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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.

Sports: Our ally against stress?

Editorial

Marie-France Marin, Ph.D.
Sonia Lupien, Ph.D.

Dear readers,

While writing these words, back-to-school is in full swing. We have both just emerged from a wave of media interviews related to COVID and talked to anyone wanting to hear about the importance of recognizing stress in these historic times. Though more importantly, managing the stress response as it happens. The first question we asked ourselves was: should we do a Mammoth Magazine on the stress of COVID? The immediate answer: obviously! However, after taking a step back, we arrived at the conclusion that we have already produced a lot of material to help individuals understand and manage stress in the context of a pandemic. There is no need to reproduce this content and to repeat ourselves. Therefore, we have assembled the texts and video capsules that have been created by the team at the Center for Studies on Human Stress. We invite you to visit the following link (only available in French) and to bookmark it in your favourites – who knows, it might be useful in the upcoming weeks and months! https://www.stresshumain.ca/ressources-stress-covid-19/

Though the information with the previous link is only available in French, we invite you to visit the following link to read the COVID blogs written by Sonia Lupien, available in English. https://humanstress.ca/our-impact/

For those of you who are followers of the Mammoth Magazine, you know that life has its share of stressful events and that the best way to navigate through them is to take steps to prevent the stress response from overwhelming us. And for many, sports are a great way to counter the effects of a stress response. We initially wanted to publish this issue in early spring, because that is often when we feel like getting back into working out or taking advantage of the outdoors to move more. As the mammoth of the COVID-19 pandemic is very present in our daily lives, we thought it would be a good idea to wait a little before publishing this issue on stress and sports. After a few months of confinement and working from home negotiating several mammoths, we are convinced, more than ever, that sports can act as an ally to control our stress response.

The benefits of sports are already well established. We all know that physical activity is beneficial for our physical and mental health. However, if you were to interview an athlete before a sporting event, they will no doubt tell you that they are stressed. This stress is most likely also felt by individuals who were sedentary for a very long period of time and who are starting a new physical activity or workout program. In short, the obvious link between sports and stress merits further exploration to allow for a better understanding of both sides of the coin that sports can provide!

For the 21st issue of the Mammoth Magazine, Laurence Dumont, a post-doctoral fellow at the Center for Studies on Human Stress, spoke with Dr. Paquito Bernard. Dr. Bernard is a researcher specializing in the effects of physical activity on mental health. Audrey-Ann Journault, a doctoral student in psychology at the University of Montreal, was interested in the link between stress and athletic performance. She begins with a short excerpt explaining the link between stress and performance. She then dives deeper into the subject and seeks out the perspective of an Olympic athlete, judoka Antoine Valois-Fortier. Dr. Sonia Lupien, director of the Center for Studies on Human Stress, wrote the subsequent article that explores the question of how stress and adversity can give rise to champions. Charlotte Longpré, a Master's student in psychology at the University of Montreal, then presents us with a very interesting article on the link between sports, stress and green spaces. Alexandra Brouillard, a doctoral student in psychology at the University of Quebec in Montreal, and Clémence Peyrot, doctoral student in biomedical sciences at the University of Montreal, explain the effects of sports on our brain. Finally, Dr. Sonia Lupien concludes the current issue with an article on sports addiction. And yes, even if sports are good for our health, it is just like anything else…if we take it to the extreme, it can lead to its own share of problems!

We hope that this 21st issue of the Mammoth Magazine will be informative and we take this opportunity to encourage you to find innovative ways of staying active, despite the various public health guidelines!

Happy reading!

Sports, always good for everyone? Hmm, not so fast…

Laurence Dumont, Ph.D., *Post-doctoral fellow at the Centre for Studies on Human Stress*

Throughout this edition of the Mammoth Magazine, we will remind you that sports and physical activity are good for you. But are they good for everyone, all the time? As we know, scientific studies are often conducted with "average" healthy individuals. But then, do the research findings found in the average person also apply to people with physical or mental illnesses? To answer these tricky questions and to find out what progress can be expected in the future, I spoke with Paquito Bernard, professor in the Department of Exercise Science at the University of Quebec in Montreal and researcher at the Research Center of the Mental Health University Institute of Montreal.

Professor Bernard began his academic career in the field of physical activity and kinesiology in France and worked for a few years in the field as a kinesiologist with individuals living with mental health disorders. His curiosity and drive to base his interventions on evidence-based findings led him to return to deepen his knowledge by specifically studying the impact of physical activity on the symptoms of various mental health disorders.

Professor Bernard's doctoral work focused on the effects of a physical activity intervention in patients living with major depression, in order to reduce their smoking behaviours and depressive symptoms. It is well known that when we want to get rid of a bad habit (such as cigarette smoking), it's easier to replace it with something positive (such as physical activity) than simply trying to avoid the bad habit altogether. But it has yet to be proven, in this particular case, that we can really encourage depressed individuals to replace cigarettes with physical activity. It's quite the challenge when you think about it!

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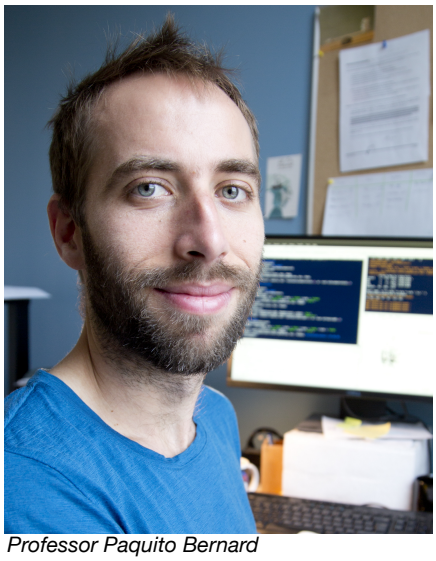

Professor Paquito Bernard

Professor Bernard's study showed that it worked for several participants and even had a positive impact on their depressive

symptoms. It, therefore, appears to be a win-win situation – mental and physical health have the potential to be transformed by the long-term effects of this intervention.

By the time he began his graduate studies, scientific findings had already begun to demonstrate the importance and value of sports in promoting good mental health. However, the psychological processes to encourage this type of behaviour in individuals with mental health disorders were not well defined. To contribute to the advancement of science, Professor Bernard needed to combine what is known about the psychology of motivation with the best methods to support positive behavioural change in different individuals. By adapting the clinical interventions used by kinesiologists to what is known about different mental health disorders, it is possible to empower individuals to concretely improve their mental health and to reduce stress in their daily lives.

Sports and mental health during cancer treatment

After Professor Bernard completed his doctorate, he crossed the Atlantic Ocean to do a post-doctoral fellowship in Quebec City in psycho-oncology with Josée Savard's team. During this fellowship, he explored the health behaviours of individuals being treated for cancer and cancer survivors. When you are diagnosed with cancer, your whole world is turned upside down. Our schedule is filled with appointments and we often experience side effects from the treatments. Going to the gym or playing badminton with friends can quickly be nudged out of our routine in order to focus on our health.

However, individuals who remain physically active during their treatments, within their physical limits and the recommendations of their medical team, experience benefits! Professor Bernard collaborated on work that grouped together several other existing studies on the subject in order to draw stronger conclusions. In science, this is called a meta-analysis. By combining participants from several studies, it was possible to evaluate the impact of different exercise programs on physical and psychological symptoms of breast

cancer patients. In comparison to patients who do not do physical activity, patients who remain active experience a decrease in fatigue and depressive symptoms, and occasionally an increase in quality of life.

With that being said, physical activity is not the only intervention option to improve psychological symptoms in breast cancer patients; cognitive-behavioural therapy (often called CBT) is also endorsed by many studies. After comparing the effectiveness of physical exercise and CBT, no significant difference was found in the effectiveness of these two therapies in improving sleep and mental health. In addition, their research findings suggested that there was no benefit to combining the two interventions.

Towards an exercise science adapted to your needs (yes, your own needs)

At the core of one of the main observations that Professor Bernard made through his work, was the possibility of making a choice in favour of what is best for us. Although we often see differences between groups who do or do not exercise in scientific studies, individual differences are very important. For him, it is important to understand the processes and steps that lead an individual to adopt behaviours that promote good physical and mental health. In other words, he wants to understand the conditions that lead certain individuals to benefit more from

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Far from being discouraged by this result, Professor Bernard was rather delighted: getting better during this critical period does not require individuals to do anything and everything! When both options are offered by their healthcare institution, each individual can decide which options seem to best meet their needs. Or, if only one of the options is available to the patient, they will not necessarily be deprived of any benefits.

exercise than others, or how certain people adopt better lifestyle habits more easily than others. The challenge created by focusing on the individual is that he treats each person as a small study within themselves. With this method, he is more suited to make recommendations that are adapted to each individual's unique obstacles and starting points. In fact, everything that is

related to physical activity influences his practice - whether it be something that happened earlier in the day, how we slept the night before or what we ate for breakfast. These factors can tip the balance in favour of motivating us to lace up our sneakers or even in favour of experiencing better physical and psychological benefits after doing physical activity.

With this in mind, Professor Bernard's team is currently conducting the «Tranche de Vie» project which follows the sleep, physical activity, motivation and symptoms of various mental health disorders of research participants on a daily basis for one month. Some participants have a mental health disorder and others do not. By understanding how depressive and anxious symptoms evolve over time, it is possible to see how they influence motivation to be physically active and to identify how this motivation encourages (or hinders) people to get moving. The goal is to be able to predict the ideal time to intervene in order to support healthy lifestyles in each individual.

Do sports have an anti-stress effect? Not for everyone!

It is often said that physical activity can reduce stress, but in fact, this association is not the same for everyone, nor does it happen at the same time. For some individuals, being physically active reduces perceived stress in their daily lives. For these individuals, scientists believe that there are at least two mechanisms of action at play. The first mechanism is the release of endorphins, molecules that have a positive and soothing effect on the mental state. Second, as the bodily changes induced by physical exercise are very similar to those induced by a stressful event (heart beating rapidly, accelerated breathing, increased body temperature, etc.), it is possible to attribute the cause of our body's reaction to doing physical activity rather than to our stress or anxiety. By doing this, we become less aware that our body is reacting to stress.

By understanding how depressive and anxious symptoms evolve over time, it is possible to see how they influence motivation to be physically active and to identify how this motivation encourages (or hinders) people to get moving. The goal is to be able to predict the ideal time to intervene in order to support healthy lifestyles in each individual.

However, this is not the case for everyone! For example, for people who are largely sedentary or have a high body mass index, starting an exercise program can increase their stress levels. Other people don't see any connection between their day-to-day stress and whether or not they do physical activity.

For example, the arguments to motivate someone to lace up their sneakers for a jog might not necessarily be the same for someone who runs three times a week, compared to someone who has never run outside of the context of their mandatory gym classes! "When you run, you'll feel as free as the air, you're really going to feel like you're accomplishing something" may seem bizarre and unmotivating for someone who struggles to get to the street corner without stopping to catch their breath. These different ways of reacting to the same physical activity interventions supports the individualized and needs-based approach that Professor Bernard advocates for in his projects.

Health, stress and the future of the planet

According to Professor Bernard, the major challenges of the future will be to ensure that the intervention and findings that we propose are accessible to all and have a positive impact on the planet. In the context of great disparities between the resources available in different communities and climate change on the rise, it is imperative for him to consider his own work and discipline as part of a larger ecosystem.

In a recent editorial article that he wrote in the journal Health Psychology and Behavioral Medicine, he argues for the need to adapt our view of human health and to rethink the way we design and deliver health care in response to climate change. For example, pollution and extreme weather events are environmental stressors that will directly affect the physical and mental health of populations. In terms of resources or technology, some interventions are costly and will not necessarily be sustainable or applicable in all communities. As a researcher, Professor Bernard believes that it will be increasingly necessary to act with an approach that goes beyond our research projects and that extends to society itself.

The social and climate changes in the decades to come will profoundly change

the way health care is provided; the last few months are a prime example of this and support the relevance of an approach such as Professor Bernard's.

In conclusion, by applying exercise science to the reality of each and every one of us, Professor Bernard's objectives for the coming years is to improve clinical practice and to ensure that it has a positive impact on individuals and the society around them.

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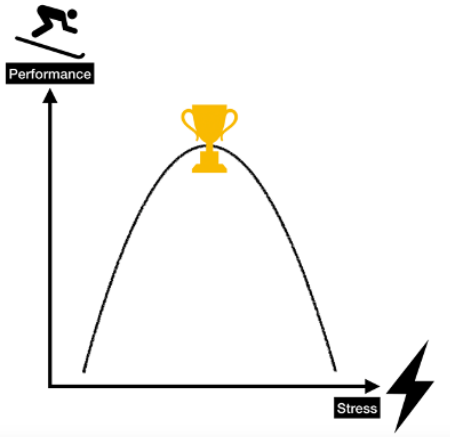
Does stress negatively affect performance?

Audrey-Ann Journault, *Doctoral student in psychology, Centre for Studies on Human Stress, University of Montreal*

In the world of sports, the relationship between stress and performance is of great interest. Professional athletes quickly learn in their careers that it is possible to use their stress to maximize their performance in their competitions. In fact, studies show the relationship between stress and performance resembles that of an inverted U-shape. Thus, an optimal stress level (well-managed) can improve athletic performance. However, it is important to note that the optimal level of stress to perform varies from one person to another. Through experimentation, an athlete discovers the level of stress that favours their performance.

Nevertheless, stress can also interfere with performance in the following two situations: if the athlete has too much or not enough. In fact, stress levels that are too low can lead to sub-optimal performance as it deprives the athletes from all the benefits of stress: increased alertness and concentration, production of the amount of energy necessary to face the challenge. At the other extreme, being too stressed in the face of a competition can also lead to poor



results. The athlete may perceive the upcoming competition as a threat and their body will produce too many stress hormones. These hormones travel up to the brain and affect certain important areas that allow the athlete to perform, including the prefrontal cortex which is implicated in working memory and emotion regulation.

Regardless of the sport, it pays to remember that a well-managed stress level becomes as essential asset for better performance and that trying to eliminate all stress is far from being the winning solution!

Stress: What is hiding on the other side of the coin?

Audrey-Ann Journault, *Doctoral student in psychology, Centre for Studies on Human Stress, University of Montreal*

It is common to hear about the negative effects of stress. However, it is less common to hear that stress also allows you to achieve extraordinary things. These positive aspects of stress are well known in sports by elite athletes. What better way to address the subject than by talking with Canadian judoka, Antoine Valois-Fortier, who has used stress to propel himself to the top of his sport and become an Olympic runner-up.

Antoine's parents enrolled him in judo at the age of four to use up all his extra energy. Already at a young age, Antoine possessed a certain talent. The complexity of the discipline and the calm atmosphere immediately captivated his interest. Quickly, this interest turned into a passion. Since the age of 21, Antoine has classed amongst the best judokas in the world; he placed on the podium at the Pan American Championships eight times, at the World Championship three times and he participated in the 2016 Olympic Games in Rio. One of his proudest accomplishments is to have been able to continue his studies alongside his athletic career. He now holds a degree in kinesiology from the University of Quebec in Montreal. Antoine is without a doubt, no stranger to stress.

Antoine Valois-Fortier in competition

Stress, a high-performance engine

Throughout his career, Antoine quickly understood that stress has two facets: one that can hinder his performance, and the other that allows him to meet his objectives. As an athlete, it is sometimes easy to get caught up in a cycle of anticipation and performance anxiety with upcoming important events or unexpected events that could occur during performance. These thoughts are very distracting and increase the overall level of stress felt by the individual. This

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then becomes sub-optimal for athletic performance. According to the judoka, one of the important and daily responsibilities of athletes is to transform this feeling into excitement and anticipation towards performing in the event, as well as being in the moment during the event itself. He points out that once an athlete finds this optimal zone, the feeling is extremely special and provides unique sensations that allow the athlete to achieve great feats and to progress within their discipline. For Antoine Valois-Fortier, a good dose of stress during a match allows him to, among other things, "be focused like never before"! In fact, the most beneficial moments in his career were those where he was able to optimize his stress. Since then, he feels so connected to the present moment that he feels like everything going on around him is happening in slow motion. This is a sign that he is ready-to-go, that his stress is on his side and that this will enhance his abilities to win the match. It is a feeling that he remembers having in the middle of a match at the most recent world championships in Tokyo.

One of the teachings that has been essential to him in his judo career, and that he would like to pass on, is to never lie to yourself; important events will always have high stress surrounding them...though trying to eliminate it all together would be the worst mistake to make. Instead, it is better to accept it and turn it into excitement. To optimize this feeling of stress, he uses several strategies before each match. He concentrates on his breathing, imagines himself losing control, but stays calm and regains control in order to win. He also remains attentive to the tasks that need to be accomplished in the present moment. This last strategy allows him to avoid anticipating what is to come by controlling what is happening in the present moment; "the match will come soon enough and I'll deal with it when I get there".

Stressed, good times, bad times

In 2018, Antoine underwent lower back surgery. For professional athletes, recovering from an injury is hard and always comes with the stress of returning to their sport. Setting small, very short-term goals allowed him to feel productive. One particular question guided his actions and decisions during his recovery, while allowing him to ignore what kind of shape he would be in 6 months: Today, have I done everything I had to do to be closer to my goal than I was yesterday? The objective for 6 months' time was the 2019 world championships. There, Antoine won the bronze medal.

Antoine Valois-Fortier in competition

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We must say, Antoine knew how to surround himself well. He learnt these essential lessons through 10 years of experience in high-level competitions. These years were marked by several major events where he learnt how to use his stress to perform better. Furthermore, he also benefited from the experience of his entourage, his coaches and sports psychology.

If the positive effects of stress are well known in the world of sports, they are also transferable to any other domain. Therefore, there's no reason to wait to experience the second facet of stress, that seems to be too often forgotten. Stress can be a powerful tool in all situations. Let's use it.

Do we need to stress athletes to make them champions?

Sonia Lupien, Ph.D., *Director of the Centre for Studies on Human Stress*

Whenever I watch a "talent" television show (singing, etc.), I am always astonished at which point the producers of the show feel it is important to highlight the participants who had experienced major traumas in their lives. For example, we would see Frank who lived on the streets before he became a country singer or Eva who supported her sick mother and who would be able to take better care of her mom if she won the competition. It is as if we think that your chances of winning a competition are higher if you have experienced adversity.

This "talent needs trauma model" is often used to "create champions" in sports! Athletic coaches each have their own approaches to use stress and adversity to create "champions" and these approaches fit into one of the three following models:

1. "Zero adversity" model: This model suggests that there exists a linear path to athletic success and that the best way to create super champions is to… practice! Thus, the more an athlete practices their sport, the greater likelihood that they will become a champion in their sport. To help a young individual become an elite athlete (a champion) and thus to develop their talent, experts and coaches will try to minimize the number and impact of various forms of stress and adversity for the athlete. Therefore, we will provide the athlete with financial support, medical care and training that will allow them to develop into an elite athlete. It is believed that by minimizing stress and adversity faced by athletes as much as possible, it increases their chances of becoming a champion in their sport (as they are able to focus 100% on their sport).

However, this model encountered several problems when research showed that by minimizing the amount of adversity faced by the athlete as much as possible, we prevent them from developing a resistance to stress. When faced with adversity during their career, athletes who are overprotected by those around them will crumble and their performance will decrease significantly.

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2. The structured adversity model: This model suggests to expose athletes to "structured adversity" to "toughen them up". Coaches that use this model are often very harsh with the athlete, exposing them to both mentally and physically difficult training conditions. It is believed that by exposing the athlete to this type of structured adversity early on in their career, they will become more resistant to inherent stressors in their sport and to increase their chances of becoming a "super champion".

However, this model also ran into problems when researchers and coaches realized that while this exposure to structured adversity works for some athletes, it can lead to a notable decrease in performance for others! Thus, there are many individual differences in an athlete's response to structured adversity.

3. The life adversity model: More recently, researchers have observed that adversity experienced by athletes in their personal lives may be the key to success. This model suggests that it is not the coach's structural adversity that explains the champion's success, but rather the athlete's own life story and the adversity within it. By studying the memory of life events of elite athletes, researchers have observed that great champions reported experiencing adversity in childhood. They also report that the adversities they experienced allowed them to develop an ability to cope with adversity early on, and to see it as an opportunity to grow and improve. Based on these findings, researchers have suggested that talent requires some form of life adversity in order to develop optimally.

However, this model also has its weaknesses because if life adversity alone explains a champion's success, only young athletes from extremely misfortunate areas would be recruited to be made into champions. But every coach knows that it is not that simple!

A new model: the reaction to adversity

Faced with the weaknesses of the three models used to train champions, a team of researchers in Great Britain suggest that it is not necessarily adversity that allows the athlete to become a super champion, but rather the manner in which the athlete handles adversity (i.e. their attitude towards the adversity).

This brings us to the notion of interpretation, which is the way in which we deal with stress or adversity. If we view adversity as a source of immeasurable misery, it will have negative effects on our physical and mental health. If we see it as an opportunity to further grow and develop, adversity can help us flourish.

If we view adversity as a source of immeasurable misery, it will have negative effects on our physical and mental health. If we see it as an opportunity to further grow and develop, adversity can help us flourish.

To see if this model held its ground, researchers recruited three categories of athletes:

1. Super champions: These are the athletes we see on television and in the major football leagues, cycling, marathons, Olympic games, etc.

2. Champions: These athletes play in the major leagues of their sport, but they do not compete in the Olympic games.

3. The almost-champions: These athletes reached high levels in their sport, in their youth, but dropped their sport before reaching the big leagues.

The researchers recruited 56 of these athletes and invited them to the laboratory to talk about their lives, explain the adversities they had experienced, how they handled these life adversities and how their family, friends and coaches influenced their ability to develop their talent.

Results showed that contrary to the models suggesting that structured or life adversity can help develop talent, the three groups of athletes did not differ in the amount of adversity reported.

However, in continuing their analysis, the researchers observed that the differentiating element between the three groups was their reaction to adversity.

The super champions were characterized by an almost enthusiastic attitude towards adversity. In the study, the majority of super champions saw adversity as an opportunity to become better. They were often energized by adversity. For example, when faced with

an injury or the deselection process, they were energized and this made them want to work harder thereafter.

In contrast, champions have a much less consistent attitude in the face of adversity. When confronted with adversity, many champions said that they gave up and reduced their training because they became discouraged. Adversity was seen as a major barrier to training and talent development.

Finally, unlike super champions and champions, the almost-champions reported that their childhood was blessed with the absence of adversity. Interestingly, the majority of all almost-champions said that the phrase they heard most often in their childhood was "You're a natural!" and that they believed it. Everything was easy for them. They had talent and they had their parents and coaches to remind them of it. The almost-champions largely said that they experienced little to no pressure to practice their sports. However, for the majority of almost-champions, adversity came in their late teens when they arrived in the big leagues. And when faced with this adversity, the majority of almost-champions attributed their difficulties to external causes, such as a bad coach, an injury, etc. They were unable to handle the adversity.

Conclusion

Thus, the thing that distinguishes super champions from champions and/or almost-champions the most is the athlete's attitude in the face of stress and adversity related to their sports. Super champions seem to approach adversity with an extremely positive attitude, whereas champions and almost-champions handle these adversities in a more negative way. Therefore, when confronted with the same difficult event, super champions will see a challenge, while champions and almost-champions will see a stress. As such, it appears to be the way that people interpret adversity (as a challenge or as a source of stress) that will have the strongest influence on their performance.

In conclusion, new research shows that it is not necessary to impose structured adversity on young athletes to develop their talent. The factors that will allow a young athlete to become a super champion are related to how they interpret adversity. These results are very important for coaches because they suggest that if young athletes are taught to interpret adversities as a challenge (rather than a stress), it will have a greater impact on their performance than any other form of adversity that they may be subjected to, either voluntary or involuntary.

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Sports, stress and green spaces: what you need to know

Charlotte Longpré, B.Sc., *Master's student in psychology, Centre for Studies on Human Stress, University of Montreal*

The sun, heat, parks filled with greenery… you may have taken advantage of the summer months to spend some time outside. After a jog or a walk in the forest, have you ever felt refreshed, energized and less stressed? We often hear that being in nature is good for us, but do green spaces have actual benefits for our physical and mental health?

The following article examines this question by summarizing recent studies that investigated the link between green spaces, physical activity and health.

Are there actual benefits to doing physical activity outside?

With the opening of more and more fitness centres, researchers have become interested in comparing the effects of doing physical exercise inside (in a gym) and outside (in a green space such as a park or a residential road lined with trees). To do so, they asked all participants to run or walk inside and on a second occasion, to do the same activity outside in a green space. Overall, compared to indoor activity, participants reported a greater improvement in their psychological well-being during outdoor activity. Also, a stronger sense of vitality was observed as well as a more positive involvement in the activity. In other words, the participants felt energized after jogging outside and stated that they were more motivated to do the same exercise again. Doing physical activity outside was associated with decreased tension, frustration and feelings of depression. Finally, participants reported enjoying themselves more when running or walking outside. Based on these studies, physical activity in green spaces clearly provides several benefits compared to indoor activities. Still, it is important to remember that being active in any environment is always better than sitting on the couch! But an interesting question remains, do we do more sports when we are outside?

Researchers agree that green spaces have a positive influence on the physical activity levels of children and teens.

What's the relationship between sports and green spaces?

As some studies suggest, the benefits of doing physical activity in green spaces are very real on a psychological level: people enjoy exercising outside more than they do inside and are more likely to do exercise outside again in the future. Equally, some studies have proposed a link between exposure to a green space and a better physical health. However, it is important to give a small word of caution before selling your downtown condo to move to the base of a mountain. Though it is true that exposure to green spaces is associated with better physical fitness, several avenues have been proposed by researchers to explain this link. Some suggest that green spaces encourage people to go for more walks and that it is the result of walking regularly that is beneficial for physical health. Another avenue proposed by researchers is that living near a green space improves psychological health by lessening feelings of loneliness and social isolation. Why? Well, when you walk outside, you may run into other people who are also out for a walk. And if you walk regularly in the same park, you are more likely to connect and interact with other walkers! All these avenues are possible, but more research is required to confirm them. But let us not forget, the benefits associated with living close to a park can be found in other environments (such as in your residential neighborhood) since it is healthy lifestyle habits, such as regular walking (among others), that make it possible to gain access to these benefits.

Let us not forget, the benefits associated with living close to a park can be found in other environments (such as in your residential neighborhood) since it is healthy lifestyle habits, such as regular walking (among others), that make it possible to gain access to these benefits.

More time outside?

A few studies have tried to determine whether young people are more physically active when they are outside. Results show that, on average, more minutes are spent doing moderate or intense physical activity in green spaces than in paved areas or near buildings. One study also showed that the probability that a youngster aged 10 to 11 does moderate to high intensity exercise is greater in parks or in playgrounds compared to anywhere else in the city. In sum, researchers agree that green spaces have a positive influence on the physical activity levels of children and teens.

Finally, one study has shown that the more people are exposed to green spaces, without necessarily engaging in physical activity in them, the less they reported feeling stressed in their daily lives. Another study also investigated whether exposure to green spaces could reduce cortisol (the main stress hormone) levels. To do this, researchers asked participants to spend 10 minutes or more, three times a week, in an area that makes them feel close to nature. Participants were free to choose their activity and researchers measured their stress hormones before and after doing the activity outside. The results showed that doing activity in nature for 20 minutes reduces stress hormones by 21% (which is pretty impressive!) and

this reduction was observed regardless of the type of activity (reading at the botanical garden, yoga in the park, hiking, etc.). In short, as previously mentioned, living in a green-filled environment appears to be associated with a better physical and mental health. But, there is no need to pack your boxes! All it takes is three times a week in the great outdoors to reduce your stress hormones! So, what are we waiting for to lace up our sneakers and head on out to our nearest green space?

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Does playing sports have health benefits for our brain?

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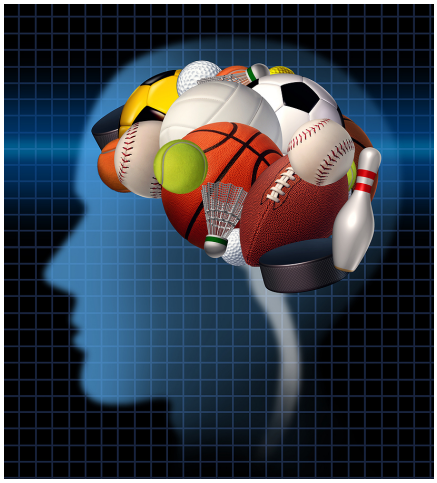
Walking, running, swimming, biking or yoga - all of these physical activities are beneficial for our physical health. But have you ever wondered about the neurobiological benefits of sports and the impact on our psychological well-being?

Neurobiological benefits

With time, and after several sessions of exercise, we realize that we can breathe better, our heart beats slower and that our muscles are more apparent. Of course, the effects differ according to the frequency of physical activity, the time you put aside for exercise or even the type of activity you do. Though the effects on the body may seem less visible for some, regular physical activity has significant repercussions on our brain. In fact, it has been shown that sports induce molecular changes in the brain, such as the production of new cells, but also at the behavioural level, by helping with concentration.

To better illustrate what happens during physical exercise, let us take the last time you hiked a mountain as an example. You started your trek up the mountain and your heart started



beating faster. This accelerated the circulation of your blood to bring more oxygen and nutrients to your muscles and brain. A burst of communication between your brain cells, called neurons, has taken place. In addition, thanks to the supply of oxygen and nutriments, the neurons begin to produce substances that are essential for their survival and development. These substances are called growth factors.

In the short-term and immediately after doing exercise, we generally feel a great sense of well-being, euphoria and reduced pain. Several years ago, these phenomena were associated with the production of endorphins, also called the happy hormones. As a result of doing sports, our brain also produces numerous substances (called neuromodulators) that help regulate communication between neurons. Of note,

As a result, people who regularly do physical activity generally have larger hippocampal and prefrontal cortex volumes. These volume increases result in improved memory, a more focused attention and a greater ability to solve problems.

there is an increase in the production of dopamine, which is involved in emotion regulation, motivation and memory. According to more recent discoveries, another type of neuromodulator, called endocannabinoids, are also produced after doing sports. Endocannabinoids are found in regions of the brain that are sensitive to cannabis and are implicated in reducing pain, anxiety and our perception of stress.

Therefore, after doing physical exercise, you produce endorphins, dopamine and endocannabinoids. This molecule cocktail allows you to feel satisfied after putting in hard work.

What happens in the longer term? On one hand, the brain adapts and is shaped according to the experiences we have in our daily lives. This refers to the process of brain plasticity. Therefore, as a result of doing sports, communication between neurons is strengthened in the hippocampus, a brain structure that is involved in memory. Communication between neurons is also modified in the prefrontal cortex, a brain area involved in the regulation of behaviour and emotion. As a result, people who regularly do physical activity generally have larger hippocampal and prefrontal cortex volumes. These volume increases result in improved memory, a more focused attention and a greater ability to solve problems.

On the other hand, thanks to the numerous growth factors that are produced due to the oxygen supply and nutrients, new neurons form, grow and migrate from the hippocampus. New neurons are also produced in the olfactory bulb (though to a lesser extent), a brain area located near the back of the nose. The creation and proliferation of these new neurons refers to a process called neurogenesis.

Sports are, therefore, an essential element to add to our daily routine. In fact, thanks to their effects on our brain, sports act as a protective factor against the onset of certain diseases associated with altered brain function. For example, in neurodegenerative diseases such as Alzheimer's disease, the neurons of the hippocampus no longer function well and will eventually die. However, doing sports allows us to delay the onset and progress of Alzheimer's disease, notably via brain plasticity and neurogenesis. Similarly, several studies have shown that patients suffering from depression and who do not take any medication show a decrease in neurogenesis in the hippocampus and olfactory bulb. Once again, sports could be a protective factor to reduce the consequences of the disease by stimulating neurogenesis.

Despite its primary role in brain functioning, the hippocampus is a very vulnerable structure and is sensitive to changes in the environment. So, yes, doing sports does have benefits for our brain, but it is also influenced by many others factors including our diet and how much we sleep. Therefore, the combination of these different factors would help to reduce the consequences of stress, burnout or even negative events on our brain and in particular, on our hippocampus.

In summary, doing sports is beneficial for the functioning of our brain and it can serve as a protective factor against

age-related memory decline or even against different neuropathologies such as Alzheimer's disease or depression. Although exercise has many benefits for our physical and neurological health, its effects on psychological health are just as important.

Psychological benefits

In general, mental health treatments come in the form of pharmacotherapy and psychotherapy. However, physical activity-based interventions are gradually being included amongst treatments prescribed by health professionals. Yes, it is entirely possible to get a medical prescription to do more exercise! Several studies have shown that physical activity and the use of certain medications (such as antidepressants) can yield similar results. In addition, exercise does not come with any unpleasant side effects, contrary to many medications.

A variety of conditions, including depression, anxiety disorders and stress-related problems, would benefit from physical exercise. However, you do not need to have a diagnosis to enjoy the benefits of exercise. There are several factors that can explain the therapeutic effects that exercise has on mental health. Here are a few.

In addition to creating a multitude of neurobiological cascades (as previously discussed), physical exercise allows us to put all of our worries on hold. Are you able to think about a stressful event over and over while running, swimming or skating? It is difficult…exercise is, therefore, one of the healthiest short-term distractions available!

Beyond the physical well-being that exercise provides, physical activity can also have an impact on self-esteem. Physical activity often leads to a sense of accomplishment, the development of new skills (such as those needed to do exercise), as well as a better perception of one's physical appearance.

Finally, being active often generates positive feedback from those around us. This is a very important element in order to persevere and maintain the practice of physical exercise. Certain sports also promote social interaction and strengthen an individual's social support network!

While the psychosocial benefits of physical activity have been established, little is known about which type of sport is the most beneficial. For example, high-intensity activities such as running have often been shown to be a good type of exercise. However, a growing number of studies are speaking to the biological and psychological advantages of low-intensity activities such as yoga or walking. In addition to exercise type, exercise frequency and duration are also important. In order to prescribe physical activity in the most optimal way possible, these parameters must be studied in greater depth. This is ever-growing field of research!

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Although science continues to search for the optimal way to do physical activity, it is possible to follow the recommendations issued by the World Health Organization (WHO) to live an active life. Each week, the WHO suggests that adults ages 18 to 64 do at least 2.5 hours of medium-intensity activity or at least 75 minutes of high-intensity activity. Each exercise period should last at least 10 minutes. So, whether it is during your daily travels, leisure activities, your household chores or by doing your favourite sport, don't stop moving: this will help you hunt down your mammoth!

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Can you become an exercise addict?

Sonia Lupien, Ph.D., *Director of the Centre for Studies on Human Stress*

For a number of years now, we have seen more and more people deciding to take charge of their lives and get a gym membership or participate in a local marathon to lose those extra pounds. Health professionals are constantly talking about the benefits of physical exercise and trying to convince their sedentary clients to start an exercise program that will surely only do them good.

Over the past ten years or so, there has been a large hype surrounding very physically demanding sports such as road biking. Just think of the Pierre Lavoie challenge, for which cyclists must bike 1000km as a team – marathons and triathlons. At the finish line of these sporting events, you see people of all levels tackling the last kilometre. They take great pride in the fact that they have worked long and hard to reach this goal.

It's wonderful. For some people however, things can sometimes turn sour. For these people, they develop what researchers call an "exercise addiction".

Studies show that this kind of addiction can be as bad as a drug addiction such as alcohol or heroin, or to a behaviour such as gambling or sex. This type of addiction develops by activating a system in the brain called the "reward system".

The brain's reward system

In the 1990s, researchers began to show that many drugs activate the production of dopamine, a neurotransmitter in the brain associated with feelings of pleasure. In the limbic region of the brain (located in the middle of the brain), there is a region called the "reward center". It is known as such because it is activated when the body does something that makes it feel good and happy.

Drugs activate dopamine in the reward center because they make you feel good, but behaviours such as sex, gambling or exercise can have the same effect. By constantly increasing dopamine levels, these drugs and behaviours lead to a constant activation of the reward center. In turn, this will increase pleasure and can lead to the development of an addiction.

The brain is plastic and adapts to everything around it. Therefore, the reward system will eventually adapt to the large increase in dopamine and consequently, it will demand more and more of it. This is when the user no longer uses the drug or engages in the addictive behaviour for pleasure, but rather to prevent the negative feeling of "withdrawal" from occurring. Here, the reward center has spun out of control and the addiction is slowly creeping in.

Given that the reward system can be activated by behaviours (e.g., exercise) just as much as drugs, this led many researchers to speculate that the dopaminergic reward system could also spiral out of control for behaviours such as exercise.

A scientific study published in 2011 showed that nearly 3% of individuals who exercise will develop an exercise addiction in their lifetime. However, other studies conducted in specific populations such as ultra-marathoners or student athletes (those in sports-study programs), showed that this percentage is much higher. According to some studies, the percentage can be as high as 42%.

The seven criteria for exercise addiction

In 2002, to distinguish between healthy lifestyle habits (doing exercise to stay healthy) and exercise addiction (doing exercise because it has become an addiction), researchers proposed seven criteria for exercise addiction.

These seven criteria are:

1. Lack of control: People with exercise addiction have difficulty and often fail to reduce the amount of exercise they do or to even stop doing exercise for a certain period of time.

2. Problem of intent: The person is unable to stick to a given routine and will constantly increase the amount of time devoted to exercise to push themselves.

3. Time commitment: An enormous amount of time is used to prepare to engage in and recover from daily exercise.

4. Less of other activities: As a direct result of the amount of time allocated to exercise, social, occupational and recreational activities are often neglected or stopped altogether.

5. Persistence: The person continues to exercise even when they're aware that it is creating physical, psychological or even interpersonal problems.

6. Tolerance: The person will increase the amount of exercise they do in order to feel the desired effect i.e. the physical high or the sense of accomplishment

7. Withdrawal: In the absence of exercise, the person will experience negative effects such as anxiety, irritability and sleep problems.

Using these criteria, a scientific study published in 2011 showed that nearly 3% of individuals who exercise will develop an exercise addiction in their lifetime. However, other studies conducted in specific populations such as ultra-marathoners or student athletes (those in sports-study programs), showed that this percentage is much higher. According to some studies, the percentage can be as high as 42%.

Two risk factors for exercise addiction

In recent years, researchers have been trying to gain a better understanding of the factors that will make one person able to do a lot of exercise without developing an addiction, whereas another person will develop a severe exercise addiction. To date, researchers have reported two main types of factors that can increase the likelihood of developing an exercise addiction.

1.Neurological factors: Certain people may have a brain organization that makes them more susceptible to developing an exercise addiction (or to any other behaviour or drug). For example, one study showed that women who develop an exercise addiction present a difference in certain brain regions that are associated with negative affect.

2. Motivational factors: Studies show that the risk of developing an exercise addiction is greater when the motivation to exercise is not related to the pleasure of doing exercise, but to psychological factors such as to reduce stress or to increase self-esteem. Evidence suggests that people who exercise to escape a living environment that makes them unhappy, or to escape from negative feelings (such as stress), are more susceptible to develop an exercise addiction than those who exercise for the joy of doing so. Similarly, people with low self-esteem and who use exercise to increase their self-esteem are more susceptible to developing an exercise addiction.

Evidence suggests that people who exercise to escape a living environment that makes them unhappy, or to escape from negative feelings (such as stress), are more susceptible to develop an exercise addiction than those who exercise for the joy of doing so.

How is exercise addiction treated?

There are still very few studies that discuss the best ways to treat exercise addiction, but research does suggest a few possible avenues. The basic idea for treating exercise addiction is not total abstinence from exercise, but rather a return to doing recreational exercise in moderation. In some cases, it may be suggested that the person picks up a new sport, with the goal of breaking the cycle of addiction associated with the old sport. The person must also be trained to recognize the different phases of the development of an exercise addiction so that they do not find themselves in the same situation...addicted to another form of exercise a few years later!

Finally, we must try to control the development of cross-addictions, i.e. the tendency to increase or develop another addictive behaviour in the absence of exercise (e.g., increase in disordered eating during exercise withdrawal).

If you think you may have an exercise addiction, researchers suggest that you consult a psychologist who specializes in cognitive-behavioural therapy. This therapy helps to modify maladaptive behaviour. For more information on cognitive-behavioural therapy and how to find a psychologist using the services of the Order of Psychologists of Quebec, consult the 16th issue of the Mammoth Magazine!

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NEXT MAMMOTH MAGAZINE ISSUE

Our next issue will focus on stress and the media. With the ability to consult several types of media at any time of the day, we live in a society where information is more accessible than ever before. During important events, the need to be informed is essential. In fact, we are currently experiencing this with the pandemic. Can the simple fact of being exposed to negative information be stressful? In contrast, can good news be beneficial and reduce our stress levels? In our next issue, we will attempt to answer these questions.

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