

THE OFFICIAL
MAGAZINE
OF THE CENTRE
FOR STUDIES ON
HUMAN STRESS

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Sex differences in Stress

Editorial

By Tania Elaine Schramek, B.A., M. Sc.

You are filling out a questionnaire and you get to that little box that asks you to indicate what sex you are. Seems quite simple doesn't it. You need only answer whether you are male or female. For most of us, there is nothing complicated about it, Mother Nature decides and then endows us with all that is necessary to either be a man or a woman. Presto, our sex has been determined. Does this also mean that our gender has been assigned?

In the scientific literature and general public publications alike the terms sex and gender are often used interchangeably. In our field we see titles such as Sex Differences in Stress Reactivity or Gender Differences in Stress Reactivity and many take for granted that they mean the same thing. You will note however, that in this issue of *Mammoth Magazine* we shall not be using sex and gender interchangeably precisely because they do *not* mean the same thing.

Let's first start with the term sex. It might surprise you to know that there are at least four ways in which to answer the question ; what is sex? To understand why, we must first look at the distinction between sex determination and sexual differentiation. Biological dictionaries define sex determination as the *processes that establish and transmit the specification of sexual status*. In English, sex determination is simply how being a male or a female is decided when the mother's egg and father's sperm come together to begin the process of life. Sexual differentiation on the other hand, is the developmental process of becoming male or female. In other words, how we become the sex we were assigned at the time of sex determination. In humans, the first half of sexual differentiation takes place in the womb (brain development and forming the

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internal and external sex organs), the other half occurs at puberty (when the sex organs mature to our adult form).

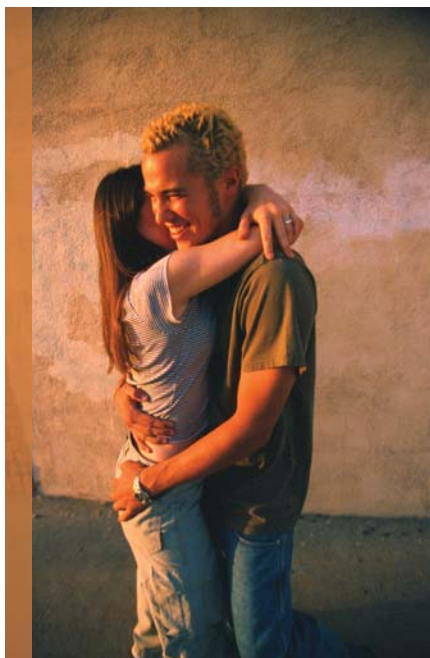
The Four Levels of Sex Determination

Now for those four kinds of sex I spoke of above. What early research has taught us is that each kind of sex is dependent upon, and is affected by, the other kinds of sex. It all starts with *chromosomal sex* (also known as genetic sex) whereby the genetic complement of XY makes you a male and XX makes you a female. The difference lies in the presence of the Y chromosome. Chromosomal sex is established at the time of conception and will determine which gonads (testes in males and ovaries in females) will form in the foetus. Then there is *gonadal sex*, which determines the hormonal environment the foetus will develop in. This brings me to an important note. In reality there is no such thing as female hormones or male hormones because *both* sexes have the same hormones circulating in their bodies. The differences between men and women lie in the amount of each hormone that is around. In men, they have more testosterone relative to estrogen and progesterone but they still have them. In females it's the reverse, they have more estrogen and progesterone but nonetheless still have testosterone.

The next kind of sex is morphological sex. This describes our body shape and type. I mentioned above that each kind of sex is de-

that differentiate males and females. This last one is a doosie. Now, before sending in your letters to the editor, keep in mind that these categories or levels of sex determination were developed and described when there were clear, and what were then thought of as biologically established sex-specific roles. In fact, for the longest time education and the environment were thought to be the **result** of the underlying biology. This is in stark contrast

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This is where the sex/gender distinction comes into play. Behavioural sex as described above now falls into the category of gender. Would it surprise you to know that when you check the box M/F you are also answering what you feel your gender is and not necessarily your sex? Here is why. The reason you check male or female is because you *identify* with that gender, or you are stating your gender identity. This is rather controversial area

and we could devote at least three issues of *Mammoth Magazine* to the topic and still would have not covered the field. Reiter puts it well when describing gender as "The set of arrangements by which a society transforms biological sexuality into products of human activity" (Reiter 1975: 159). Thus, to associate one's self as either masculine or feminine is identifying with gender. A famous psychologist by the name of Sandra Lipzitis Bem developed a gender theory to explain how individuals come to use gender as an organizing category in all aspects of their life. She posited that we process information our culture provides on what is deemed masculine or feminine and regulate our behaviour accordingly. The first exposure to gender roles in our lives is the time spent with our parents. We not only learn how to speak and walk with our parents but we also learn how to think and behave. Gender differences are signaled much sooner than we think.

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pendent upon and affected by the other kinds of sex. This is a perfect example because our body shape and type is largely influenced by the kind and amount of hormones we have circulating which is influenced by which gonads we have which is influenced by the chromosomal complement we have. What it boils down to is that the more testosterone circulating the larger our muscles and bones and the more bodily hair we have and thus our body type is male¹.

Finally, there is behavioural sex, which describes the series of sex-specific behaviours

with today's view which proposes that biology can set the stage but learning and the environment can determine what show will be posted on the billboard. We can thank years of hard-won battles and scientific studies (and the publications thereof which could probably fill the room you are sitting in now) for this one.

1. While we portray things as black and white (male or female) even sex should be considered on a continuum. For the purposes of simplicity however we opted for male-female distinctions. This by no means is a statement that male and female are the only sexes or genders for that matter.

Studies show that as early on as infancy, parents tend to treat their children differently as a function of sex. For instance, in keeping with the notion that girls are more fragile and vulnerable, parents tend faster to a crying baby girl than to a crying baby boy even though boys are actually at greater risk for infant death. Girls are more cuddled than are

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baby boys and as they age; little boys are allowed to try more new things than are girls of the same age. Parents also inadvertently appreciate different things from their boys and

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girls. While girls will often be told that they look cute and pretty, boys are often praised for their actions, "what a big boy you are; standing on your own". Thus, over time girls learn that they are appreciated for their beauty and boys for their accomplishments. Many would argue that the role of primary caregiver in most societies is reserved for females. When both parents contribute to child-care however, studies show that boys grow up with the internalized notion that the role of caregiver is not exclusively female. Thus children learn what they

Thus gender roles are learned through socialization.

see. This is also true for negative traits and beliefs. A boy growing up in a home in which the father beats his mother will often be physically abusive himself. The same goes for girls, they often end up becoming victims of domestic violence in their adult lives when their mothers were beaten by their fathers. Importantly, gender role influences are not limited to the home. What a child sees on television, in the media, at friend's houses all contribute to how they internalize what a male should be and what a female should be. Thus gender roles are learned through socialization.

The problem is that there are several credible studies [i.e. well-conducted, peer-reviewed (see the *Mammoth Magazine vol 3* editorial to see what goes into peer review) and replicated] that show that biology has

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strong influences on behaviour (see box 1). But, there are also other studies that are credible for the same reasons that show that sex-specific behaviours can be learned. Who to believe? I certainly cannot provide the answer; in fact no one can. One thing we can assert is that gender roles are largely based on what our *own* culture dictates; after all we do not look to other countries to determine our gender roles. Moreover, we tend to accept the

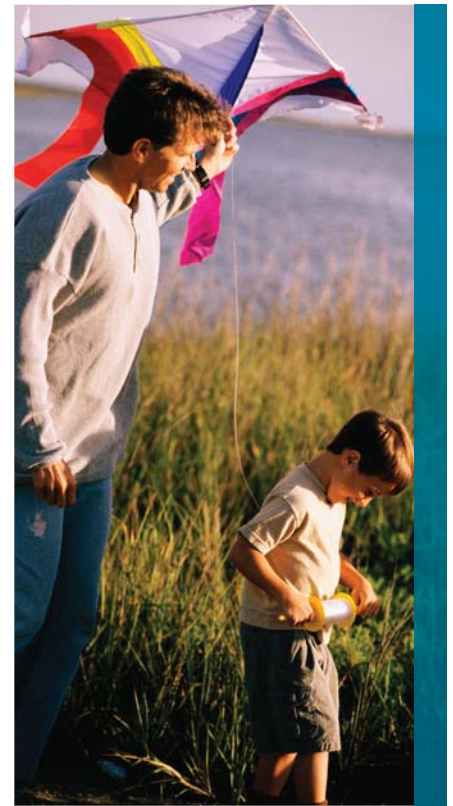
gender roles in our culture as fact and seem to think that the same rules apply everywhere and to every one. While this is a normal tendency it is nonetheless an erroneous one.

Here is why. In pre-Industrial Europe for instance it was unthinkable that a woman become a medical doctor. But in the same period in history in Russia, health care was considered a feminine role and women were the doctors. Thus gender roles are not the same in every culture and as such, the results of studies conducted in North America cannot be applied everywhere. Further still, many studies have found that men are better than women at spatial orientation and mental rotation. We have come to accept this as a certainty in the cognitive sciences and as a clear difference between the sexes. The problem is that if we

Understanding how biology and the environment interact to give rise to the beauty of being human, male, female, or somewhere in between, could be a good avenue to explore.

test people from different cultures we do not find the same results. Inuit women living in northern Canada do not fare worse than men on spatial tasks. Just to drive the point home, in the pre-WWII job market clerical jobs were reserved for men. During the war however, women flooded the job market and the same clerical jobs (i.e. secretaries) became known as more female occupations and still are today. Thus, many jobs have switched gender roles.

The little bell going off in your head right now is right on the money. Gender, gender identity, and gender roles have and continue to change and evolve over time and from one place to another. What this means is that any deterministic view of sex or gender is too rigid and does not take into account the reality of what being human (male or female) is. We change, we adapt, and we learn more and more each time around. We *may* also do



so differently according to our sex. We (as in humans) all too often make the assumption that different somehow translates into worse or *lesser than*. We do not need mountains of scientific evidence to see how this is not the way to look at things.

One thing is clear; men and women are different. If we were the same then what would be the purpose of having two sexes? There must be something beyond reproduction-based differences? We got to where we are today most likely because some of the differences made us complimentary. Here neither Nature nor Nurture wins. Not being able to admit that biology influences behaviour or that the environment affects biology is not in keeping with the current state of knowledge we possess. Understanding how biology and the environment interact to give rise to the beauty of being human, male, female, or somewhere in between, could be a good avenue to explore. One thing is definite though, men and women are exactly the same in the most important respect; we are both human and as such are deserving of the same consideration and rights.

Stress: What's sex got to do with it?

In this Issue

One way in which men and women are definitely dissimilar though, relates to stress. From how we perceive stress, physiologically respond to stress, to how we cope with stress differences are found in most studies. Women are also more vulnerable to developing stress-related physical and mental health disorders. Why this might be the case, and what factors might contribute to these differences are exactly what we will be discussing in this issue of *Mammoth Magazine*. There are many variables (biological, psychological, cognitive,

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environmental to name a few) to consider when looking at sex/gender differences. Accordingly, each article in volume 6 does just that, explores a different variable that relates to stress and sex/gender differences.

In the researcher profile of this issue, Lyane Trepanier reports on an interview with Ron Sullivan Ph. D., a researcher at the Fernand-Seguin Research Centre, who studies differences in the brain anatomy of males and females and how these differences might relate to reactions to stress. In his piece, Robert Paul Juster teases apart reactions (psychological and physical) to stress. Once we have reacted to a given stressor though, what goes on in our heads? Pierrich Plusquellec Ph. D. a visiting researcher at the Fernand-Seguin Research Centre, will explain that how we juggle stressors in our minds after we experience stress and how mulling them over and over again might put us at risk for depression and anxiety disorders and explains how men and women differ in this respect. Then, Shireen Sindi explores the factors that render

individuals vulnerable to stress-related disorders over the lifespan. She covers events that occur before the crib to those that lead to the crypt. Then, Marie-France Marin will inject a little humour in her explanation of how the sexes differ with respect to obtaining social support. Finally, as you may have noticed, we

gender interact to influence physical and mental health. Using the dichotomous approach of pure sex does not truly inform us and can actually lead to erroneous findings. Given that research findings often influence health behaviours and outcomes in the general public, this can be a problem.

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tend to adopt an evolutionary perspective when we describe the stress response and its purpose; hence, our friendly Mammoth. . . Robert Paul Juster will wrap up volume 6 with a second look at some of the variables discussed in this issue but put into the context of evolution. Using evolutionary theory as a backdrop, he will explain what purpose some of the sex differences may have had back in our mammoth hunting days.

One of the take home messages in this issue is that there are clear sex/gender differences with respect to stress. But are there really? At the physiological level we can definitely say yes; but when we look at cognitive, psychological, and social variables the line between the two becomes blurred because these variables fall within the framework of gender. We did not discuss gender differences in great detail in this issue. The reason for this deliberate omission is quite simple; little is known about them. In fact, few researchers in our field are aware of the sex/gender distinction or if they are, studies are not designed in a way that could address the notion of gender.

The reality is that gender is not static and instead falls on a continuum that is defined by our culture, religion, geographic location, sexual orientation and ethnicity (to name a few). As such, important challenges lie ahead in science. By incorporating the notion of gender in our research we are complicating things on one level, but we will likely be able to explain some of the conflicting findings out there and get much closer to the answers we seek. We have only begun to scratch the surface on understanding sex and gender differences and much work is needed still. When we planned this issue of *Mammoth Magazine* we were not aware that the Director of the Centre for Studies on Human Stress Sonia Lupien Ph. D., had been awarded the high honour of receiving a Canadian Senior Investigator Chair from the Institute of Gender and Health of the Canadian Institutes of Health Research for her desire to just that, tease apart sex and gender differences in stress. Thus this issue was quite timely and fitting indeed! We will be celebrating this event with a scientific meeting of some of the top researchers in the field of sex and gender effects in mental health. The goal

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There are always trends in science and one of the current trends is to revisit studies in which sex differences were observed and to re-analyse the data using a gender-based approach instead of a dichotomous sex approach. For instance, many of the questionnaires we use in psychological studies were developed several years ago. As such, some the questions reflect the views (and therefore gender roles) of the day. Researchers have found that if the clearly gender biased questions are removed and the data re-analyzed, the previously obtained sex differences disappear. It is therefore critical that we begin to investigate how sex and

of this meeting on the 27th or March 2009 is to understand the current state of knowledge, identify what needs to be done, and propose ways to do so. A report on what was discussed during this day will be made available on our web site. One this note, we hope you enjoy this issue of *Mammoth Magazine*!



The Influence of Biology on Behavior

In the late 1960's a series of experiments in animals laid the groundwork for most of what we know today about hormones and sex-specific behaviours. Researchers found that when a male rat was castrated at birth and thus did not get exposed to testosterone at puberty or over his lifespan, he did not engage in male-typical rat sexual behaviour. They found the same in females that had their ovaries removed at birth. They thus concluded that hormones must be necessary for these sex-specific behaviours to occur. In rodents the sex-specific behaviours to which I refer are lordosis and mounting. When a female rat is sexually receptive she will arch her back and raise her buttocks i.e. lordose to make mating possible. Male rats mount females. The researchers then gave adult male rats estrogen and female rats testosterone to see if the hormones alone could stimulate the sex-specific behaviours. Even with testosterone female rats did not mount and males with estrogen did not lordose. The researchers therefore concluded that hormones alone were not sufficient to induce sexual behaviours. Now keep in mind that for hormones (or any chemical messengers for that matter) to have their effects they must bind to receptors. So, for mounting for instance, the testosterone is released and it travels to the brain where it binds to receptors in the areas of the brain responsible for sexual behaviour and mounting is possible.

Knowing this and seeing the results of their studies the researchers posited that there must be events in early development that set up the brain to receive testosterone (i.e. receptors) and the body to develop in the male direction. This in turn would give rise to male-typical patterns of behaviour. The same went for females. WC Young and his colleagues embarked on a set of elegant and complex experiments to test whether their theory, which they called the organizational/activational hypothesis, was correct. Dr. Young showed that genetically male rats that were not exposed to hormones during development

could not engage in mounting behaviour later on. After all the experiments Dr Young was able to conclude that the brain first needs to be organized in a male-typical way for an animal to engage in male-typical behaviours. The same was true for female-type behaviours. Puberty and thus a large flux of hormones later activate the brain areas and body that were organized during development. Think of it this way, what is the purpose of a chair? To sit on. Could an Ikea chair serve its purpose if we left it in the box? No, we need to build it first; then we can use it. Same goes for us. We need to build the brain areas and the body before we can use them in a male or female way. But what style and model is entirely up to the designer! You cannot activate (puber-



ty) something that had not been previously organized (early development and exposure to hormones).

Many years later a different group of researchers showed that biology is important but perhaps not all determining. In one experiment they let a rat have lots of sexual experience before they castrated him. Interestingly, he continued to mount female rats

even though he did not have testosterone around. Thus, learning and experience can circumvent physiology. But this is only true for a certain amount of time. These same male rats eventually could no longer mount, but their experience alone allowed them to continue to mount in the absence of hormones for some time.

What about humans? The study of organizational and activation effects in humans is rather complex. But there are some groundbreaking studies that have provided us with some pretty strong evidence that biology does play a role in influencing sex-specific behaviour. Some children are born intersexed, which means that even though they are genetically male or female they can have both male and female genitalia. When gender theories arose in the 1970's the view was that socialization (upbringing, learning and education) established our gender identities and as such they were malleable and modifiable. In one famous case, a genetically male child was born with both male and female sexual organs. The doctors performed a surgery that removed the male genitalia and the parents were told to raise their child as a female. They did so but the girl struggled most of her female life with her identity. She felt male and identified most with the male gender. After years of struggle, she eventually underwent a sex change and returned to being a male which tremendously improved his quality of life. More recent studies have confirmed that one's gender identity is typically established by the age of 4 and that the environment can do little to really change one's core gender identity.

So, if I were to sum up all of these studies in my words; what all of these experiments seem to suggest is that the expression of gender roles (i.e. how we demonstrate our femininity or masculinity) is largely socially and culturally based but the propensity towards identifying with a given gender is most likely biologically based.

How do the Brains of Men and Women Differ when Dealing with Stress ?

Answers in a Researcher's Profile : Ron Sullivan, Ph. D.

By Lyane Trepanier, B.A.

Ron Sullivan is a behavioural neuroscientist and an assistant professor of research in Psychiatry at the University of Montreal and an associate researcher at the Fernand-Seguin Research Centre of the Louis H. Lafontaine Hospital. Ron Sullivan seeks to understand how early-life stress and the mother-child relationship may shape one's response to stress later in life as an adult. Of particular interest to this scientist is whether these early life experiences might affect males and females differently. Through his work with animal models of anxiety disorders and human studies, he has discovered that not only do male and female brains differ anatomically, but they also have completely different patterns of brain activity when faced with a stressful situation.

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Dr. Sullivan's interest in how the brain works began at a very young age when he saw his first image of the human brain on television while watching the *Nature of Things* hosted by David Suzuki. This was in large part the driving force that later inspired him to pursue a Doctorate in behavioural neuroscience at McMaster University (Hamilton), which he completed in 1995. He then pursued post-doctorate research related to stress, hormones, and ulcer formation, at the Douglas Hospital Research Centre in Montreal, until he joined the University of Montreal and the Fernand-Seguin Research Centre in 2001. Ron Sullivan has since led a productive career publishing his work in prestigious journals and presenting his work at scientific conferences around the world.

When asked what led him to focus his research on the neurological differences between males and females under stress, Dr. Sullivan will tell you that until recently, the health science community had long fo-

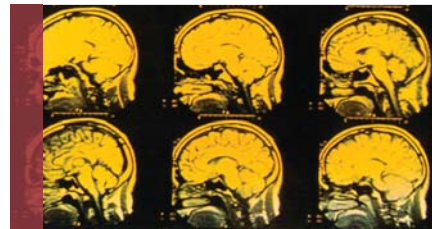
cused their research on how males respond to stress, but not on females. This is somewhat surprising given that his Ph.D. supervisor Dr. Sandra Witelson had shown that there are real anatomical differences between the right and left hemispheres of the brain between men and women. This made Dr. Sullivan wonder why females were not given more attention and studied separately in stress research. He recalls his own experience when as a graduate student he saw newborn female rats being systematically removed from the litter because the experiments were done exclusively on the male rats due to the challenges that the cycling hormones in females presented. Since stress affects hormones, it makes it a little easier to study the cause and effect when you don't have to control for cyclical variations in hormone levels. "There are so many complexities in female hormones and stress activity" says Dr. Sullivan.

What research tells us is that some stress-related illnesses affect men and women differently. Dr. Sullivan states "we are discovering that females process stress and emotion

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differently than males". He explains that the amygdala, a brain structure that processes emotions and regulates hormone secretion, is found in both the right and left hemispheres. Brain scans of this critical brain area reveal that a stress response results in greater activation of the right hemisphere in males and greater left hemisphere activation in females. "This is an important finding because it may start to shed some light onto why women are twice as likely to experience certain stress-related health problems as men" says Dr. Sullivan.

How does this all tie back to early life events? Our brain structures and the pat-



terns of brain connectivity are in part shaped by our life experiences. An early upbringing where constant vigilance was required, as in the case of neglect or abuse for instance is likely to alter how the brain is activated and processes a stressor and thus how we react to stress later in life. Dr. Sullivan notes that in cognitive tasks, women activate different parts of the brain in different patterns, not just related to stress per se but in all of the systems involving memory or anything with a strong emotional component. This affects how well an event is remembered. Therefore, it is important to study early life family adversity and how this can lead to different responses to stress in men and women. "We don't know if there is a good or bad pattern per se, but no one is looking at this and it warrants more investigation," says Dr. Sullivan.

Looking to the future, Dr. Sullivan believes that greater attention will be paid to sex and gender differences in all aspects of health research. Since chronic stress is an important precursor to many illnesses in both men and women, Dr. Sullivan plans to continue his investigations. Understanding how stress affects men and women differently has important implications for the treatment of many health problems including mental health, cardiovascular health as well as personal wellbeing.

Mind-Body Differences in Distress and Stress Reactivity Among the Sexes

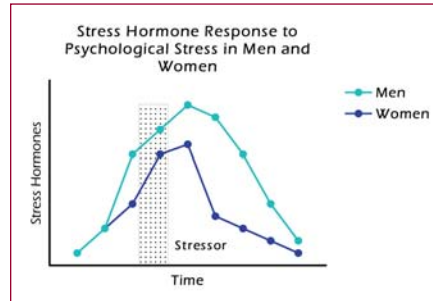
By Robert-Paul Juster, B.A.

The perception of stress and responses to stressors differ between the sexes. While there is strong evidence that subtle variations in psychological interpretations and biological activities can account for these divisions, sex differences to stress represent a controversial and contradicting field of study. According to a massive review of the research out there, women subjectively experience more stress than men and consistently report more physical health symptoms. What is surprising, however, is that it is in fact males that are generally more biologically responsive to psychological stress. If women report more emotional distress but men react with stronger mounted “fight-or-flight” responses, then are women really from Venus and men from Mars? Science has something to say about this mythological paradox. As this article will reveal, minds and bodies experience stress in chorus, but the notes and songs that scientists hear from each do not always logically or harmoniously correspond.

When measuring “stress”, scientists incorporate knowledge from three traditions. First, the *environmental* perspective focuses on objective stressors like the frequency of

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exposures to violent neighborhoods, chaotic workplaces, or countless other contexts that most would deem stressful. Second, the *psychological* perspective focuses on the how individuals evaluate stressors in terms of emotional distress. And third, the *biological* perspective focuses on biological systems involved in stress responses. Laboratories devoted to uncovering the complexities of stress phenomena therefore assess stress using different measures like questionnaires and the collection of biological markers like stress hormones. As is clear, stress can get under



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your skin and damage health via the interplay of these components. When individuals are bombarded and distressed with stressors that repeatedly activate biological responses; bodily systems undergo undue wear and tear and begin to break down.

Using an environmental and psychological approach, a recent study by Dr. Nicole Weekes (2005) assessed stress exposure, stress perceptions, and health symptoms in young adults and found that stress exposure related to health for both sexes, but stress perceptions were predictive of health symptoms only for women. This suggests that men may

In the early 1990s, European researchers set out to tease apart sex differences in reactivity to mildly stressful situations in laboratories specializing in biological stress responses. Several studies consistently showed that young men react as much as a two times more than females of the same age in the release of the stress hormone cortisol in the face of acute stress. In other studies, increased levels of adrenalin and blood pres-

sure were also more likely to occur in men. Increased cortisol, adrenalin, and blood pressure are all biomarkers of a stress or the “fight-or-flight” response activated by the perception of stress. There is a very popular idea in stress science circles called the *reactivity hypothesis*, which states that abnormal biological and behavioural responses to stressors represent an important risk-factor for stress-related disorders. For example, classic studies done in the late 1970s revealed that greater stress hormone reactivity related to increased cholesterol, blood pressure, and smoking – the traditional risk-factors for cardiovascular disease. Keeping in mind that women report more stress and distress predisposing them to certain diseases, it seems rather odd that men react more to acute laboratory stressors.

An important distinction should be made: there is a big difference between stress hormone responses to acute stress and the normal cyclic day-to-day variations in stress

be less likely than women to say that they perceive and interpret stressors to be affecting them. From a surveying point of view, can we assume that women cry and men deny? The presumed intensified expression of emotions is thought to be at the heart of women’s greater vulnerability to anxiety and depressive disorders, and yet men seem more responsive biologically to stress. Women might communicate emotions and report more hassles than men, but when biological activities are considered the “cry and deny” statement becomes an oversimplification.



Mind-Body Differences in Distress and Stress Reactivity Among the Sexes

hormones (dubbed *basal* cortisol) that help to ensure the adequate functioning of many of our bodily systems. Basal cortisol levels often provide us with the first indication that stress systems are going haywire. This cyclic variation begins with a surge in cortisol levels as we wake that helps us to prepare for the day. Cortisol levels then gradually decline over the course of the day, cycling back again the next time you awaken. It has been cautiously suggested that women might have higher basal cortisol levels throughout the day. Thus, if women already maintain high levels of basal cortisol, then they might simply have fewer reserves of cortisol to mobilize during acute stress. Fair enough, but maybe the sexes are also simply stressed by different stressors.

Our own data seem to indicate that this may be the case. Over the years we have asked hundreds of individuals to fill out a simple survey about stress and we have found that men and women tend to report being stressed by different types of stressors. Now over 50 years of research has shown that irrespective of age, sex, and social status humans are stressed by the same things. Sound confusing? NUTS anyone? Recall that for a stress response to occur in humans we must first have interpreted a situation as being either Novel, Unpredictable, as one that Threatens our ego or sense of self, or decreases our

Sex hormones add an extra layer of information regarding stress responses among the sexes, but still much more research is needed before arriving at any conclusions regarding these elusive sex differences.

Sense of control, hence NUTS (see every issue of *Mammoth Magazine* for more info!). What differs between the men and women we have surveyed is in *what* they report to be NUTS. Specifically, while both men and women state being stressed by work responsibilities, women report more stress from home responsibilities, from conflict (78% vs 58%), and being blamed for something. Men on the other hand reported being stressed by meeting the expectations of others and their own expectations.

Some American researchers propose that men might be more reactive to stressors and laboratory tasks involving performance pressures while women might be more reactive to

tasks involving social alienation. Consider the existing stereotypes of gender-typed behaviors: women are socializing creatures while men are competing beasts. There are many social, cultural, and historical circumstances at play for such beliefs and behaviors, but no absolutes are agreed upon. Yet, there is some, albeit limited, scientific evidence that men and women react differently to specific stressors in line with this ageless Venus and Mars

Several studies consistently showed that young men react as much as a two times more than females of the same age in the release of the stress hormone cortisol in the face of acute stress.

dichotomy. Propensities towards achievement versus social inclusion have more to do with personality traits and gender roles though, so let us turn the page for now and consider another potent candidate for biological sex differences.

Sex hormones like estrogen and progesterone for women and testosterone for men are emerging as important modulators of acute biological stress responses. Up until recently, male participants were totally over-represented in studies of stress; only a meager 17% of research participants were female! The rationale adopted by many stress

researchers was that the reproductive cycle of women makes it harder to discern the magnitude of their stress responses. Given that estrogen and progesterone levels fluctuate over the course of the cycle, it can make it harder to tease findings apart. One of the reasons for this is that estrogen is known to contain the activity of the stress response system. In other words, when estrogen levels are high stress hormone levels are kept lower. The converse is also true. When stress levels are high, this can decrease estrogen levels and thus make it harder to conceive for instance. Think about our ancestors and evolution; if a major stressor occurred, let's say a drought, do you think reproduction was on their minds? Likely not.

Researchers also believe estrogen to be protective for brain regions involved in the activation of stress responses. In fact, there is some pretty compelling research demonstrating that older women have the most heightened stress responses – perhaps because of depleted estrogen levels after menopause. Similarly for men, higher levels of testosterone are usually accompanied by lower levels of stress hormones (testosterone actually acts chemically like estrogen when converted in the brain). Sex hormones add an extra layer of information regarding stress responses among the sexes, but still much more research

is needed before arriving at any conclusions regarding these elusive sex differences.

In conclusion, what the data seem to show is that one's sex will influence one's sensitivity to stressors and stress responses. This is manifested differently in women who report more stressful life events, daily hassles, and health symptoms, and perhaps also greater day-to-day levels of stress hormones. Men, on the other hand, report less stress exposures and distress, but appear more stress reactive. We have explored how sex hormones can interact with stress hormones, but here things are far from fully understood. It is also important to state that some of this information is contested with research findings showing the opposite. Indeed, many hormonal profiles get flipped around at different stages throughout life as does the nature of the stressors to which we are exposed.



Ruminate Much ? That would Depend on Whether you are a Man or a Woman

By Pierrick Plusquelec, Ph. D.

One fine day, you arrive at work and hear one of your colleagues talking behind your back. You avoid confrontation and carry on with your daily activities. But by the end of the day, this story comes back to mind. At several moments, for instance, when on the subway, in the locker room of your gym, in front of the oven while cooking a family supper, or even during an advertising break while watching a television show – you simply cannot stop thinking about that pestilent incident. As you flip it round and round in every angle and try to understand how, when, and why could this colleague have spoken badly about you, and to how many people, and what will happen tomorrow? These scenarios turn in your head and you will undoubtedly have trouble sleeping. Ladies and gentlemen, what you are doing is called «ruminating».

Rumination belongs to a class of adaptation strategies, or rather maladaptations, to stress. It is defined as a way we respond to distress by concentrating on the signs of this distress, its possible causes and its consequences, and thus leaves no room for the necessary actions to resolve this distress. More simply, rumination is characterized by the mental churning of elements that disturb or stress us, imagining negative consequences, all the while anticipating the next stressor. Science sometimes has a funny way of integrating terminology from other disciplines. For instance, the psychological term “rumination” stems from the manner cows churn their food over and over again in their mouths. . .

Did you know that ruminating over your problems could in part help to explain why women are more prone to depression than men? This is what Susan Nolen-Hoeksema maintains, a scientist based at the prestigious Yale University who recently synthesized an article on the state of knowledge on rumination.

Irrespective of what country, culture, or ethnicity they are from, women are two times more at risk than men of developing depression.

In fact the figures come in at 21 % of women and 13 % of men that will develop a major depression over the course of their lives. Researchers know that this difference between the sexes appears in adolescence. Many of them have explored risk factors that could explain this difference, and some, like Susan Nolen-Hoeksema, have made this their war horse. She became particularly interested in understanding why women are more vulnerable by exploring two big risk factors of depression : the first deals with *stressful life events*, which include those recurrent tensions associated with social status, the role of women compared to men, and the redefinition of roles for young women during adolescence. Secondly, she examined the *manner of reacting to stress*, which involves the biological response in the strict sense and the strategies of adaptation to stress.

In order to measure one's tendency to ruminate, Susan-Nolen-Hoeksema constructed a scale based on the frequency with which we use 22 behaviours or thoughts judged to be ruminative when feeling sad or depressed (for example, I think that I will not be able to do my work if I cannot snap out a problem). By following hundreds of participants over several months, she was able to show that women resorted to rumination more often than men. She found that people with a tendency towards rumination were depressed, they experienced longer periods of depression and were at greater risk of further developing depressive disorders. People who ruminated also had more negative thoughts about the past, present, and future, displayed a fragile capacity to resolve problems, felt their social support network reduced, and saw their family members grow weary of their continued need to talk about their problems.

Susan Nolen-Hoeksema was also able to associate ruminative tendencies with other types of mental health disorders. Therefore, the tendency to ruminate is associated not only with depression but also with alcohol abuse in adolescents and adults. Rumination is also predictive of auto-mutilating behaviours in young adolescent women, and to an increase in thoughts of suicide in groups of adults. Finally,



rumination was associated with important levels of Generalized Anxiety and to symptoms of Post Traumatic Stress Disorder.

Dr. Nolen-Hoeksema went even further as she has begun to study the neurobiological mechanisms by which tendencies to ruminate might contribute to mental health. She has since identified that rumination is associated with deficits in concentration and memory, the incapacity to turn from one coping strategy to another, and also to cognitive biases in the processing of information. Specifically, above all others, rumination was linked to a preferential remembrance of negative events. These indices led some neurobiological researchers to discover that the tendency to ruminate is associated with greater brain activation in structures implicated in emotional regulation (the amygdala and the medial prefrontal cortex) in response to negative facial expressions and stimuli. Susan Nolen-Hoeksema even contributed to a study that revealed how the tendency to ruminate modifies how a gene is turned on or off to do its job (i.e. the expression of a gene) that plays a role in depressive symptoms.

Taken together, these data suggest that finding ways to neutralize the tendency to ruminate terrible thoughts seems like a perfect avenue for designing interventions in situations involving psychological distress. One way might be through teaching individuals who tend to ruminate how to distract themselves so that they can snap out of vicious circles that feed symptoms of depression even more, so that they can ultimately begin a concerted effort towards resolving the problem.

While Susan Nolen-Hoeksema's article represents 30 years of intensive research on ruminative phenomena, no one yet knows how the tendency to ruminate develops from childhood to adulthood, even if it seems to appear in adolescence. Moreover, the magic formula to scrap this bad habit has yet to be discovered and relies solely upon our capacity to develop resilience.

Sex and Gender Differences and Vulnerability to Stress-Related Disorders

By Shireen Sindi, B.A., M. Sc.

Sex and gender differences are observed for a wide range of stress-related conditions. Numerous biological (sex) and social factors (gender and gender roles) can exert different effects throughout lifespan development to predispose the sexes to specific mental and physical health problems. In this article, we will explore some of these conditions as they are thought to relate to either prenatal stress or stress at every stage in life; thus from before the crib to the crypt.

The Prenatal Period and Early life

As developing babies, we are at the mercy of our mother's health and well-being. Experiencing powerful stressors (e.g., malnourishment, poverty, environmental toxins, physical/psychological abuse) during pregnancy can result in harm to both mother and child. Such stress can be toxic at every stage of pregnancy, but especially so during the first trimester of pregnancy when basic growth is very sensitive to the resulting high levels of stress hormones. These stress hormones can cross the placental barrier where they then interact with numerous important biochemicals and impact the developing fetus. Now please do not panic if you are pregnant and experience a little stress here and there – here chronic and/or severe stress is the culprit.

The study of the effects of stress during pregnancy (and during life for that matter) is very difficult given that so many other factors could be contributing to any later negative effects observed. Despite this, there are consistent enough data in both animals and humans that show an association between prenatal stress and increased risk of pre-term birth and lower birth weight in both males and females. Both of these outcomes on their own can have a myriad of different effects over the lifespan increasing the risk of many physical and mental health problems; hence, why the study of prenatal stress becomes complicated. Are later effects observed the result of the

stress during pregnancy or of being born early? Other than effects at birth, prenatal stress has been linked to delays in psychomotor development and difficulties adapting to strange or new situations in the first year of life again in both boys and girls but this has not been consistently found in all studies.

To date however, we are not certain how prenatal and early life stress relate to sex-specific outcomes, but it is assumed that these biological activities may set the stage for vulnerabilities during infancy and beyond. Overall though, the emerging pattern in both animal and human studies is that the end result of prenatal stress seems to predispose males and females to different types of problems over the course of their lives. Sometimes the effects are observed as early as in childhood and adolescence while at others it is only in adulthood that the presumed effects of prenatal stress emerge.

Factors during Childhood and Adolescence

One of the most detrimental risk factors of stress-related disorders later in life is childhood sexual abuse. Most statistics indicate that females are at higher risk for sexual

abuse. However, newer studies show that boys likely experience as much abuse as girls but do not report their offenders. Thus, we refer to declared risk for sexual abuse. In fact, at every stage of development women have a significantly higher declared risk of experiencing physical or sexual assault. We know that early sexual abuse predicts poor health outcomes later in life in general, with victims being at risk for a plethora of physical and mental health problems as well as lower levels of emotional and social well-being later in life.

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Some sex and gender differences begin to emerge in childhood but for the most part most differences between the sexes become apparent at puberty. In childhood though, girls tend to display more of what are known as internalizing behaviours like anxiety whereas boys are more likely than girls to be diagnosed with externalizing behavioural problems like Conduct Disorder and Attention Deficit Hyperactivity Disorder (ADHD). Externalizing behaviors are easier to detect and impact others in an obvious manner, whereas conversely, internalizing behaviors are more related to anxiety, depression, withdrawal, and somatic complaints and mostly affect the person experiencing them. Interestingly, while depression is considered an internalizing disorder, during childhood, the rates of depression among girls and boys do not differ. However, during adolescence, the tables turn. From here onwards and throughout adulthood, women are two





times more likely than men to experience depression in their lifetimes.

Adolescence is also a period when eating disorders such as anorexia and bulimia emerge and their rates are higher for girls. Personality traits like low self-esteem can increase the risk for depressive symptoms among girls who have a negative body image and for those undergoing stressful life events. In addition,

It is during adulthood that very striking sex differences in stress-related conditions fully surface.

much scientific focus has been placed on sex hormones like estrogen and progesterone and their influence on mood states. Keep in mind that some individuals are more sensitive to hormonal changes than others. It is thought that hormones are not likely to have a direct effect on mood on their own, but instead may interact with other psychological factors such as self-esteem, self-identity, as well as different ways of coping, revealing a clear sex by gender interaction. Hormones may also influence some of the chemical messengers in the brain (i.e. neurotransmitters like serotonin), which play an important role in a variety of psychiatric conditions.

When we think about adolescence, hormonal issues are often the first culprit to be accused, but adolescence involves more than just hormonal changes. An important factor is the observable change in physical appearance. This brings different preoccupations and increases depressive symptoms and perceived stress for some. This effect may be more pronounced for a minority of adolescent girls

... if a girl cries and complains of some pain after a fall, she is more likely to receive help in order to address her discomfort, whereas a boy in the same situation will have the significance of his pain minimized and is likely to be told that "boys don't cry", instead they should be "strong and tough".

who mature at an evidently faster rate than their peers or classmates. Discontentment with one's body is a normal experience for many adolescents, but it is when this becomes an all consuming fixation that stress-related disorders are potentially brewing. Conversely among adolescent boys, greater satisfaction may be expressed with regards to pubertal changes, as this is perceived as increasing their masculinity although some findings show that early puberty among boys is associated with an increased risk for externalizing behavioural problems such as aggression and hostility.

Another significant component linked to adolescence that seems to be a risk factor for various stress-related conditions is gender socialization, which is the process of learning about expectations regarding culturally defined roles based on one's sex. Interestingly, whereas adolescent boys report more school-related stressful events, adolescent girls re-

port more negative interpersonal events, and perceive them to be more stressful than boys do. This does not mean that males are not experiencing distress, but rather that they express it differently in a manner consistent with cultural and social norms. Considering that adolescence is a period whereby self-identity is evolving and highly influenced by the sometimes conflicting pressures between personal and parental expectations, it is not surprising that the sexes uniquely behave in ways to be accepted by their peers. In essence, the reconciliation of all these factors during adolescent largely shapes who we will become and what conditions might beget us.

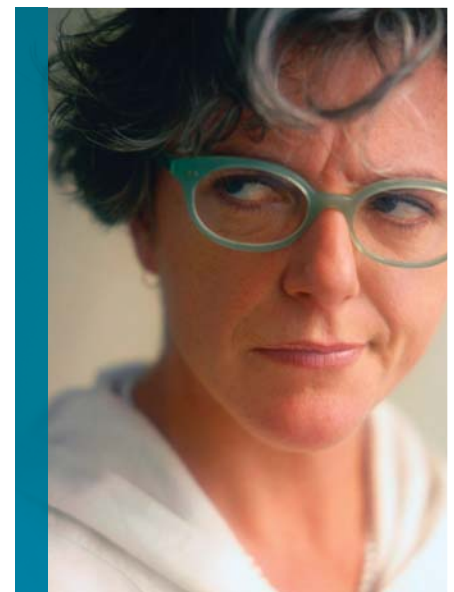
Factors during Adulthood

It is during adulthood that very striking sex differences in stress-related conditions fully surface. When compared to women, men are more prone to developing alcohol and substance abuse or dependence, as well as developing antisocial behavior whereas women show a greater propensity towards depression, irritable bowel syndrome, chronic fatigue syn-

drome, migraine headache, and fibromyalgia. Moreover, suicide rates are considerably higher among men. Although women are more likely to attempt suicide, men tend to use more violent means (e.g. guns, hanging vs pills in women) and unfortunately succeed more.

Women are all the same more susceptible to other stress-related mental health disorders. Higher rates among women are especially pronounced for anxiety disorders, including generalized anxiety disorders (GAD), simple phobia, social phobia, and panic disorder, and women report more psychosomatic symptoms. The later observed sex difference may partially be explained by the fact that women are less hesitant to enact health-seeking behaviors such as contacting health professionals.

Men and women also differ when it comes to pain perception. Some evidence shows that women may be more sensitive to pain. These differences however, may be shaped by social, cultural, and psychological factors. For example, if a girl cries and complains of some pain after a fall, she is more likely to receive help in order to address her discomfort, whereas a boy in the same situation will have the significance of his pain minimized and is likely to be told that "boys don't cry", instead they should



Sex and Gender Differences and Vulnerability to Stress-Related Disorders

be “strong and tough”. The media also reinforces such stereotypes that can limit men’s ability to emotionally express themselves.

Marriage interestingly holds more health advantages for men in terms of psychological well-being when compared to women. Additionally, when compared to single or divorced men, married men are protected from devel-

take on the role of caring for aging parents and parents-in-law. Such additions in responsibilities and daily demands may play an important role in predicting negative physical and mental health outcomes, particularly for women who may already be at risk due to predisposing biological and psychological factors, and for those who do not use appropriate coping strategies.

... chronic stress not only exacerbates women’s vulnerability to stress-related health problems, but can predispose them to conditions more prevalent in men decades earlier.

oping mental health problems like depressive symptoms in response to negative life events such as workplace stress. Women though are more likely to foster social networks outside of the home environment, such as via the benefits of employment and work colleagues. This being said, many women find it difficult to cope with the strain of having multiple roles and responsibilities. When looking at psychological well-being and overall health outcomes, it is important to keep in mind that over the past decades, there has been a significant change in women’s roles, which are often accompanied by increased demands. Whereas women used to primarily play the role of homemakers, caring for children and their household, today they have largely maintained these responsibilities *in addition* to having entered the workforce devoting as much time as men to work. Women often also

Such chronic stress not only exacerbates women’s vulnerability to stress-related health problems, but can predispose them to condi-

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tions more prevalent in men decades earlier. For example, earlier research studies suggested that on average, women developed cardiovascular disease 10-15 years later than men. But now, in Canada, adult women die more of cardiovascular disease and stroke than do men. The case of women’s risk of cardiovascular disease represents a societal change still ill understood, but it is suggested that the greater burden of perceived and chronic stress is to blame. Interestingly, sex differences are



bances, whereas men show more symptoms of agitation. However, it remains unclear what is responsible for the change with age.

Conclusion

Thus, the effects of pre-natal and early life stress seem to manifest differently in men and women and as this article has shown, there are risk factors that increase vulnerability to developing stress-related disorders at each developmental stage that are independent of prenatal stress. Overall however, women may have a greater number of biological as well as psychosocial risk factors that start early in life and are maintained later in life relative to

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not typically observed with respect to risk of developing other stress-related disorders like obesity, diabetes, and high (LDL) cholesterol.

As we age, the picture tends to change somewhat. Some evidence shows that the rates for depression decrease in older adulthood, such that women are no longer twice as likely as men to be diagnosed with depression. This might be because depressive symptoms are manifested differently among older men and women. For example, older women express more fatigue and appetite distur-

men. As such, gaining a better understanding of the fundamental differences between men and women with respect to stress; be in prenatal, early life or adult experienced is critical. We must first determine the primary effects of stress at each stage of development. Then ascertain whether these effects are the same in both sexes. A tall order indeed, but stress science is taking several steps in the right direction as young emerging scientists are devoting their careers to understanding how the sexes are alike and how they differ with respect to stress.



Men & Women : Are we useful for each other in times of stress ?

By Marie-France Marin B.A., M. Sc.

Thursday night 5:00 pm, you just ended a stressful meeting with your boss that kept criticizing your work and gave you three new deadlines for... yesterday. First reflex: you need to vent! No worries, seeking this type of social support is quite normal given that studies have repeatedly shown that social support is one of the most powerful weapons in your arsenal against stress. Moreover, numerous studies have demonstrated that social support has positive effects on both physical and mental health problems ranging from cardiovascular conditions, to depression and to schizophrenia. In the same vein, social support is related to better recovery from illness and to longevity. Stress scientists believe that social support exerts these positive effects because it either directly or indirectly influences stress pathways in the brain and body. As *Mammoth Magazine* and the general media alike have explained, stress is an important contributing factor to the onset of various diseases. So, vent away, the social support will do you some good! Here is how we have come to know this.

... stress researchers wished to determine whether social support could have immediate on the spot effects on stress hormone levels in individuals exposed to an acute psychological stressor.

Although there was considerable evidence showing the beneficial effects of social support on general health, stress researchers wished to determine whether social support could have immediate on the spot effects on stress hormone levels in individuals exposed to an acute psychological stressor. They also wanted to find out if social support would have the same effects in men and women. One study showed that social support provided by a woman, but not by a man, was linked to lower blood pressure in face of stress for

both male and female participants. In another study, women were stressed by having to give a speech in front of either a female friend or a female stranger. The results demonstrated that having a girlfriend present likely provided social support given that much lower cardiovascular activity (recall that during a stress response our heart rate and blood pressure increase, so lower cardiovascular activity can mean a smaller stress response, see *Mam-*

moth Magazine Vol. 2, So, Why a Mammoth?) was found in the group where the girlfriend was present. What this means is that social support is likely better coming from someone you know and trust, especially from one of your girlfriends. While these results are very interesting, in everyday life, who are you most likely to come home and vent to after a stressful day? Your partner or spouse. So, is he or she a good buffer against stress?

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received social support from a stranger, and the rest of the participants received support from their respective boyfriends/girlfriends. Intuitively, one would think that the participants who were with their life partner would respond less to the stressor and thus have smaller stress reactivity. Well, the story is not that simple! The male participants who were with their girlfriends during the anticipation

received social support from a stranger, and the rest of the participants received support from their respective boyfriends/girlfriends. Intuitively, one would think that the participants who were with their life partner would respond less to the stressor and thus have smaller stress reactivity. Well, the story is not that simple! The male participants who were with their girlfriends during the anticipation



Men & Women: Are we useful for each other in times of stress?

period showed a reduced stress response compared to men who were alone or with a stranger. Interestingly enough, women who were supported by their boyfriends during the anticipatory phase showed a tendency towards increased stress reactivity. In other words, a partner's support seems to be beneficial for men but a boyfriend's support for women seems to make things worse. These findings are quite interesting given that other studies have shown that married individuals live longer than non-married individuals but that the protective effects of marital status seems to be greater for men than women.

Ladies, do not jump to any conclusions about the usefulness of your husband's! Gentleman, please do not give up reading this article! I promise... the story gets more interesting!

Some researchers found these results quite intriguing and decided to further investigate the question. They conducted essentially the same study as above and assigned women to one of three conditions before exposing them to a stressor. Some women were alone, others had their spouse provide verbal support, and for the rest of the women, their spouses were asked to give them a neck and shoulder massage. As demonstrated in the other study, women who received verbal social support from their spouse did not exhibit a smaller stress response than women who were alone. However, women who received physical social support (massage) from their husbands had lower stress hormone levels and a decrease in cardiovascular activity in face of the stressor. In other words, physical but not verbal social support from the partner was beneficial for women.

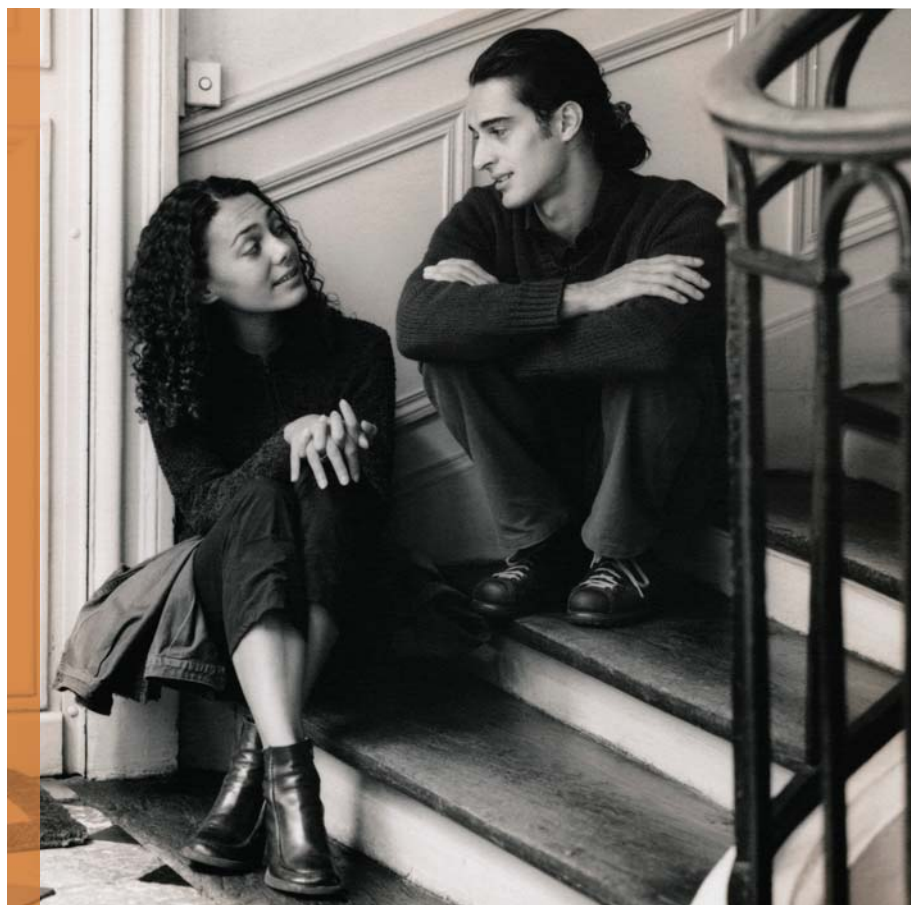
Did I not tell you to not conclude too fast? What science tells us is that both men and women are good sources of social support; it is just important to remember how to provide it. Another proof that science is often about nuances... In this case, the nuance is quite simple: women should talk whereas men should... massage! However, it is important to mention that the effects of physical social support on men have not been tested yet. Who knows maybe men benefit not only from verbal, but also from physical social sup-

port? Intuitively, I have the impression that most men who have read this article will hide this issue of *Mammoth Magazine* to make sure that their wife does not see it whereas women will have an unexplained tendency to leave it on their husband's night stand with a bottle of massage oil.

In all seriousness, ultimately though, what science tells us is that things are rarely black and white or definite, real life is most often about the gray areas in between. Same-sex couples have not been tested in any of these experiments. Also, we now know that being a man or a woman is not as black or white as it used to be either. One's gender identity may play a large role. What this also means is that if you are a woman and your husband offers you very effective support; then don't drop him like a dirty shirt in times of stress only to run to your girlfriends! The same thing that makes stress such an individual phenomenon (i.e. what is novel to you is not novel to

your friend, remember those NUTS...) is also what makes dealing with stress highly personal. Use what works for you and do it with whoever provides you the best support.

What science tells us is that both men and women are good sources of social support; it is just important to remember how to provide it.



The Evolution of Sex Differences in Stress and Coping

By Robert-Paul Juster, B.A.

This year commemorates the 200th anniversary since Charles Darwin's birth, as well as the 150th year since he published *The Origin of Species*. This notorious book meticulously documented a vast collection of insights that form the theory of evolution. Briefly, this theory suggests that individuals must constantly adapt to environmental pressures in order to survive and characteristics that maximize survival are more likely to be passed onto offspring. A central tenant to evolutionary theory is the notion that biological and behavioural strategies that gain reproductive advantages for a particular species will be more important, evolutionarily speaking, than the health or well-being of individuals. In the grand scheme then, advantageous biological systems like our stress response are therefore "naturally selected" and maintained throughout time and across species. In fact, it is believed that the cell structures that receive stress hormone signals originate from a 500 million year old ancestral gene found even in primitive fish! Such Darwinian speculations are not without their fair share of religious and secular criticisms alike, but evolutionary theory has proven extremely insightful in our understanding of biology. Scientists applying evolutionary perspectives to biological and behavioural problems frame questions in two broad ways. Firstly, *proximate* or "how" questions about biological mechanisms are posed; for example, how does a stress response work? Secondly, *ultimate* or "why" questions are

In the grand scheme then, advantageous biological systems like our stress response are therefore "naturally selected" and maintained throughout time and across species.

proposed; that is, why did a stress response evolve? Within this framework, evolutionary arguments take a cost-benefit approach whereby the advantages and disadvantages are examined and evolutionary hypotheses are proposed. With this methodology in mind, this article will take an evolutionary perspective to the topics discussed in this issue of *Mammoth Magazine*.

Once upon a time, a vigorously activated "fight-or-flight" response would have been essential for predators and prey alike. Gradually over time, biochemicals, cells, glands, and organs became systematically attuned to stressors, and the stress response evolved and passed on from one species to the next. Behavioural strategies simultaneously evolved with biological ones, so that differences began to emerge in whether certain species fought or fled, froze or hid, etc. This same range of reactions exists in humans faced with challenging situations, some freeze, some just walk away, and others still, dig their heels in for the fight. Differences in, say, the use of aggression or passivity would have been molded and modified to maximize survival. It is important to

To quote Darwin: "it is not the strongest that survive but those most adaptive to change."

note that no one approach is better or worse here, so long as you would have lived and passed on your genes. To quote Darwin: "*it is not the strongest that survive but those most adaptive to change.*" Therefore, variations in behavioural strategies in concert with biological systems would have evolved when matched appropriately to environmental pressures (e.g. food shortages, climate fluctuations, competition with a neighbouring tribe, etc.). So, the "fight-or-flight" stress response would have evolved if it assisted our survival in such activities as hunting mammoths and acclimatizing to our surroundings.

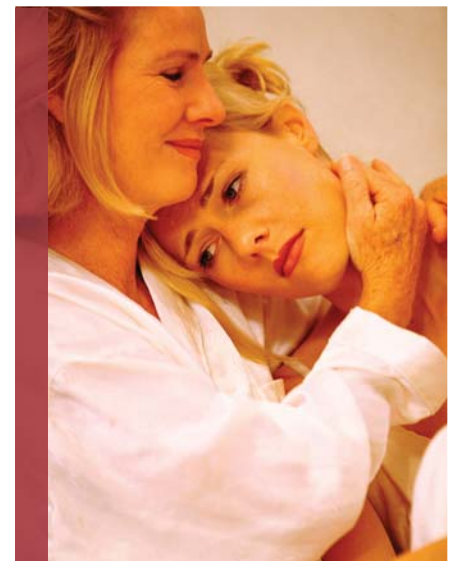
We have seen in this issue how women experience more perceived stress, ruminative cognitions, and gravitate to their social networks more than men, who in turn experience more stress reactivity. Focusing now on this last point, is it possible that men are more reactive to stressors because of evolutionary pressures that molded differential biological hardwiring among the sexes and different

behavioural responses to stress more generally? The physical "fight" part of the "fight-or-flight" response is a largely masculine manner of responding to stress in rodents, primates, and humans but is rarely exercised in females. Where are cave-women and modern-day women in this story and why do they perceive more stress but show less biological reactivity?

In 2000, Dr. Shelly Taylor postulated that perhaps it was because evolution had developed a uniquely female stress response that was not addressed in male dominated studies. Dr. Taylor and other eminent stress researchers proposed the female-typical "tend-and-befriend" stress response as an alternative to the male-typical "fight-or-flight" stress response. The central tenant of this theory is that women are more vulnerable to external threats because of the demands of pregnancy, nursing, and child care. When we think of cave-women struggling not to go extinct, "fighting" or "fleeing" may not have been the best course of action since it might have meant the loss

her infant or child. Taking other biological and behavioural routes might then have been more favourable, such as "tending" by nurturing her distressed offspring during periods of difficulty, as well as "befriending" others via a social support network that might protect against future threats.

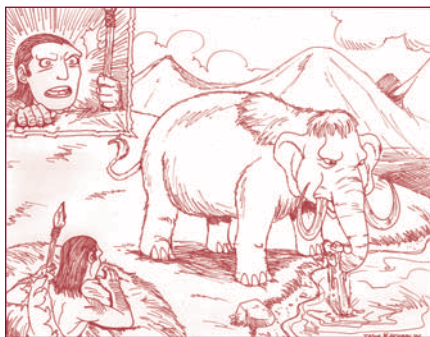
The "tend-and-befriend" theory has received some compelling research support in animals and humans. In terms of "tending",



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research has shown that female rodents are likely to show nurturing behaviour when separated from offspring. Human mothers are similarly more affectionate with their children after a stressful workday than are fathers. In terms of “befriending,” women are much more likely than men to seek social support during periods of heightened stress in numerous animal species and different human cultures. As described in this issue, the presence of someone from your social network can help dampen stress reactivity for both sexes, but more strongly for women. The “tend-and-befriend” response adds an extra layer of understanding to stress-sex differences within an evolutionary perspective, however, careful studies and theorizing are always needed as backup.

In considering sex differences in stress-related disorders within the context of evolution; two questions come to mind. The first: why might problems such as depression have survived evolutionary pressures if mostly adaptive traits were passed on to offspring? Some theorists (Stevens and Price Rank theory of Depression to be exact) propose that depression may in fact have supported the survival of our genes. While this may sound counterintuitive, let us explain. According to this view, depression was selected to aid in the acceptance of subordinate roles within a hierarchy. Whether a group is composed of males or females, there is always a dominance hierarchy and challenges to establish it. After a difficult defeat, some individuals who had little faith in their ability to climb back up the rank ladder would have engaged in behaviours (some voluntary and others not) that signaled to others that they were not fit to compete; hence the outward symptoms of depression. These in turn would also prevent others from trying to help by reinstating their place in the hierarchy. As such, depressed individuals would have been afforded protection by the group and were less exposed to situations that would put them at



further risk. They may have been assigned other supportive roles within the group and given that they would still have access to resources and mates, their survival was ensured. Social harmony may have been restored in these ancestral communities because there would have been fewer conflicts within the group. The leaders were ensured of their status as subordinate individuals would likely have stopped challenging them. Thus the entire group becomes stronger (due to fewer injuries putting them at risk when other human groups challenged or animals attacked) and thus the community was stabilized.

Consider a wise quote from Dr. Taylor: “Biology is not so much destiny but central tendency, but a central tendency that influences and interacts with social, cultural, cognitive, and emotional factors, resulting in substantial behavioural flexibility.”

Now to address the second question that begs asking: why would women be more vulnerable to stress-related disorders like depression? According to Dr. Randolph Nesse depressive moods evolved from situations when certain goals were unattainable and required the individual to disengage and reflect on future courses of action. In fact, many clinicians will argue that some depressive episodes subside only when certain distressing goals are

dropped. A long time ago, it was therefore in the depressed cave-person’s best interest to disengage from unattainable goals (i.e. competing with higher rank members of the community) and to withdraw in order to strategize the next move. This mental chess game is in essence rumination, as the mind endlessly churns different tactics that will ultimately focus attention on the problem. Evolutionary theorists believe that ruminative defense mechanisms were more frequently exercised by women in our mammoth hunting days because of the social implications of rumination. Drs. Paul Watson and Paul Andrews believe that ruminators are more attentive to social comparisons and information. On the flip side, rumination regrettably comes with social costs as the ruminator is likely to be less physically and mentally present for friends and family. Indeed, many symptoms of depression, such as sleep problems, strange appetite, lack of motivation, and so on – are similar to shut-down behaviors observed in hibernating mammals. Depressed individuals might therefore become more dependent on diverse social networks for remediation and survival, which might translate into behaviours that seek support from others. Drs. Watson and Andrews believe this to be the case, for if ruminations were to have escaped the Darwinian whip-lash and gone extinct so to speak, it must have had some advantageous element.

Taken together, evolutionary theories are often used to explain biological phenomena. The stress response is an essential biological system with wide-spread effects throughout the body and mind. Stress-related diseases like depression and cardiovascular disease can therefore be considered as the abnormal functioning of biological and behavioural strategies that normally promote survival. These “hick-ups” in functioning would therefore be the result of wear and tear. These are further manifested differently between the sexes in ways consistent with evolutionary drives. This being said, variation is biology’s only rule and nothing is set in stone. Consider a wise quote from Dr. Taylor: “Biology is not so much destiny but central tendency, but a central tendency that influences and interacts with social, cultural, cognitive, and emotional factors, resulting in substantial behavioural flexibility.”

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