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The Centre for Studies on Human Stress is dedicated to improving the physical and mental health of individuals by empowering them with scientifically grounded information about the effects of stress on the brain and body.

Stress and Wealth: How Our Social Standing Affects Our Health

By Robert-Paul Juster & Marie-France Marin

Last year was particularly difficult economically speaking. Recession, financial crisis, economic scandals…we were all hit hard in some way. While a few among us were relatively protected by stable jobs and good education, many of us were less fortunate in this tragic story and may have lost employment.

In some way or another, this situation involved a sense of increased novelty, unpredictability, threat to the ego/self, and diminished sense of control. These factors dictate whether a situation will be interpreted as distressing and lead to the secretion of stress hormones. Not since the Great Depression of 1929 have we been faced with such hard times (**N**ovelty), experienced so much uncertainty for the future (**U**npredictability), questioned "why me and not another" (**T**hreat to the Ego/Self), and felt so unable to get back on our feet financially (**S**ense of Control). Clearly, all the psychological and social ingredients inherent in the **NUTS** model of stress are at play in these trying times. As we shall see in this issue, these psychological characteristics are experienced differently by people having climbed to the top of the social ladder in comparison to those struggling to step onto the first ladder rung.

Economics are interconnected to social elements that are experienced as more or less stressful depending on your status. The term "**socio-economic status**" refers to a constellation of factors that include, among others, one's occupation, one's financial security, and one's level of education. Governments and researchers alike often stratify individuals according to socio-economic status that varies from Low, to Middle, to High depending on which measure is used. This is not done with the aims of segregating populations, but rather with the aim of better understanding the different realities experienced by individuals coming from different socio-economic levels. In this manner, better policies and practices can be implemented in order to improve the health and welfare of all.

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ladder in a way that can be damaging to mental and physical health. Some of the most important studies known throughout the health sciences are the Whitehall studies of British civil servants. In these studies and others like them, researchers found that individuals with lowest socio-economic status had the most compromised health, whether this was measured as the number of annual hospitalizations, more heart problems, weakened immune systems, greater symptoms of depression, and even shorter life expectancy.

In line with these findings, Sir Michael Marmot demonstrated the existence of a socio-economic *gradient,* showing that those from Low socio-economic status are the least healthy, those from Middle socio-economic status have slightly better health, and finally those with High socio-economic status have the best health. This step-like gradient in health as a function of socio-economic status is remarkably powerful and repeatedly demonstrated in several nations. For example, take a look at **Figure 1.** This is the socio-economic status gradient for blood pressure; however, this also applies for countless health problems.

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How can this gradient be explained? One answer is stress, although we must remember that stress affects absolutely everyone regardless of our place in society. All the same, stress can prompt us to smoke more, eat more, and exercise less. It

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is possible that stress is also dealt with differently depending on the socio-economic strata of an individual. For instance, not everyone can afford or easily schedule an appointment with a mental care professional if they are experiencing psychological distress. We cannot all cope in the same ways because we do not all possess the same resources. Indeed, stress will interact with different factors that dictate how we manage our stress, notably at a behavioral level (e.g., diet, exercise, smoking, alcohol), psychological level (e.g., personality traits, general perceptions and outlook on life, coping strategies), and social level (e.g., social support, neighborhood characteristics). For example, someone with low socio-economic status experiencing chronic stress might not have healthy foods available or be able to exercise outside safely, which can contribute to diminishing health and well-being. It is also important to recognize that where someone lives, namely their neighborhood, is also extremely powerful in determining one's exposure to stressors. As seen in **Figure 2,** a neighborhood where someone lives is embeded within a broader socio-economic status. In other words, you could be the wealthiest within a disadvantaged neighborhood or vice versa and this would have an impact on your health. In addition to blood pressure, many other examples of socio-economic and neighborhood gradients abound. On this note, we wish to introduce the reader in this issue to the fascinating and complex world of socio-economic status research vis-à-vis stress and health.

Welcome to Volume 8 of *Mammoth Magazine* on how wealth affects health. Dr. Mai Than Tu, a post-doctoral fellow at University of Montreal, will start this issue with a synopsis of ongoing research coming from Quebec and Canada. This will be a great opportunity to learn about the different research questions 'en vogue' and the different approaches taken in studying socio-economic status and health. One of these researchers is Dr. Jennifer McGrath from Concordia University, who is interviewed in the second article by Robert-Paul Juster, Ph.D. student at McGill University. Dr. McGrath is an exceptional scientist-practitioner who is teasing apart the various risk factors associated with cardiovascular disease in children and adolescents. By using neighborhood characteristics in addition to traditional measures of socio-economic status, Dr. McGrath's and her colleagues' findings shed new light on the relation between socio-economic status and stress. In addition to cardiovascular disease, allergies and asthma are also health conditions that appear to be distributed unequally among different socio-economic levels. In his article, Jason Behrmann, Ph.D. student at University of Montreal, discusses this phenomenon. He notably reports upon interesting hypotheses that could explain why certain people from high socio-economic status are more affected by hay fever whereas people from low socio-economic status are more allergic to mold. A coincidence? Maybe not, according to this very informative article. In our final article, Dr. Pierrich Plusquellec, associate professor at University of Montreal, takes this subject from a different angle by reviewing parallels between socio-economic status in humans and social hierarchies formed by dominance in non-human animals. As we shall see, there is much that we can learn about human behavior by observing that of our pets and our cousin primates.

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On this note, we hope you enjoy reading this 8th issue of *Mammoth Magazine!*

Figure 1

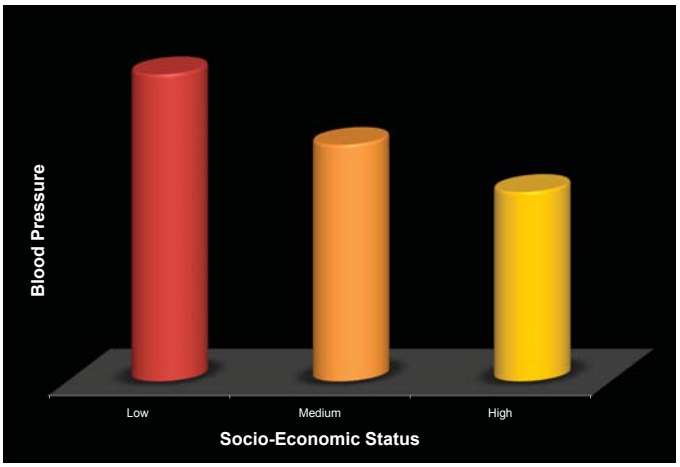
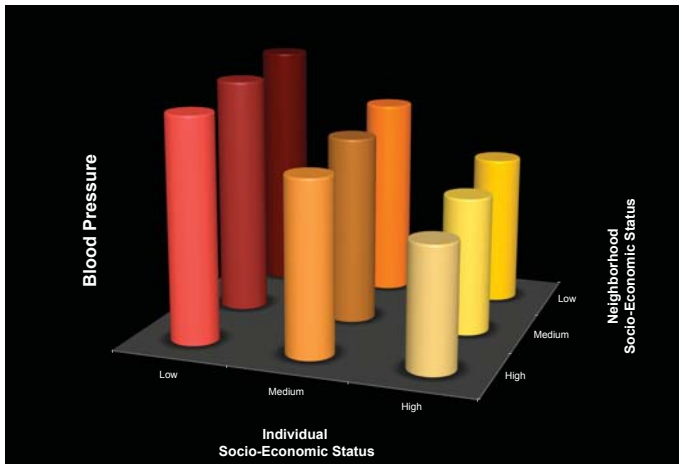


Figure 2



Financial Strain, Stress & Health: The Contribution of Quebec & Canadian Researchers

By Dr. Mai Thanh Tu, Ph.D.

Countries around the world are facing significant and concerning economic challenges. Naturally, anyone who has worried about job loss or financial strain may eventually wonder whether his or her health will be affected. Indeed, poorer health is often observed among individuals living in stressful and disadvantaged conditions. What needs to be examined in greater detail is how duration in these stressful conditions intermingle with risk and protective factors to ultimately affect health and well-being. For instance, we know that facing temporary financial strain has fewer consequences on health than facing chronic strain. Moreover, how can we reduce the damaging impact of such strain with protective factors like social support and positive health behaviors?

Indeed, poorer health is often observed among individuals living in stressful and disadvantaged conditions.

A way to look into this matter is through the Life Course Approach. Scientists and practitioners alike use this approach to examine how individuals' health is affected by protective and risk factors from social, physical and biological spheres. Numerous findings using this approach have and continue to give rise to efficient intervention programs that reduce health deterioration in those most vulnerable. Social and health researchers in Quebec and in Canada are highly involved in trying to understand how living in disadvantaged conditions unfolds and affects health at various moments of the lifespan: from infancy childhood, adolescence, adulthood, and into old age. Below is a short summary of their important contributions that are attaining international recognition.

Dr. Nathalie Auger is an assistant professor at the Department of Social and Preventive Medicine at University of Montreal. She is interested in risk factors that contribute to adverse birth outcomes in families living in poor conditions. Among different adverse birth outcomes are prematurity at birth (this occurs when a child is born before 37 weeks of pregnancy with a lower than recommended birth weight). This can affect health throughout one's life and is therefore an essential line of research for improving the health of populations the world over.

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For many years, **Dr. Louise Séguin,** a Professor at the Department of Social and Preventive Medicine at University of Montreal, has been concerned with the impact of poor living conditions on children's health. Part of her work has shown more frequent asthma attacks in preschool and school age children whose families have faced severe and repeated financial strain over a short period of time. As will be seen in a later article, living in poverty can predispose individuals to asthma. In 2007, Dr. Séguin co-founded the International Network for Research on Inequalities on Child Health (INRICH), which brings together leading investigators from Canada, Europe, the United States, Australia and Brazil in order to improve knowledge regarding consequences of household financial strain on child health.

Since 2003, **Dr. Greg Miller** and **Dr. Edith Chen** have been associate professors at the Health Psychology Department of the University of British Columbia in Vancouver. Among many lines of research, one of their interests lies in better understanding the complex interplay among social and biological factors that contribute to physical health outcomes in children and adolescents living in disadvantaged environments. Their work explores the associations at different moments during childhood and adolescence, to see when children might be more sensitive to the stress of living with financial strain. Furthermore, they are examining how different bodily systems, namely the nervous, endocrine and immune systems of children react to this type of stress.

Dr. Sonia Lupien is Professor at the Department of Psychiatry at University of Montreal as well as Scientific Director of the Fernand-Seguin Research Centre and Director of the Centre for Studies on Human Stress. Dr. Lupien's research centers on the effects of chronic stress throughout the lifespan. In 2001, she and colleagues showed that children from disadvantaged neighborhoods had higher stress hormone levels than those who were more economically privileged. However, when transitioning from elementary to secondary school, an increase in stress hormone levels was detected in all youths regardless of their socioeconomic status. Consequently, Dr. Lupien and her research team started the DeStress for Success Program to investigate this phenomenon further.

Dr. Lupien, Dr. McGrath, Dr Miller and Dr. Chen are also members of the INRICH.

Dr. Jean Caron is an associate professor in the Department of Psychiatry at McGill University. His research focuses on social support and mental health in disadvantaged populations. Among other studies, he reported that food insecurity is linked to higher psychological distress in groups of

Upper row (left to right): Marie-France Marin, Robert-Paul Juster, Pierrich Plusquellec and Nathe François. Bottom row: Tania Schramek, Nathalie Wan, Sonia Lupien, Shireen Sindi and Lyane Trépanier.

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individuals living with lower income. Interestingly, the quality of social relations - which includes factors such as emotional support or the presence of a stressful person - played a much larger role on psychological distress than previously thought.

Dr. Amélie Quesnel-Vallée is an assistant professor at the Department of Epidemiology, Biostatistics and Occupational Health at McGill University. She is putting together a research program to study how health insurance and socio-economic situations during the life course can affect perceptions of health, physical health, and mental well-being in adults from Canada, the United States, Germany, and the United Kingdom. Her work will contribute to a better understanding of how certain social policies (e.g., health insurance policies) can help improve the health of individuals living with financial difficulties.

Dr. Jennifer J. McGrath is an associate professor at the Department of Psychology at Concordia University. Part of her work focuses on how socioeconomic situations relate to cardiovascular health behaviors in youth. These include physical activity, sleep behaviors, and many more health behaviors that will be discussed in the next article.

Anyone who has faced the stress of financial strain may wonder: if health is affected by prolonged and severe episodes of stress related to financial strain, can we regain health once the situation is resolved? Well good news! A study on financial strain and health showed that 49-59 year old men and women who reported reductions in financial strain after 3 years also had decreased blood pressure. This amazing finding suggests that the body may adapt to better living conditions to reduce the impact of stress on the body. Unfortunately, this is not always easily possible. Meanwhile, until financial strains are reduced for those with less wealth, it is important to keep in mind that protective factors exist. For instance, social support from friends and family, accessible services and programs within the community and the neighborhood can all help reduce the impact of financial strain on health and well-being.

We can be proud of the fact that Quebec and Canada are leaders in the world when it comes to social policies that can help individuals and families deal with financial strain. From universal health care to paid parental leave to care for a child, these measures are helpful so long as they are implemented to answer the needs of those requering greater assistance.

Profile
Dr. Jennifer J. McGrath, Ph.D., M.P.H.

By Robert-Paul Juster

Why worry about salting your food, binging on junk, or smoking socially when you are young? Heart problems only concern people when they are older…right?! Wrong! Research by Dr. Jennifer McGrath and her colleagues suggests that childhood and adolescence is the beginning of a dangerous path that can lead to cardiovascular disease (CVD). This refers to a vast array of diseases related to the heart and blood vessels that are the main cause of death in Canada. It is when we are young that we get put on the track away from or towards a healthy heart. For example, cholesterol buildup, high blood pressure, and obesity begin early and are alarmingly on the rise in North American youngsters.

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Dr. McGrath and her team at Concordia University's Pediatric Public Health Psychology laboratory examine how early signs or precursors of CVD in youngsters interact. They do this by teasing apart behavioral (diet, exercise, sleep, smoking, screen time), environmental (neighborhood, access to parks, crowding, toxin exposure), and psychological (stress, coping, social support) precursors of CVD in youngsters and their parents. The goal of this comprehensive approach is to identify those at greatest risk of developing CVD in adulthood so that interventions can be tailored to target precursors of CVD early.

So what does socio-economic status have to do with this? Many CVD risk factors are more prevalent for individuals living in lower socio-economic status. While the adversity inherent within disadvantaged environments can contribute to CVD, it is not always easy to pin-point exactly how health is affected by wealth. When looking at socio-economic status in youngsters, the parents' or guardians' annual income, education or occupation is traditionally used. This information is then used to break up individuals on different socio-economic elements to see how they relate to CVD and health more broadly.

> ***Generally speaking, children who have parents with low socio-economic status have higher heart rates and blood pressure***

Generally speaking, children who have parents with low socio-economic status have higher heart rates and blood pressure **(Box 2).** Oddly enough, this trend is not easily detectable during adolescence, but then resurfaces in full force during early adulthood, where those having grown up in lower socio-economic environments begin experiencing CVD. This suggests that there must be more going on than just socio-economic effects during adolescence. Indeed, living in lower socio-economic environments is associated with risky health behaviors like smoking, fatty diets, and the like, that are solidified into lifestyle choices throughout adulthood.

While measuring an individual's socio-economic status in such a manner is extremely useful, some researchers felt it lacked contextual information. Instead of looking at an individual's socio-economic status alone based on those of parents, why not broaden things by examining features of their neighborhood? Neighborhoods are more representative of a person's immediate environment after all. As an alternative to measuring socio-economic status the traditional way, researchers can use information from census tracts. These are tiny statistical sub-divisions of geographic regions that can be calculated as simply as taking someone's postal code. This information is like taking a magnifying glass over different municipalities in order to more clearly see the social and economic contexts of a small set of individuals living in similar circumstances. This is exactly what Dr. McGrath and her colleagues did in a study of cardiovascular health in adolescents from Pittsburgh.

Drs. McGrath, Matthews, and Brady wanted to know if lower socio-economic status would relate to higher blood pressure in about 200 adolescents ages 14 to 16 from two schools in Pittsburgh. In order to best represent the adolescents' socio-economic status background and context, data on parents' income, education, and race/ethnicity was collected and contrasted to data collected from their respective neighborhoods. By using both sets of complementary information – individual and neighborhood socio-economic status – Dr. McGrath and colleagues were able to compare teenagers to other teenagers from within their neighborhoods, and were also able to compare them to teenagers from other neighborhoods.

Here are the three main findings regarding cardiovascular activities that were obtained:

1. Systolic blood pressure: even after taking parents' income into account, the percentage of people living below poverty predicted higher systolic blood pressure in the adolescents more than other parental socio-economic factors.

2. Diastolic blood pressure: regardless of demographic makeup of the neighborhood, those who were of African American decent had significantly higher diastolic blood pressure. This is a consistent ethnic finding across many studies.

3. Heart rate: parents' income mattered more than the percent of individuals living in poverty within the neighborhood, such that adolescents with higher household income had lower heart rates. Likewise, parental education mattered more than the percent of individuals with high school diplomas living in a given neighborhood, showing that the higher parents' education was, the lower the adolescents' heart rate. Finally, living in neighborhoods where African Americans predominated meant adolescents had higher heart rate, regardless of their own race/ethnicity.

That these precursors and outcomes were detectable at such a young age is quite striking and suggests that where someone fits socio-economically within their neighborhood can tell us a different story than only taking into account the socio-economics of their parents. By carefully selecting individual and neighborhood factors, researchers are in a better position to understand how they can influence health. In this process, we are better able to answer questions like what is different in disadvantaged neighborhoods where most people have little education and are racially/ethnically composed of African-Americans? How might stress, environmental toxins, noise pollution, and a host of other factors be perhaps different in some neighborhoods versus others?

The interaction between neighborhood strains and individual deprivation can contribute to poorer physical functioning through factors such as social integration, sense of control, financial strain, chronic stress, and health behaviors. Other precursors of CVD that are often considered are neighborhood crime, social stressors such as discrimination, availability of grocery stores selling nutritious foods, presence of nearby health clinics as well as exposure to toxins. Dr. McGrath and her team are continuing to tease apart how these interacting precursors all fit together. How do smoking habits, stressful life events, sleep patterns, physical exercise, dietary choices, and a myriad of precursors relate to CVD risk? You can be sure that Dr. McGrath's ongoing research projects will help answer these questions.

Here are three exciting projects currently underway:

Healthy Heart Project – This comprehensive study examines links between shorter sleep duration and weight status. Special emphasis is placed on considering whether activation of the stress pathway may link the two. The Pediatric Public Health Psychology laboratory is actively recruiting new participants ages 10-15 years. For more information, please call 514 848-2424, extension 5287.

AdoQuest – This school-based study examines how secondhand smoke exposure may predispose youths to earlier smoking initiation through both a pharmacological pathway and a social modeling pathway.

Quality Cohort – In conjunction with a larger group of Team Prodigy researchers, a group of children at-risk for developing obesity are being tracked to examine the onset of risk factors.

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For more information – or to participate in Dr. McGrath's research projects, we encourage you to check out the Pediatric Public Health Psychology laboratory's website: http://pphp.concordia.ca/

Heart rate

Heart rate refers the number of beats your heart makes over time, so usually beats per minute.

Diastolic blood pressure refers to the minimum force of blood against blood vessels when the heart is not contracted.

Systolic blood pressure refers to the maximum force of blood circulating against blood vessels when the heart is contracting.

When someone has blood pressure of 120 over 80 – considered normal levels – "120" is their systolic blood pressure and "80" is their diastolic blood pressure.

Dr. Jennifer J. McGrath completed a Doctorate in Clinical Psychology at *Bowling Green State University* and a Master's of Public Health in Epidemiology from the *University of Pittsburgh.* While in Pittsburgh, she joined the *Cardiovascular Behavioral Medicine Training Centre* under the direction of Dr. Karen Matthews, a leader in the field of cardiovascular health in youngsters.

Dr. McGrath became particularly interested in thinking about cardiovascular health disparities in youth after doing "wrap around services" in Pennsylvania. These were state-funded visits into children's and families homes to offer behavioral specialist and psychological services. As she drove into different neighborhoods, she was struck by the remarkable differences in housing quality, neighborhood vandalism, access to foods, and access to public transportation. This largely inspired the paper above and continues to be the impetus for her interests in social inequalities in health work.

Dr. McGrath is currently an associate professor in the Department of Psychology at Concordia University and Director of the Pediatric Public Health Psychology laboratory.

A Vicious Circle: Socio-Economic Status, Stress, and Allergic Disease

By Jason Behrmann

Nations of the developed world are currently witnessing a pandemic of unprecedented proportions – and it has nothing to do with H1-N1! Rather, this illness is induced by the air we breathe, the clothes we wear, the food we eat, and the pets we love. It is allergy: a chronic ailment of the immune system whose incidence continues to rise throughout societies of the Western world. We are now at a 'tipping point' where allergic sensitivities have become a population norm rather than an exceptional disease inflicting but a few.

The surge of allergic disease now affects up to 30% of the population. This does not imply the mere increase in annoying symptoms like itchy eyes and stuffy noses with the arrival of Spring. Rather, allergic reactions produce a multitude of additional disease symptoms (also known as morbidities) ranging from skin rash, digestive disturbances, and respiratory illnesses such as asthma. In extreme cases, sudden death can occur by a condition known as anaphylaxis that is typically observed in individuals with sensitivities towards bee stings and foods such as peanuts.

> ***We are now at a 'tipping point' where allergic sensitivities have become a population norm rather than an exceptional disease inflicting but a few.***

What all these morbidities share is that the immune system mistakenly perceives common substances in the environment as something pathological. Whether it is in the form of sea food within the gut or pollen that enters the lungs, these allergens cause the release of histamine that induces swelling and inflammation at the site where the allergen makes contact with mediators of immune reactions. These mediators also communicate with stress hormones that can increase or decrease their activities. While much research has deciphered many aspects of allergic reactions, how they are induced and what controls their severity remains to be defined in detail. As we shall see, allergies are rooted in biological, social, and physical factors in complex ways.

Mr. Jason Behrmann
(jason.behrmann@umontreal.ca) is a doctoral candidate in Bioethics at Université de Montréal whose primary research interests include ethics in health policy and public health issues related to the treatment of allergy.

Determinants of allergy: Genetics and our environment

Unfortunately, the exact root determinants of allergy are unclear and the subject of continued research and practice. This being said, certain biological and environmental factors are well known to be associated with the ailment. Genetics are a notable factor since allergies cluster in family lineages. Specific mutations of genes involved in the functioning of the immune system have also been identified in relation to allergy-induced asthma and skin rash. Even so, genetics are but a small piece of the puzzle. There is good reason to believe that environmental factors play a more significant role. The basis of this argument rests on the observations that allergic disease has only *recently* emerged as a significant challenge to the population's health and predominates in economically developed nations. What aspects of our modern Western lifestyle might aggravate allergic sensitivities?

> ***Allergic disease has only*** recently ***emerged as a significant challenge to the population's health and predominates in economically developed nations.***

Some experts suggest that our current obsession with cleanliness and hygiene is depriving our immune system of exposure to bacteria and infections that are necessary for normal immune development. Others question whether our living environments might be a key culprit. Since most of us now spend much of our time in sealed structures like houses, cars, and work places, we might be artificially distancing ourselves from the outdoors and consequently are 'fooling' our immune system into thinking that substances like pollen are 'foreign invaders'. At the same time, these sealed structures permit our immune systems to be exposed to 'unnatural' levels of substances such as dust and pet hair, which in turn may make our bodies more hypersensitive to these allergens.

In addition to the physical environment, emerging research suggests that aspects of our social environment may play an equally significant role in allergy, especially in relation to socioeconomic status and stress. Recall that socioeconomic status (SES) refers to measures such as wealth, degree of social prominence, and level of education.

> ***Where one lives clearly effects health, but also exposure to different stressors.***

Now, what is the link between SES and allergy? Different categories of allergic disease predominate in certain socioeconomic classes. For instance, hay fever is more often a disease of the rich and allergy-induced asthma disproportionately inflicts the poor. In addition to categories of allergy, allergen sensitivities also correlate with SES, where wealthy individuals more often display sensitivities towards pollen. This might be due to the fact that wealthier members of society more often reside in suburban areas, areas that have more green spaces and thus more pollen sources. Conversely, impoverished members of society are more commonly allergic to cockroaches, vermin, dust and mould, all being allergens that are more prevalent in low-quality housing. Where one lives clearly effects health, but also exposure to different stressors.

We have all personally experienced or witnessed someone who got sick with a common cold or other illness when stressed out. But what exactly is the link between stress and allergy? Stress hormones are very powerful molecules that can shut-down or over-activate our bodies' systems. Indeed, chronic stress is known to have detrimental effects on numerous systems, including the functioning of the immune system. Interestingly, emerging evidence suggests that stress-induced immune problems include allergic hypersensitivities, where children raised in stressful family situations may be at greater risk of developing allergy. It appears that chronic stress worsens existing allergy morbidities in adults. This is particularly so in the case of allergy-induced asthma, where this debilitating respiratory illness is exacerbated by the irregular breathing and tightening of the chest that can be caused by distress.

A vicious circle: Why socioeconomic status and stress have an impact on allergies?

The interactions between heightened distress, lower SES and allergies have multiple implications in our understanding of allergic disease. For one, the determinants of allergy (genetics, physical and social environments) are currently viewed as distinct elements that contribute to morbidity. We now know that this is a misconception, as these determinants are in fact *interconnected*. Stress and SES are

prime examples: poverty, social exclusion, reduced opportunities in one's life stemming from a lack of education, are but a few sources of socioeconomic deprivation that contribute to chronic stress.

> ***By identifying precisely how low SES and chronic stress contribute to allergy, we will be better positioned to treat and perhaps even prevent allergic disease.***

In this way, socioeconomic deprivation compounds upon existing chronic stresses and daily hassles that can ultimately intensify allergic morbidities. When severe, these morbidities inhibit one's ability to fulfill employment duties, engage in social interactions, and pursue higher education. When we view these factors together over time, SES, stress and allergy can produce a vicious circle that can compound socioeconomic deprivation.

This 'vicious circle' should not be viewed as exclusively negative or as a hopeless situation. Rather, it highlights specific opportunities in improving treatment strategies for allergy. Current treatment strategies typically employ medications to reduce symptoms and preventative strategies that aim to reduce allergens in one's environment. Both methods have their limitations in effectively managing allergy morbidity, which implies that improvements in treatment strategies are needed.

By identifying precisely how low SES and chronic stress contribute to allergy, we will be better positioned to treat and perhaps even prevent allergic disease. Future treatment strategies for allergic disease could include methods to reduce stress and social policies for poverty alleviation, such as education and employment programs. This possibility does not imply that social policy and stress alleviation interventions will eliminate the need for medication in the near future. Instead, it signifies that research is uncovering additional tools to fight the growing pandemic of allergic disease and improve current treatment strategies. Indeed, the multiple determinants of allergy make this ailment complex and treatments must take into account multiple factors. Fortunately, our increasing understanding of the interconnections between SES, stress and disease shows promise. One day soon, we hope to refine ways to counter the health burden of allergy and break the vicious circle that burdens the health and wellbeing of our population.

Dominating to Better Stress

By Dr. Pierrich Plusquellec, Ph.D.
Translation: Robert-Paul Juster

My dog's trainer says that one in four dogs is born "naturally" dominant. He probably bases this statement on numerous scientific studies carried out with our four-legged companions. For mankind, no one knows or has the faintest idea how many dominant individuals walk about within the population. Yet, man is a social animal. We live in increasingly large societies, we create networks and we engage in virtual worlds where leaders emerge. *Facebook©*, the famous cyber-community has even elected a president. These social constructions based on dominance are called *hierarchies* and we are all active players, whether it is at work, at home or even at the gym…this dominance takes on many shapes. In fact, the director of a large enterprise can be the least in control of the living room television remote and in other cases, even a dog can be our superior, hierarchically speaking.

The first scientific observation of "dominance" was made in 1922 by the Norwegian zoologist Thorleif Schjelderup-Ebbe who was studying the formation of groups in chickens. His logic was very simple: if A pecks B and B rarely, if ever, retaliates, then A is dominant over B and B is submissive to A. This observation was the starting point of a field of research dedicated to the study of dominance. In the 1970s, researchers became interested in kindergartens and observed different behaviors in groups of children. Their conclusions? Even in early age, there already exists a hierarchical organization between individuals. In fact, very young children deploy numerous strategies – from aggression to cooperation – to attain the most prestigious social positions, the ones that permit, for example, access to the most coveted game positions. Today, dominance is considered by scientists as an individual's capacity to control resources by any means necessary.

This capacity is in fact the consequence of evolution aimed at facilitating social life. In fact, when resources are scarce, dominance shows its true colors as it functions to drive each and everyone's rights to resources and thus diminishes aggression in competitive situations. If you are not persuaded, just think of a pack of wolves, where the hierarchy is well established, and compare it to a bunch of dogs playing in a park. If you dropped a piece of food in front of these two groups, you would see a marked difference; in the first case, no combat would occur, while in the second, the dogs would fight to have access to the resource.

In animals, there exist different types of hierarchy and each has an impact on the partitioning of resources among members of the group. On

the one hand, *despotic hierarchies* offer absolute control and access to resources by individuals that have attained a dominant position by means of aggression and intimidation. On the other hand, *egalitarian hierarchies* have a more uniform distribution of resources, and dominance is maintained by support from subordinates. While dominance is an adaptive phenomenon when living in groups, it creates stress because of the inherent partitioning of resources. For example, subordinates within despotic hierarchies experience chronic stress because they lack resources. Is it therefore fair to state that subordinates are always more stressed?

> ***The conclusion is not that simple. In reality, the relationship between stress and dominance varies as a function of the hierarchy's stability.***

Well now, no! The conclusion is not that simple. In reality, the relationship between stress and dominance varies as a function of the hierarchy's stability. For example, if the hierarchy is unstable, the level of social control by dominants is weak, and so, the predictability of events is diminished, leading to chronic stress for the dominant. However, as soon as the hierarchy is stable, the subordinates are the ones who seem to live in greater distress.

We now know that chronic stress has an impact on health. Thorleif Schjelderup-Ebbe noticed that birds at the bottom of the pecking order were less healthy than others. A century later, an American primatologist by the name of Robert Sapolsky published a review in the prestigious journal Science entitled *'The Influence of Social Hierarchy on Primate Health'*. He described numerous examples linking health to chronic stress induced by hierarchies, including a description of Schjelderup-Ebbe's seminal observation. Sapolsky demonstrated that dominant chimpanzees subjected to a group whereby the hierarchy was unstable had lower levels of white blood cells, the sentinels of our immune response. He also

The social rank of men can be measured by socio-economic status, which originates from inequalities in access to resources.

explains that dominant macaque monkeys living in unstable hierarchies develop cardiovascular problems. Even in rodents, subordinates show signs of brain damage! So, chronic stress caused by hierarchies seems to have an impact on different systems, that in turn contribute to the emergence of different problems: cardiovascular (e.g., hypertension), lipid metabolism (e.g., elevated cholesterol), reproductive (e.g., diminished levels of sex hormones like testosterone), immune (e.g., diminished levels of white blood cells) and even neurological (diminished birth of new brain cells or *neurons* in a process known as ***neurogenesis***).

So what about us? Men are not hierarchical in as linear or unidimensional a manner as other species of animals. This being said, for Robert Sapolsky, the social rank of men can be measured by socio-economic status, which originates from inequalities in access to resources. Are there factors that can contribute to the ascension to the top of the ladder? It seems that individuals with personalities that facilitate leadership are also those who attain higher positions in the socio-economic strata. For example, the personality trait of hostility is associated with an increased risk of cardiovascular problems.

Briefly, what we can retain is that dominance is present throughout different species of animals including man and it interacts equally with other essential components such as personality, reactivity, exploration, sociability, aggression and activity.

Scientists have also shown that people with lower socio-economic status are at greater risk of developing depression. It is important to keep in mind that such individuals often have a diminished sense of control over their work and in comparison to those occupying higher positions in the hierarchy, they do not have the chance to foresee nor foreplan their efforts. Indeed, a study of over 5000 Canadians demonstrated that respondents with higher salaries as well as those with higher education declared having a greater sense of control over life events and also had better mental and physical health than others. So, if we come back to our NUTS model… it would seem that sense of control plays an important role when talking about stress and dominance.

The association between social dominance, the chronic stress that it induces, and health remains an open question. Although it is easy to make the parallel between dominance and socio-economic status in humans, it is surely not solely limited to this alone. Briefly, what we can retain is that dominance is present throughout different species of animals including man and it interacts equally with other essential components such as personality, reactivity, exploration, sociability, aggression and activity. My dog trainer will surely smile when I recount to him that we at least share this trait with our four-legged friends.

Conclusion

Our aim in this issue was to introduce you to socio-economic status research, but we confess that these four articles only touch the tip of the iceberg! The myriad of interactions among socio-economic status as measured by education, finances, occupation, and access to goods and services is of importance to all of us regardless of our place in society. We all have an ethical responsibility to distribute resources as equally as possible and to not take them away from others. If living in a disadvantaged neighborhood carries with it a whole hodgepodge of hidden risk factors for cardiovascular disease or allergies and asthma, then we must stand up and address these problems with social policies and good will. In the process, this might force us to look within ourselves and question the moral fabric of our value system. Is cheating someone on a business deal or stealing from an elder really how we would like to be treated? Probably not! "Wealth" is not necessarily measured by how much money you have in your wallet, but by the richness of your worth as a human. While human beings are individualistic at times, it is important to remember that we live within societies, and so our choices and behaviors will impact those surrounding us. After all, money is often fleeting and so we must cultivate more enriching attributes for ourselves that are also for the benefit of others.

Bear in mind that socio-economic status is not set-in-stone as other factors will influence your health and your opportunities. While this construct is informative, it is not static but rather dynamic. In fact, it can be changed or at the very least, moderated by different protective factors. How can these be cultivated in order to live a richer life regardless of socio-economic status? Resilient individuals often answer that their way of facing adversity and hard times has been by building strong social support networks, or engaging in constructive hobbies, or by reading and educating their minds even if finances did not permit for higher education, or even through activities such as community work that help foster connectedness with others. Not only are these examples of ways of managing stress effectively, but these protective factors can enable us to live healthier. Best of all, they do not cost much!

Next issue

Is there a stress gene?

Said differently, is there a signature in our genetic baggage that renders us more or less reactive to stressful situations? If this is the case, can the environment where we grow up modulate or change this relation between our genes and stress? Here are but a sample of questions we can all intuit and ponder as individuals. But we are no alone… in fact, certain scientific researchers devote their careers towards understanding the relation between stress and genetics as well as the role environment plays in this complex interaction. In our next issue, we will explore this subject in depth in the aims of informing you about this domain and also to make it comprehensible and accessible to all.

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