family dysfunction, which includes family conflict, lack of cohesion and discipline and familial disruptions, has a large affect on the likelihood that a child will develop alcoholism. Not only is there an increase for the likelihood of alcoholism but there is also higher risk for depression and other forms of substance abuse. (Felitti, 5)

In a study done by the Department of Preventive Medicine, Southern California Permanedte Medical Group, seven risk factors were developed. These include psychological, physical or sexual abuse, violence towards the mother, living with alcoholics, mentally ill or suicidal family members or imprisoned family members. Their study showed that people who experienced four or more of

these risk factors were at far greater risk, in the range of 4 to 12 fold increase, for developing alcoholism or depression and other health risks. (Felitti, 2)

This study sends a clear message that families that are highly dysfunctional are putting their children at extremely high risk for highly destructive behavior later in life. Most of the factors that this study looked at are highly controllable by competent parenting. Despite claims that Hollywood and mass culture are creating an atmosphere in which children are being encouraged to drink, there appears to be ample evidence that despite modern culture a large amount of the blame still deserves to be laid at the feet of bad parents.

There are a lot of reasons that people become alcoholics, no doubt many of them are not even touched in the preceding information. However we can learn something from this information. There are a lot of reasons that individuals become alcoholics various disruptions and instabilities in their lives, depression (Davies, 1) and simple genetic risk. When alcohol is picked up through environmental pressures there seems to be used as a coping mechanism(Schuch, 1). Alcohol tend to be used as a way to solve the problems in the individuals life.

Post Traumatic Stress Disorder

I. Introduction

A. The person has experienced an event that is outside the range of usual human experience and that would be markedly distressing to almost anyone, e.g. serious threat to one's children, spouse, or other close relatives and friends; sudden destruction of one's home or community; or seeing another person who has recently been, or is being seriously injured or killed as the result of an accident of physical violence.

B. The traumatic event is persistently reexperienced in at least one of the following ways:

(1) recurrent and intrusive distressing recollections of the event(in young children, repetitive play in which themes or aspects of the trauma are expressed)

(2) Recurrent distressing dreams of the event

(3) sudden acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations and dissociative [flashback] episodes, even those that occur upon awakening or when intoxicated.)

(4) intense psychological distress at exposure to events that symbolize or resemble an aspect of the traumatic event, including anniversaries of the trauma.

C. Persistent avoidance of stimuli associated with the trauma of numbing of general responsiveness(not present before the trauma), as indicated by at least three of the following:

(1) efforts to avoid thoughts or feelings associated with the trauma

(2) efforts to avoid activities or situations that arouse recollections of the trauma.

(3) inability to recall an important aspect of the trauma(psychogenic amnesia)

(4) markedly diminished interest in significant activities (in young children, loss of recently acquired developmental skills such as toilet training of language skills.

(5) feeling of detachment of estrangement from others

(6) restricted range of affect, e.g.,.unable to have loving feelings

(7) sense of a foreshortened future, e.g., des not expect to have a career, marriage, or children, or a ling life

D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by at least two of the following:

(1) difficulty falling or staying asleep

(2) irritability or outbursts of anger

(3) difficulty concentrating

(4) hypervigilance

(5) exaggerated startle response

(6) physiologic reactivity upon exposure to events that symbolize or resemble an aspect of the traumatic event (e.g., a woman who was raped in a elevator breaks out in a sweat when entering any elevator)

E. Duration of the disturbance (symptoms in B, C and D) of at least one month.

(Official Diagnostic Criteria)

II. Evidence for Genetic Influences

By its very nature PTSD is a environmentally influenced disorder. Genetics plays a small role in the development of PTSD. The only biological factors to consider with PTSD are that of how the physiology of the individual changes given the environmental over-stimuli which occurs.

III. Evidence for Environmental Influences

Post Traumatic Stress Disorder (PTSD) is a disease that has gained wide spread acceptance in recent years, though there are passages in Shakespeare

that describe a condition that seems very similar to PTSD. Essentially PTSD is a condition that occurs after severe exposure to some sort of trauma, the popular example is the Vietnam War. What happens to victims is that during the initial trauma the body naturally produces opiates. These opiates mask pain and allow people to do amazing things under duress. This is one of the reasons that we must be careful when dealing with people recently in car accidents. They may have serious injury without knowing it. Naturally these opiate levels drop once the traumatic event is over. In those who suffer from PTSD the levels never drop and the person is stuck in a permanent hyper-awareness state. This is the reason that many with PTSD seem very dead and empty; the hyper-awareness is the reason that they can react violently to be startled. (NIMH, 2)

So what sorts of situations commonly cause someone to enter this unnatural state? One of the largest and most relevant to military situations is best summed up in an article title “The Psychological Cost of Learning to Kill.” Studies done by the military and law enforcement show that despite claims that people are inherently violent, combat with other people is a general human phobia. This means that whenever a person is trained to kill or enter into human combat a violation of basal human psychology is taking place. The midbrain, in most health members of the human species, has such a dislike of killing, that when confronted with a military situation it will go dormant when the forebrain shuts down. To reduce the chances that a soldier will not perform in a true combat situation the military uses training situations that are highly accurate depiction of

true combat. The cost of training people against the grain of their nature is an accompanying increase in the occurrence of PTSD. (Grossman,1)

There are some things that can be done as a form of preventative medicine to avoid the development of PTSD. Especially in military situations, though this applies to the general situation as well, debriefing and being in a socially accepting environment can stem the chance of development of PTSD after a traumatic experience. This is something that seems especially relevant to Vietnam War soldiers, in whom PTSD occurrence runs as high as 30%. Returning soldiers from Vietnam were treated, I think it is safe to say, with virtually no social acceptance. They were ostracized which maybe a significant reason that they have such a high level of PTSD in their ranks. (Grossman,1)

Lets' take a look at the military, the institution where PTSD got its legs and grew into the visible disease that it is today. We can look at the response of the public to returning soldiers and agree that it was hardly helpful to veterans, but that did the military itself do to encourage PTSD? During the Vietnam War the military would deny that actions preformed yesterday happened at all. Not only did they not encourage debriefings they put the additional stress of making the soldiers memory of an event come into conflict with what he was being told be his superiors. They made soldier exist in a world where nothing was really, they hadn't seen what they thought they had seen. The following is an excerpt that illustrates this point very potently. (Shay, 170-172)

Daylight came [long pause], and we found out we killed a lot of fisherman and kids.

What got us thoroughly fucking confused is at that time, y'know, you turn to the team and you say to the team, "Don't worry about it. Everything's fucking fine." Because that's what you're getting from upstairs. The fucking colonel says, "Don't worry about it. We'll take care of it." Y'know, uh, "We got body count! We have body count!" So it starts working on your head...

The lieutenants got medals, and I know the colonel got his fucking medal. And they would have award ceremonies, y'know I'd be standing like a fucking jerk and they'd be handing out fucking medals for killing civilians. So in your minds you're saying, "Ah fuck it, they're Gooks."

I was sick over it, after this happened. I actually puked my gut out. You know what had happened, but - see, it's all explained to you by captains and colonels and majors that "that's the hazards of war. They were in the wrong place." Y'know, "It didn't have anything to do with us. Fuck it. They was suspects anyways." And we was young fucking kids. That reasoning didn't come into effect right away, with me anyways. All I could see was anger building up. And what did is they played on my anger. "You guys did a great job." Y'know, "Get drunk. You guys deserve it." Y'know, "You guys party." Y'know, "If yous wanna go downtown and get laid, go ahead." Y'know, and everything's fine, y'know. "RECON! AIRBORNE!" Y'know,uh, "We made it! We got body count!"...

As a young fucking kid, which we were, but we were old men. I don't know if you can understand what I'm saying. We were young in the heart and the body but they made us old men...Y'know, "Erase that. It's yesterday's fucking news." "Ain't got nothing to do with us." "Move on."

(Shay, 171)

I include this excerpt because it shows the level of destruction and instability that existed in the lives of Vietnam soldiers. This is the recollection of a multitour airborne veteran about a bombing which killed a number of fisherman and children, those he viewed as innocents. This man now suffers from PTSD. It

is very clear from this story that the military provided very little support for soldiers trying to come to grips with their situation. The constant atmosphere of instability, as far as reality was concerned, made it very hard for soldiers to share their experiences with those around them. In all likelihood this contributed to the high level of PTSD among Vietnam veterans.

Is PTSD an illness that is only affected by traumatic experiences in the near past? A very good example of how past childhood experiences can play a roll in the development of PTSD later in life can be illustrated with this example. Women who experienced childhood sexual abuse and then later in life experienced another sexual victimization generally had much more severe symptoms of PTSD. These symptoms were sever in comparison to women who were sexually assaulted as adults with no prior experience with sexual assault. This is an interesting example because these women experience a trauma when they were children which had an affect on them. Later in life when they experienced a trauma of a similar sort the PTSD symptoms were worse because of the earlier experience. However the former experience may not have put them at greater risk of developing PTSD. (Bolstad, 1)

A slight variation on PTSD is Posttraumatic Stress Symptoms or PTSS. These people basically have some of the symptoms of PTSD but do not fit the requirements to be classified as having PTSD. This study examines the relationship between the level of parental stress during a child's Leukemia

treatment and the occurrence of PTSS after treatment is completed. They discovered a connection between the amount of stress that parents felt during the treatment and the level of PTSS after an extended period of time. So it appear that those that were very high stress parents during their child's treatment continued to have trouble adjusting back to normal life. (Best, online)

This study only spoke about parents and their reactions during leukemia treatments and PTSS but I wonder if this study can be extended to cover a variety of situations. As was mentioned earlier there are some people who will develop PTSD when exposed to a situation while there are some who will not. Perhaps one of the key factors that separates those that develop PTSD from those that don't is the amount of stress that they experience during the traumatic situation. Even given my somewhat limited knowledge of PTSD, it would seem to be a fairly coherent and rational step to take.

So to sum up briefly what has be presented about PTSD. There must be an initial traumatic event which has a very strong impact on the individual. There are some predictors that point to those that are especially susceptible to strong cases of PTSD, however at present there are no indicators that point to development of PTSD. This lead to a inability to determine who will and who will not develop symptoms when exposed to situations outside of the normal range of human experience.

Conclusions

The onset of mental illness is due to discrete physiological changes occurring within patients. Whether or not, and to what degree, these changes come about is influenced by both environmental and genetic factors to varying degrees based upon the disease state and the individual patient in question. Genetic factors in the onset of behavioral disorders tend to (epidemiologically speaking) alter trends of susceptibility within the patient population being sampled when compared to normal controls. Environmental factors tend to both alter patterns of susceptibility and also ultimately control the courses with which disease states run. For example, a genetic factor may be present in 70% of patients suffering from a particular disorder, but is rarely present in 100% of patients diagnosed with a particular disease.

Part of the problem with respect to determining respective levels of genetic versus environmental influence comes from the nature of disease diagnosis and definition. Well understood diseases are often times categorized by etiology. Those diseases that are less poorly understood are often categorized by their symptomology. For example, viral infections are often broken down into subcategories based upon the nature of the virus, the organ systems being attacked within the body, and so forth. The mechanism by which the onset of the disease state operates is clear. For behavioral disorders, this neat categorization is not so simple. The line between that portion of the disease

that stems from a physiological origin and that which stems from a psychological origin is less clear.

In order to further understand the origins of these diseases, research into the developing factors must be made. The data which results from this research comes in two forms: correlative and causative. A point should be made about the nature of the conclusions which can be drawn based upon correlative data. A distinction must be drawn between that which is causative and that which is correlative. Also, a distinction must be made between that which is statistically significant and that which is statistically meaningful.

Correlative data takes the following form: "in X percentage of patients suffering from disease Y, Z factor appears to be present." This is not the same as causative data, which clearly defines itself: "X condition is necessary and sufficient to cause disease state Y." Demonstration of functional conclusions such as these requires the ability to induce disease states, which is unethical in human beings. Causative data can be demonstrated to some degree in animal models. A special problem comes into play when trying to study the factors that contribute to the onset of mental illness in animal models: the human brain is vastly different and more advanced that that of a mouse or even higher level primates. In addition, environmental influences often are introduced into patient populations over the course of decades of living. This is just not a feasible kind of

kind of condition to simulate well in the laboratory. Thus the kinds of questions that science is currently equipped to ask are inherently limited.

Both correlative and causative data are subject to scientific scrutiny. To claim that a finding is statistically significant, one must only meet criteria regarding sample size and quality. As the size of a given sample increases, the strength of the claims one can base upon the nature of that data increases. Thus, the stronger the claim one is trying to make, the larger the sample size one must acquire to generate ones data set. In addition, depending on the variables one is measuring, the degree of variance between the expected outcome and the actual outcome, the difference between the 'null hypothesis' and the hypothesis one is trying to prove, must have a certain magnitude as well. Below this magnitude, finding may be statistically *significant* but they may not be statistically *meaningful*. Determining the lines between that which is statistically significant or insignificant, between that which is meaningful or not, can be a complicated task. Often times, researchers are limited in terms of the kinds of data they have the resources to gather. Thus, (ideally) they design their experiments to ask questions they believe they are capable of answering. Sometimes, researchers simply design experiments based on what they would like to do, have the capacity to do, and so forth and what they are interested in. From there, they try to make the case that their findings are either significant or not. In addition, during the course of experiments, perhaps on average one experiment in ten will

work out in such a satisfactory manner that the conclusions drawn from that experiment are used in published work .

This is why rigorous peer review, as well as independent verification of results is so key to maintaining scientific integrity and validity of the assumptions science makes based on the data that is available. Many fields of research move so quickly that the push to publish findings based on primary and sometimes incomplete experimental data encourages not so much a sense of dishonesty about ones findings as a tendency to exaggerate the claims one can make about the field one is working in based on the data that is currently available. For example, many molecular biologists write their grants in such a manner as to link whatever process they are researching to hot topics of research, such as cancer, when the real world link between these subjects and cancer is more likely than not somewhat tenuous. Certain grant topics are more likely to get funding than others, which for many laboratories is simply the bottom line. Thus, even the research published in respected journals must be read with some skepticism. Maintaining this skeptical attitude towards data, your own as well as others, is one of the primary goals of undergraduate scientific training. Given all information presented, a concerted effort must be made to use articles that are reputable and contain clear, well-explored supporting facts.

Here we will present the conclusions that can be drawn based on the data that was publicly available on the sampling of diseases chosen. These behavioral

disorders were designed to run the gamut between being thought to be highly genetic in origin (Autism, Downs' Syndrome) to being thought to be largely environmental in origin (Alcoholism, PTSD), or as in the case with most, a careful balance which proves to be different for every disease researched.

Autism and Downs' Syndrome

Autism, of all of the diseases sampled here, is perhaps the least well understood. Those whom suffer from autism suffer from a variety of symptoms, and it seems clear that it is a discrete genetic event, or series of events, although currently unknown, that induces the state prior to birth. An interesting idea is how those whom suffer from autism develop when subjected to different developmental environments. Those who receive more encouragement often have better levels of development and a greater ability to interact with others.

Autism is a very interesting disease because despite being an almost entirely genetic disease the course that the disease will take is influenced by the environmental surroundings. Given a similar level of autism, entirely different results can be obtained with carefully controlled and designed environments. This is a nice example of genetics creating a disease which environment shapes.

Downs' Syndrome, strictly speaking, is not a behavioral disorder. The mechanisms in terms of the chromosomal anomalies are well characterized. But

in terms of diseases that induce developmentally disabled individuals, it does fit. The same questions can be asked: to what degree is the disease induced by genetic factors or environmental factors? There is evidence showing that environmental factors from the parents influence their ability to generate healthy progeny. Smoking, drinking, drug abuse, exposure to mutagenic agents, and other factors can all induce the disease entirely separate from more 'natural' mechanisms of induction with respect to the disease state. How individuals learn to cope with the effects of the disease is also an important environmental variable. Of course, it is very clear that those whom suffer from Downs' Syndrome will always have limited capacities. But progress can be made with patience, effort, and skill. Down's Syndrome is different from Autism in the amount of control environment can exert over the course of this disease. With Down's Syndrome the symptoms of the disease can be eased by specifically designed surroundings. However, whereas autistics can vary widely in their development based on environment, Down's Syndrome suffers seem to have a glass ceiling beyond which they have great difficulty advancing. This in turn varies with the degree of genetic abnormality.

Schizophrenia, Bipolar Disorder, and Depression

Schizophrenia is a disease whose origins seem largely genetic, rather than environmental. Within the population of sampled patients, a number of

physiological differences were noted to exist. Hence, there is no one genetic disorder or mutation that results in the schizophrenic state. However, there did not seem to be a common environmental influence either. Schizophrenia, being a condition defined symptomatically rather than etiologically, probably has several root causes. Currently, those who suffer from schizophrenia are treated medically. Attempts to control the schizophrenic mind state via psychotherapeutic remedies have to date generally failed. Some varieties of schizophrenia are more treatable than others, and are more or less severe in their symptomology, based on the root cause involved with respect to the particular patient.

Bipolar disorder and depression are disorders somewhat related to schizophrenia, although generally less severe. Both are treated via psychotherapeutic and medication pathways. Generally their effects on the behavior of the patient are somewhat less severe. Depression in particular has been treated with a great deal of success via psychological methods.

Bipolar disorder and other major depressive disorders have root in a set of environmental factors which curb preexisting genetic behaviors towards extremes. Given extreme environmental factors any human can be driven to suffer from condition symptomatically similar to bipolar disorder. By the same token with very little environmental differences a severely genetically dispositional individual will exhibit bipolar behaviors as well. For this reason

bipolar disorder is a "middle ground" disease. In the argument of nature versus nurture it has points for both sides of the debate.

Another key point of depressive disorders is that they generally stem from known psychological causes. Research of bipolar disorder spans both the exploration of correlations between patients, resulting in knew psychological theories, but also provides data reaffirming existing psychological theories. It is for this reason that major depressive disorders fall in to the "middle ground" of nature versus nurture debates. Schizophrenia is the most genetic, then bipolar disorder. Depression , amongst the three, is the least genetic.

OCD and ADHD

(Obsessive Compulsive Disorder and Attention Deficit Hyperactivity Disorder)

OCD and ADHD seem to be two sides of the same symptomatic coin: both are diseases of eroded impulse control of varying severity. OCD seems to spring from deficits in the functioning of a series of specific well characterized neuronal pathways. OCD, of all the behavioral disorders, is one that responds the most well towards medication regimens. Alternatively, ADHD seems to stem more from environmental influences. Its treatment via medical pathways often seems as though they are trying to treat the symptom rather than the disease.

ADHD research has had a large influence on the nature versus nurture debate. While more and more genetic research has found physiological (genetic) roots to many mental disorders, ADHD remains a disease believed to be largely environmentally determined. Although recent research with animal models has brought into question ADHD as a solely environmentally determined disease, it still stands as a largely dependent on the ever-changing societal surroundings. This fact is an important argument in a major trend towards genetic pre-determinism.

As the research presents itself it would seem that the effects of environmental stimuli on the individual can be seen not only on an individual level, but also on a societal level. With an ever increasing pace of daily life and interpersonal relationships, as a society all persons are feeling the effects. Those persons whom are afflicted with ADHD are those whom, for some reason, react to this changing pace with a lack of stimulus response. While this is a genetic response in nature, it is a genetic response common to all humans, rather than an abnormality present in unique individuals. The major reason why some individuals are afflicted and are others not are the developmental differences concerning how certain over-stimuli and stresses are responded to.

PTSD and Alcoholism

PTSD (Post traumatic stress disorder) is a behavioral disorder that requires an environmental influence in order for symptoms to develop. Hence, it is a disease that cannot be said to be of entirely genetic origin in any case. Although certain genetic factors may predispose certain people towards PTSD, these correlations aren't causative, and are largely related to global hormonal and opioid response systems.

The onset of PTSD seems to be entirely environmental in origin. All cases of PTSD have an environmental situation that initiates the condition. Therefore it serves as a very clear and easily explained case where environment plays the decisive factor in its development. This is rather unique because the genetics and environment can play a roll in the chances that someone will have of getting this syndrome. However, the creation of the disease requires a traumatic, without the traumatic event the disease will not occur. This is also a special disease because there is a very clear time and place at which the disease start and it is very easy to link to situations which are its environmental causes. In other words, it is an example of a genetic predisposition that requires an environmental trigger. Alcoholism is similar insofar as the decision to start drinking is influenced by environmental factors. The decision to continue drinking is influenced by both. While it is clear that those whom suffer from alcoholism suffer from symptoms of withdrawal, to what degree these symptoms are induced by psychology and to what degree they are induced by physiology is uncertain. Determining the line between that which is psychological and physiological has been one of the main

goals of this research. Alcoholism is one of those areas to which this debate becomes key.

Alcoholism is a disease who causes are very strongly environmental. It is different from PTSD in that there is not a single defining moment at which the disease starts. Therefore when looking at the causes of alcoholism one must look towards a persons past. When we look at alcoholics it becomes clear that most of the causes originate in the family during childhood. So when contrasted with PTSD we see that one is a disease where there is a clear beginning while the other is spoken of in the language of susceptibility. So the environment can create a person that is more likely to become an alcoholic but it cannot turn someone into an alcoholic in a direct sense.

Society is driven to explore by the questions which provide the most interest. Perhaps most important to out development as individuals and a society is the understanding of how we become who we are. While traditionally arguments over genetic or environmental prevalence in the study of self-development has drawn upon the focus of research, perhaps we should be asking a different question. To what degree are can we predict behavior based upon developmental context? From the view of the geneticist, genetic variations can cause susceptibilities to a disease, while a psychoanalyst views environment as the key factor in the direction which a disease can take. Perhaps these views are not mutually exclusive. Instead as a scientific minded society, we must ask

questions which probe the causes which allow and influence the development of disease. Only through an open minded pursuit of these inquiries, taking in to account both points of view, may we hope to approach a complete understanding of any disease, or diseases as a whole.

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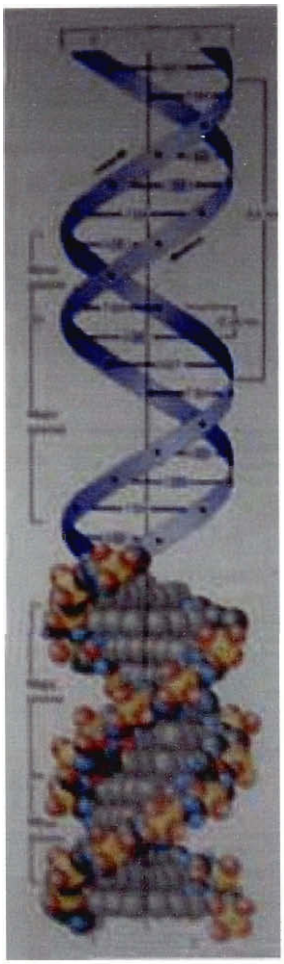

Figure 1

A segment of a strand of DNA. It is about 2nm wide with each major groove about 3.4nm in length.

Second Letter									
First Letter	U		C		A		G		Third Letter
U	UUU	Phenylalnine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC		UCC		UAC		UGC		C
	UUA	Leucine	UCA		UAA	Stop	UGA	Stop	A
	UUG		UCG		UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Gistidine	CGU	Arginine	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA	Glutamine	CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC		ACC		AAC		AGC		C
	AUA	Methionine	ACA		AAA	Lysine	AGA	Arginine	A
	AUG	Start	ACG		AAG		AGG		G
G	GUU	Valine	GCU	Alanine	GAU	Aspartate	GGU	Glycine	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	Glutamate	GGA		A
	GUG		GCG		GAG		GGG		G

Figure 2

The Genetic Code

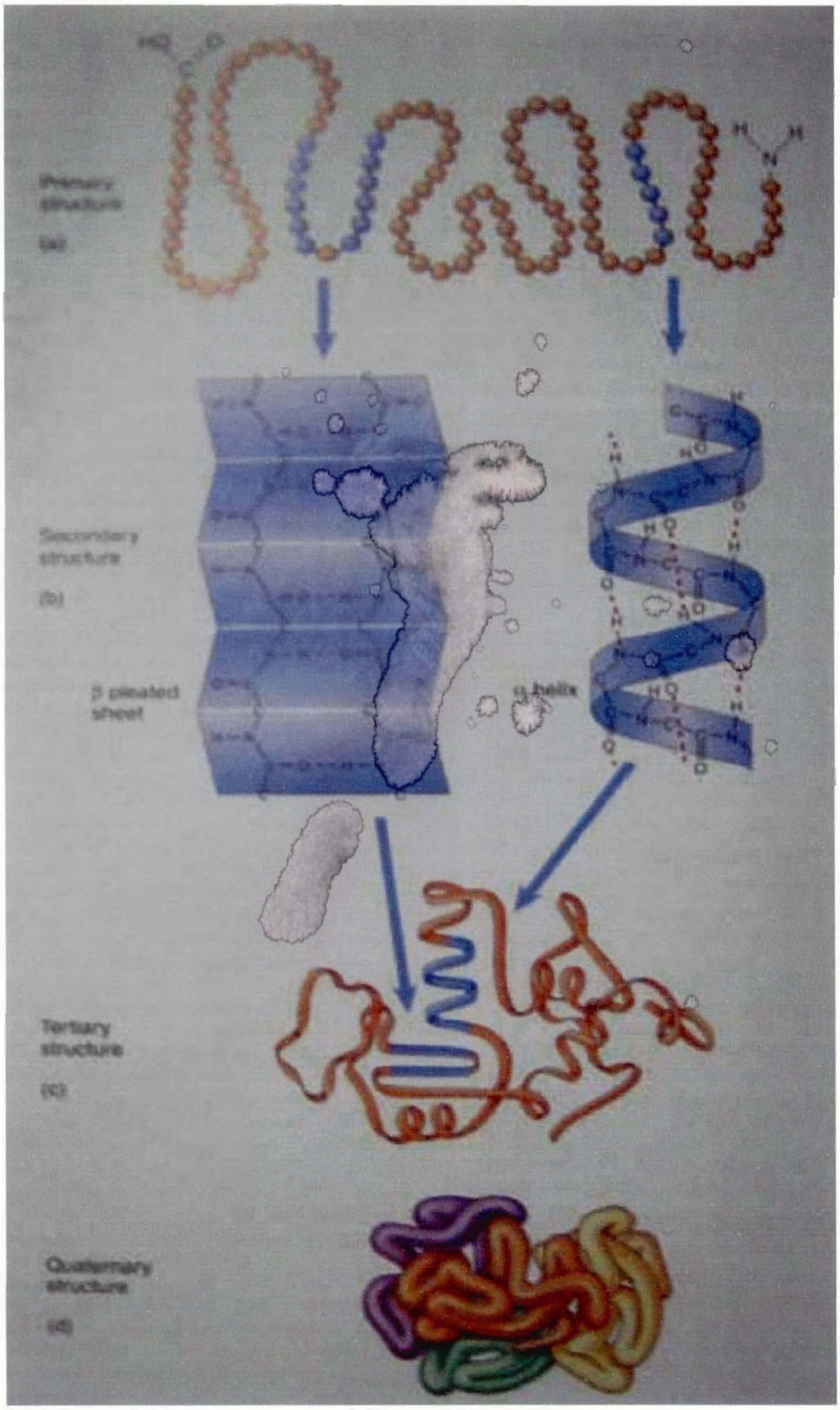

Figure 3

The primary, secondary, tertiary, and quaternary structure of proteins.

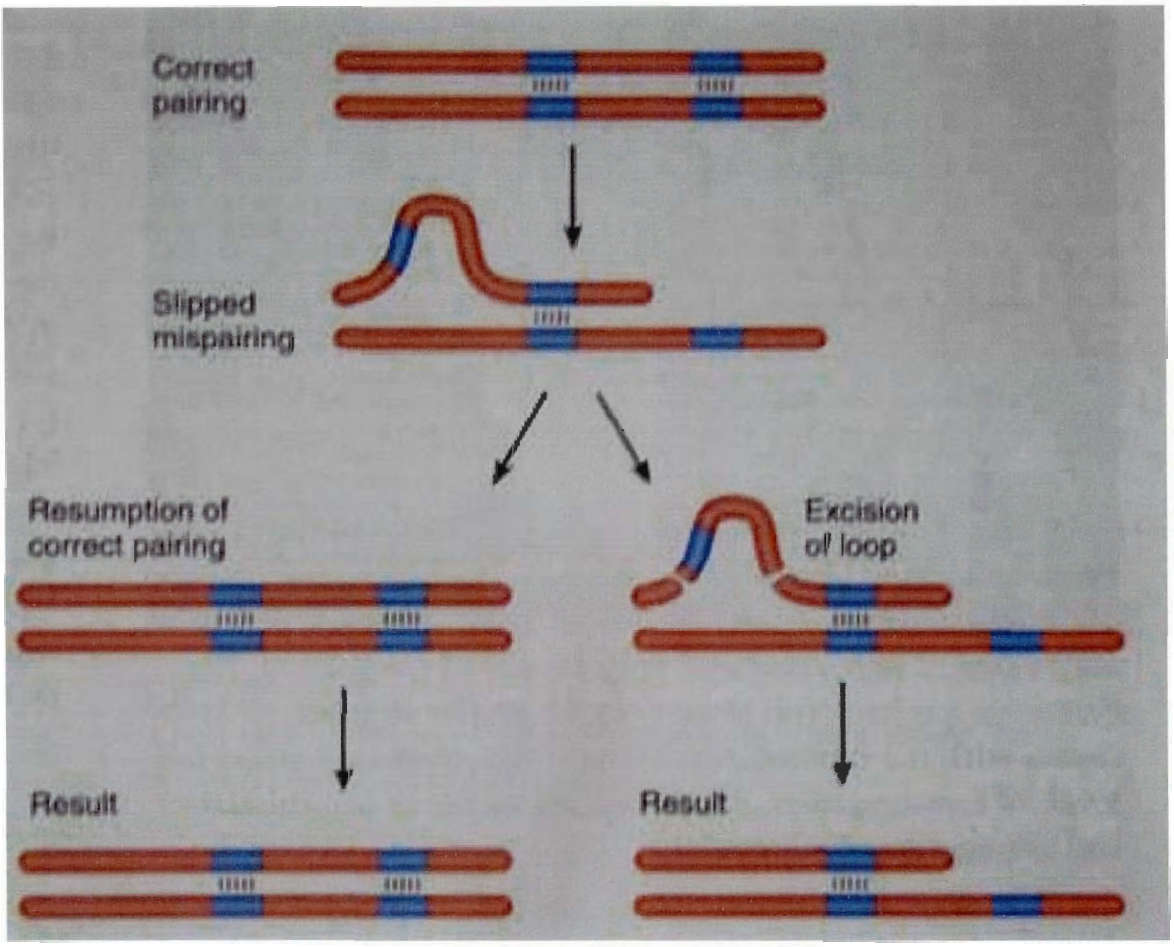

Figure 4

A slipped mispairing

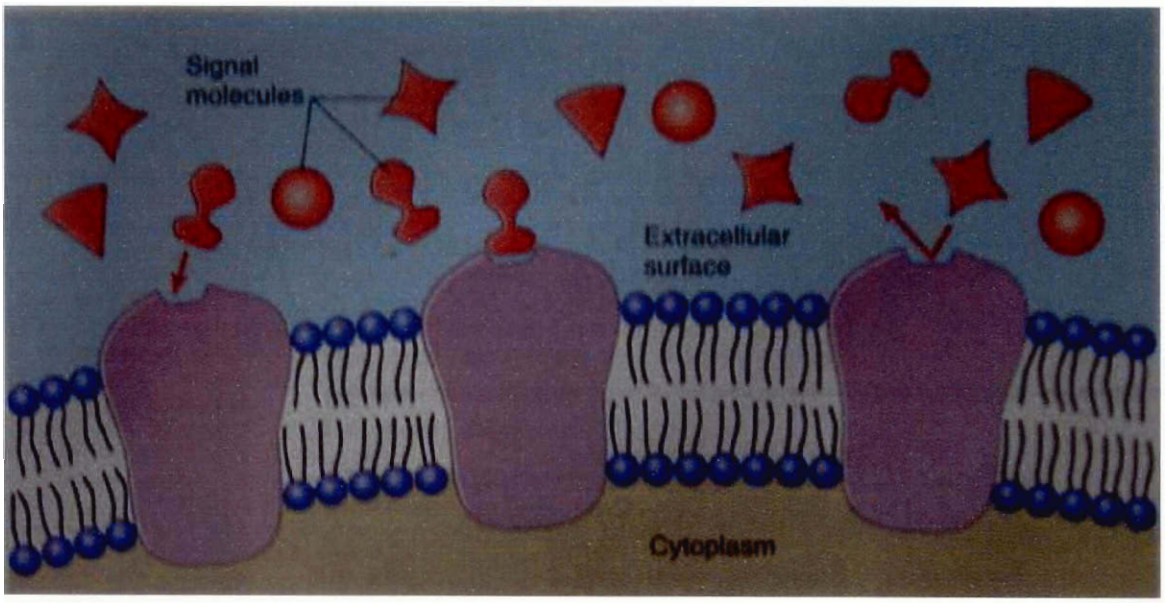

Figure 5

Cell signaling

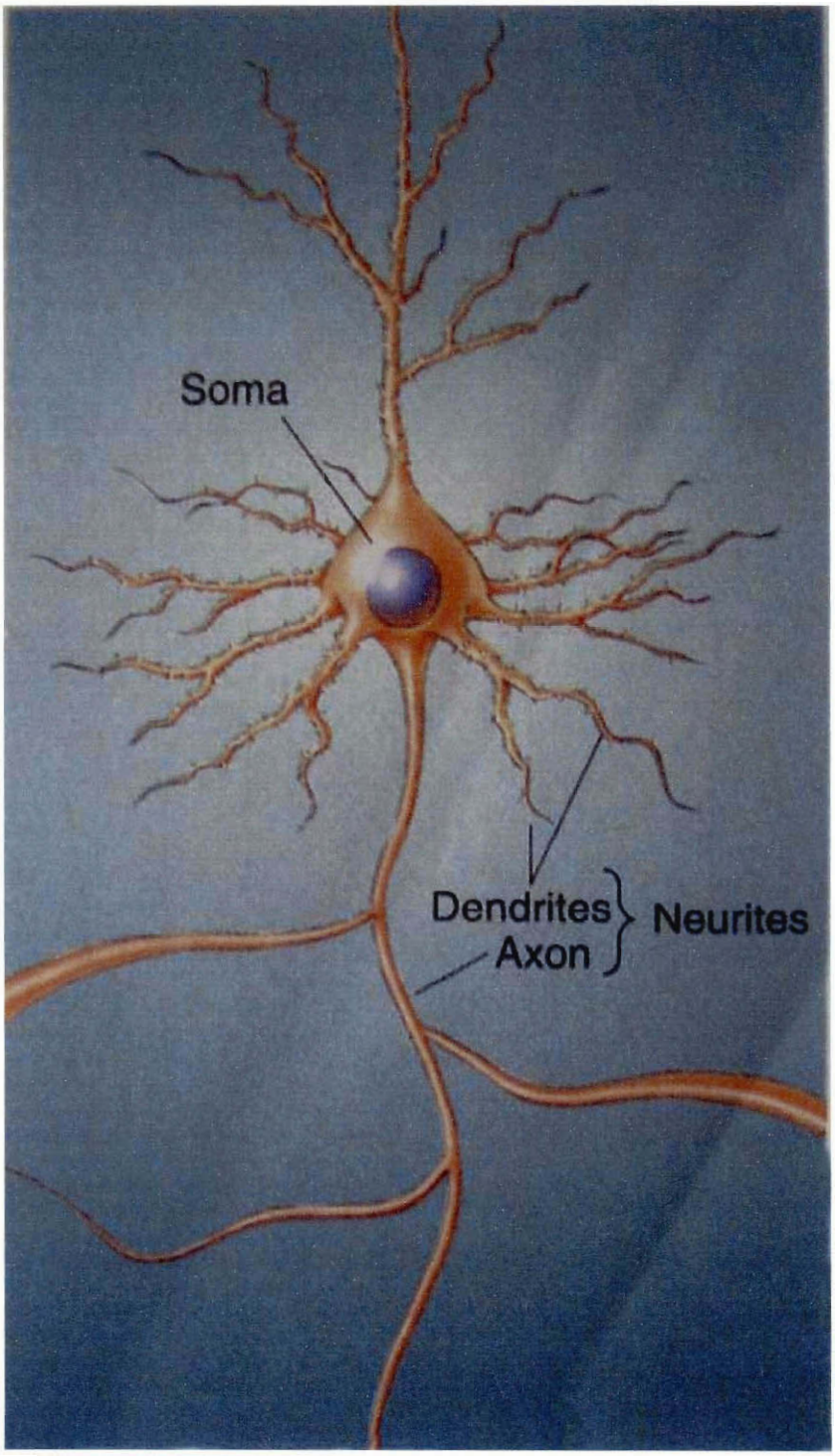

Figure 6

A typical neuron

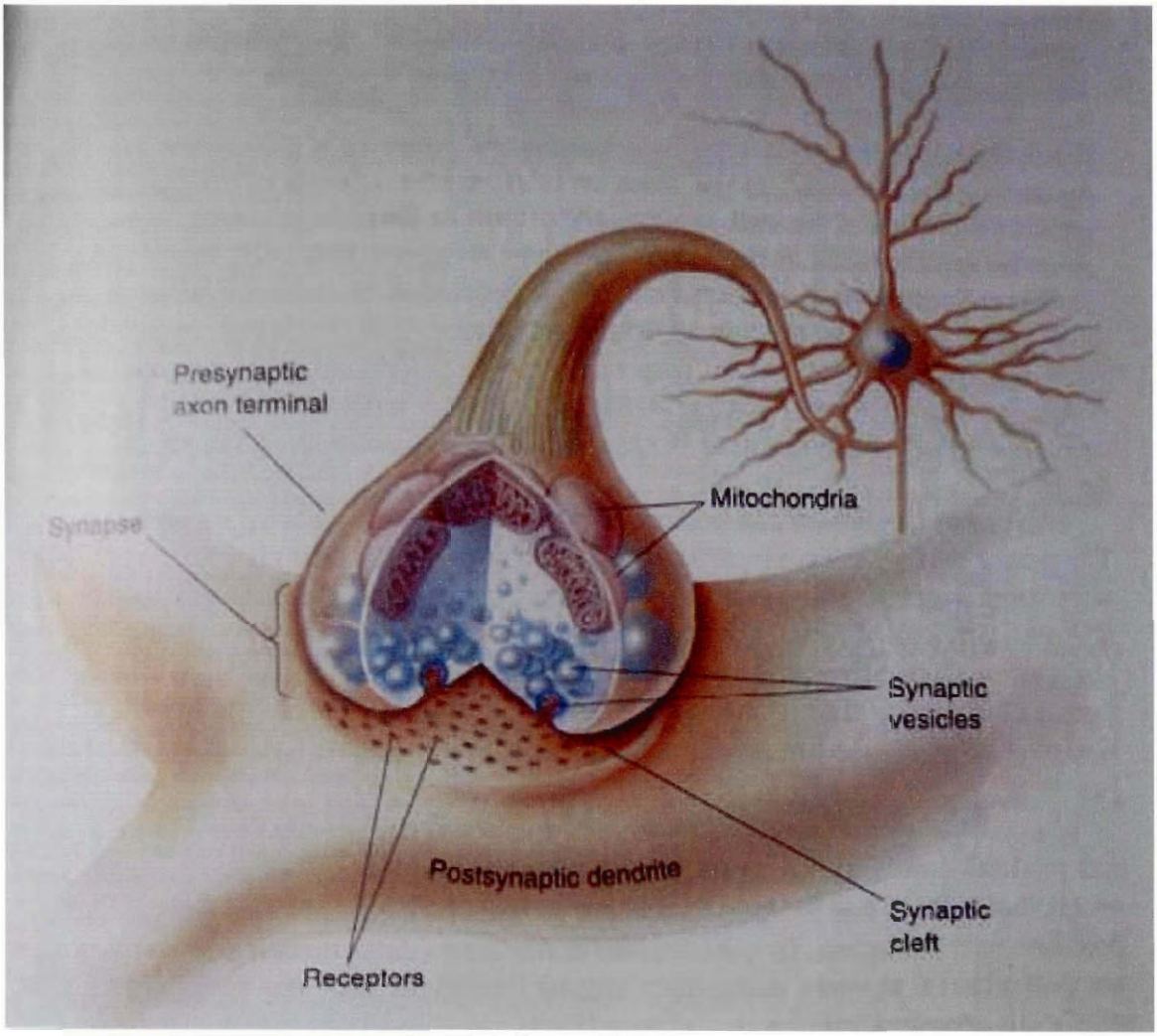

Figure 7

A terminal bouton

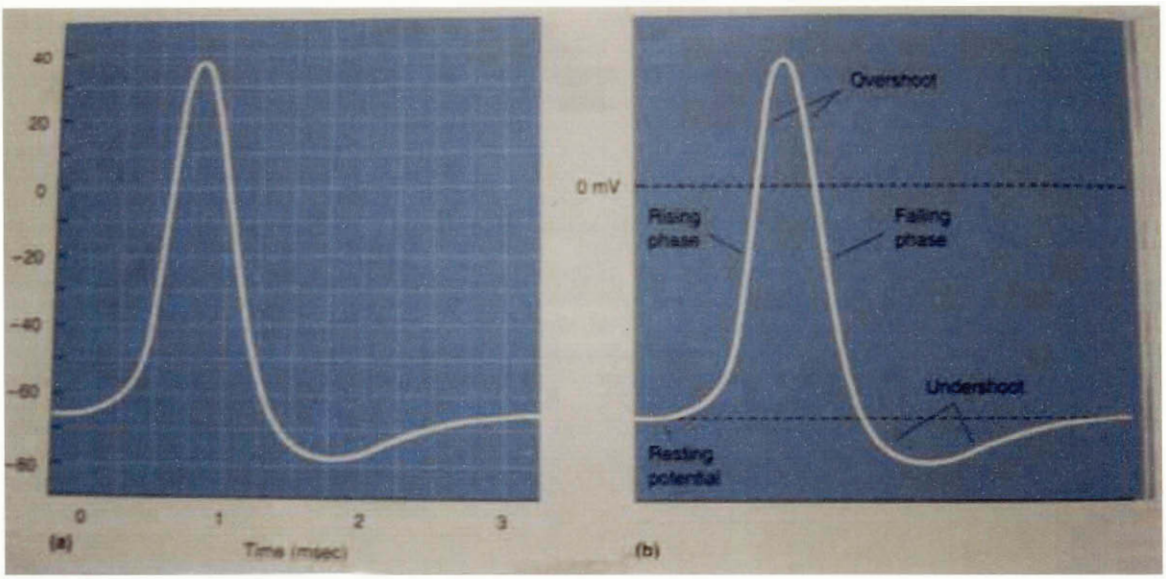

Figure 8

The cycle of an action potential

Amino Acids	Amines	Peptides
Gamma-amino butyric acid (GABA)	Acetylcholine (ACh)	Cholecystokinin (CCK)
Glutamate (Glu)	Dopamine (DA)	Dynorphin
Glycine (Gly)	Epinephrine	Enkephalins (Enk)
	Histamine	N-Acetylaspartylglutamate (NAAG)
	Norepinephrine (NE)	Neuropeptide Y
	Serotonin (5-HT)	Somatostatin
		Substance P
		Thyrotropin-releasing horomone
		Vasoactive intestinal polypeptide (VIP)

Figure 9

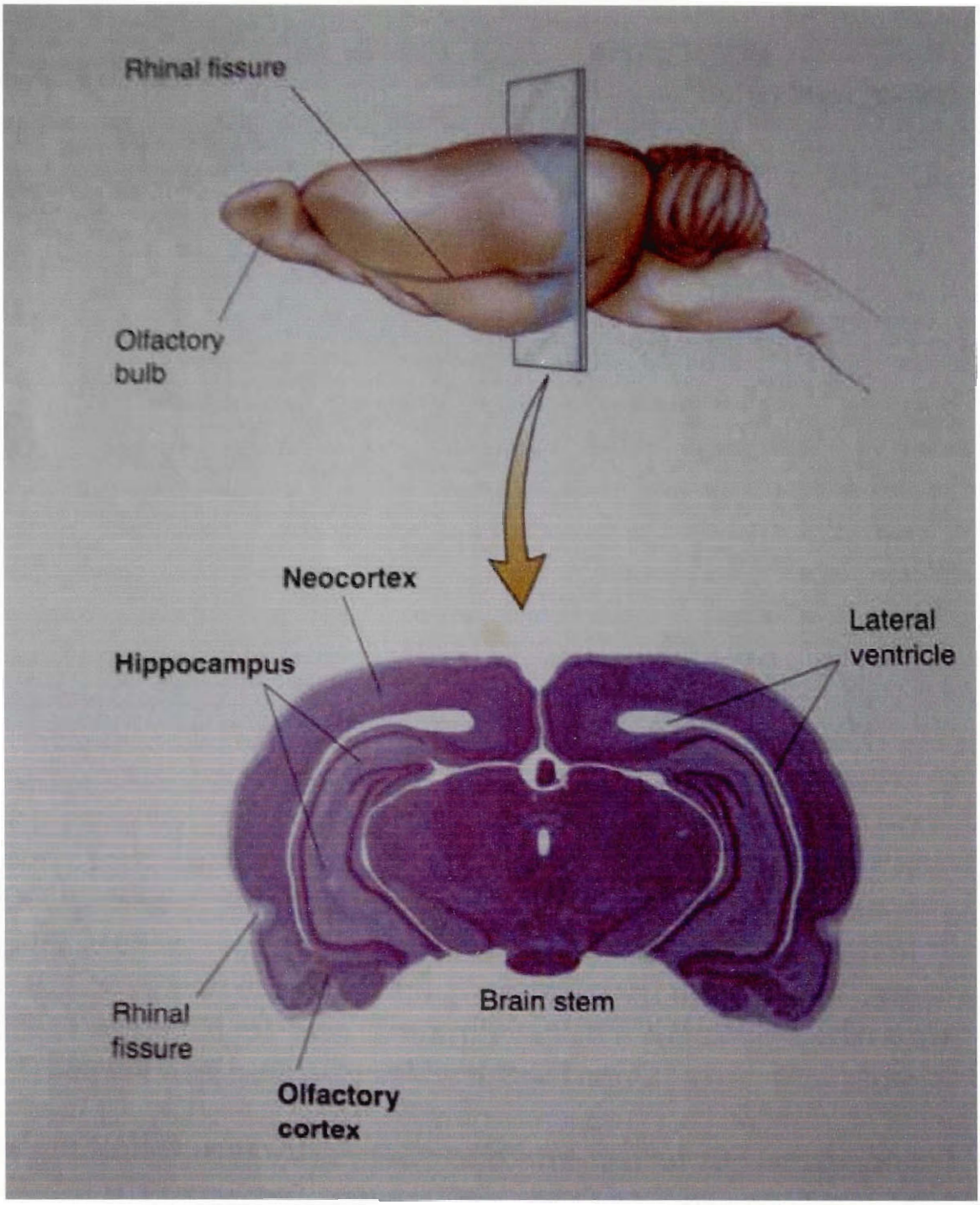

Figure 10

The hippocampus