Multiple sclerosis: from distress to hope

By Laurent Salez

More than 100 years after it was first described by the French physician Jean-Martin Charcot, multiple sclerosis remains a disease that has yet to reveal its inner workings.

According to the Multiple Sclerosis Society of Canada, three new cases are diagnosed every day in Canada, adding on to the 100,000 already identified patients. The disease is typically diagnosed in people between the ages of 15 and 40, 75% of whom are women. Multiple sclerosis progresses towards a severe handicap in 85% of all cases, and there is no known cure.

The origins of this disease are poorly understood. We do know that it is not contagious. The consensus among researchers is that its causes stem not only from genetic components, but also from environmental factors.

Clinicians can now call upon powerful tools to diagnose the disease. Following interviews and functional exams, nuclear magnetic resonance and lumbar puncture (spinal tap) are reliable means for formulating a verdict. Although it is impossible to predict how the disease will progress, there are two broad types (each with sub-types) according to the frequency and reversibility of the symptoms. The first type, which accounts for 85% of all cases, is called relapsing-remission MS (RRMS). It is characterized by episodes or attacks followed by periods of remission. Although a few drugs are available that help reduce the severity of relapses and ease the symptoms, there are none that prevent the appearance of new episodes. The remaining 15% of cases are quite different. These cases include various so-called progressive forms. No treatments exist to halt the constant and irreversible progress of the disease and its symptoms.
While little is known about the origins of MS, its manifestations are well documented. Research has shown that it is the result of the degradation of nerve fibres in the central nervous system. The main culprit is the immune system, responsible for defending our bodies against infections and various forms of cancer. However, sometimes immune cells mistake their target and attack the myelin sheath, which both insulates nerve cells and facilitates the flow of nerve impulses. When the myelin sheath is damaged, as is the case in multiple sclerosis, a series of pathological conditions arise: pain, stiffness, fatigue, problems with balance, mobility and memory, anxiety, depression, infections, etc.

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The following pages present multiple sclerosis from a variety of different, though complementary perspectives: patient, nurse, clinician and researcher.

The CRCHUM and the CHUM are world leaders in multiple sclerosis research and treatment. A multidisciplinary team of some of the best scientists in the field work in close collaboration with a dedicated group of clinicians and healthcare professionals whose expertise and accomplishment serve as a reference. Together, they devote themselves and their expertise to the thousands of patients who have turned to them for help and solutions over the years. It is the convergence of observations and ongoing exchanges between patients and healthcare professionals that ensures both a mutually-informing dialogue and improved care, not to mention a source of crucial feedback and information for further research.
Chantal Girard used to be an educational therapist working with patients suffering from severe mental disorders at the Rivière-des-Prairies Hospital. She enjoyed her work and carried out her duties with enthusiasm and conviction.

Chantal Girard: “The important thing is not what happens to you, but what you do with it.”

One can well imagine that she was appreciated and acknowledged, given the strength of her obvious love of life that she gives off from the moment you meet her.

In 1996, the appearance of worrying symptoms led to her consult a physician. At first, her doctors thought it might be a case of amyotrophic syndrome. Then, in 2003, the diagnosis came down like a ton of bricks: she had to live with multiple sclerosis. Since that moment, she has always refused to see it as the end of the world but as a reason to fight and to understand the message life has sent to her.

Chantal makes a point of keeping up with the latest research and developing therapies. She has unconditional faith in those who have declared war on this disease, which is still poorly understood and difficult to treat.

Chantal has primary-progressive multiple sclerosis, for which no treatments exist. In 2007, she agreed to come to the CHUM’s clinic to participate in a new therapy. Her friends who continue to support her and encourage her to continue her combat, soon began to call her the “laboratory rat.” Unfortunately, the treatment did not work. Although her hopes for a cure faded for a while, her optimism soon returned. Her overwhelming desire to live won out over her moroseness. More than ever, her smile and vivaciousness guide her towards new hope.

She pays regular visits to the CHUM’s Neurology Clinic, where she receives specialized care as well as advice to help her navigate the challenges of her day-to-day life. Although her autonomy and vitality remain intact, she feels that the psychological support from and human approach taken by an experienced, professional healthcare team are essential to help her keep her head up. When asked about how she views the CHUM’s team, she replies that she is particularly appreciative of those who conduct research, those who provide care and those who make generous donations to ensure the development of new treatments aimed at alleviating increasingly painful symptoms that make it difficult to lead a full, happy life.

As her departed father once told her, “it’s not what happens to you, but what you do with it that counts.” Chantal has never forgotten this advice and makes it a central part of her reason for living. She decided to become an active member of the board of directors of Sclérose en plaques St-Hyacinthe – Acton. She puts her skills to work as the board’s secretary and is particularly involved in fund raising activities and mutual help events.

I met with Chantal a few minutes after her nurse had proposed a new therapeutic molecule currently undergoing trials. She told me that her goal was to recover how she walked as a young girl. And her dream, she confided, was to save up enough money to go to France and travel along the Compostela pilgrimage route.
Empathy, Honesty and Trust
The patient-physician team

“Telling a patient that she has multiple sclerosis is an art,” says Dr. Marc Girard, a neurologist with the CHUM’s Neurology Clinic. It is a critical moment during which the seeds of a strong patient-physician relationship of trust must take root. Indeed, this special relationship will likely last several years.

Upon hearing the news, patients ask many questions: Will I have to stop working? How will I tell my family and friends? Will I eventually lose my autonomy and become dependent on others? What kinds of treatment are available? Physicians must deal with these questions and answer them with honesty, empathy and respect.

The fact that it is impossible to predict how the disease will progress puts the physician in a delicate situation, requiring him or her to take the time to listen, to inform and to reassure. The cohesion of the message goes hand-in-hand with that of the other members of the team that will provide care for the patient and accompany her throughout her struggle. Indeed, the effort is a collaborative one with all those involved to ensure a treatment regimen adapted to the patient as well as to collect precious data for research purposes.

When Dr. Girard first began receiving multiple sclerosis patients around 20 years ago, his work was basically limited to diagnosing the disease. The complete absence of treatments meant that there was little to offer in terms of follow-up and patients were left without medical solutions. Today, however, things have evolved somewhat. With the development of magnetic resonance imaging and the discovery of generally reliable pharmacological agents, his work has increased considerably, particularly with regard to managing the side effects induced by certain medications and to proposing specific treatments to alleviate the symptoms of the disease.

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Her functions require considerable experience in monitoring and treating this disease. Her profession is a complex one since she not only has to be intimately familiar with the variability of symptoms and treatments, but must also be able to meet her patients’ many needs and expectations. For example, multiple sclerosis is often accompanied by depression. In her view, empathy and selflessness are an integral part of her function, which she views as a vocation. Even though it can take months to develop a relationship of trust with a patient, it eventually takes place and makes the struggle more effective.

Announcing the diagnosis to patients involves managing the accompanying uncertainties and worries they feel with tact and humanity. “When you accompany a patient who has been diagnosed with multiple sclerosis, you have to help her accept the many negative aspects of the disease,” explains Poirier, well aware that it is important not simply to accept the disease but to learn how to live with it. Therein lies one her most important challenges.

In her view, it is clear that patients’ mental state can help considerably in treating their symptoms and that creating a team spirit with the attending physician ensures a more successful treatment program. Indeed, the choice of which treatment path will be taken rests largely on what patients decide: their ability to step back and understand their choices is crucial.

In today’s healthcare system, Josée Poirier is an exception. Given the way the disease progresses and that the response to treatment can vary from one patient to another, the fact that she is specialized gives her a better understanding of the disease and enables her to be more effective in responding to her patients’ distress and anguish. This anxiety, which is specific to multiple sclerosis patients, is an important component that must always be kept in mind.
Discovering and validating new treatments

Upon completing his studies in the United States, he returned to Montreal in 1975 with the intention of bringing together some of the best researchers, nurses and clinicians in the world. Forty years later, he can proudly boast: mission accomplished. His team’s international reputation is well established and continues to grow.

In addition to the patients that he treats, he is above all a clinician researcher. His reputation has enabled him to secure funding from major public funding agencies as well as from pharmaceutical companies. These investments have enabled him not only to make significant progress in caring for patients, but also to develop and validate almost all of the accepted therapies used to limit the appearance of new multiple sclerosis symptoms and to reduce existing ones.

Dr. Pierre Duquette has participated in no less than 75 research protocols over the past few decades, several of which have led to the development of new medications. In the early 2000s, for example, he participated in a large North-American clinical study that identified interferon beta by injection as a powerful tool for reducing the rate of multiple sclerosis relapses. In close collaboration with patients, healthcare personnel and researchers, he is currently involved in 15 research protocols aimed at developing new therapeutic tools.

Notwithstanding these many successes, the fight continues. Building on past accomplishments, Duquette has more than one arm at his disposal. With his team, his wish is to find a cure rather than simply alleviate disease symptoms or slow its progress. Several very costly projects are underway and others are under evaluation. For example, he would like to establish cohorts of patients under his care in order to establish a full pathological profile for each of them, with a view to providing them with personalized, long-term treatments. To do so, he believes that advances in medical imaging, which has already proved its usefulness in early MS diagnosis, are needed. He would also like to be able to provide a better description and identification of just which cells of our immune system commit targeting errors and attack rather than defend or repair nerve cells.

But his needs are above all human in nature: it is essential to recruit talented researchers, to have better, speedier access to specialized radiologists and to technologies such as magnetic resonance, to find computer programmers to design analytic software, and so on. And, of course, acquiring these means requires more funding and more available skills.

Although the lion’s share of his time is devoted to clinical research, Dr. Duquette remains in constant contact with day-to-day realities. He maintains active interactions with a team of healthcare professionals and researchers, but worries about the fact that it is becoming increasingly difficult to ensure the care and follow-up of 2,600 patients with a single nurse. He is particularly concerned about the future capacity to receive patients, the quality of healthcare and patient monitoring. Indeed, in his view, his past successes could well be for naught if the appropriate measures are not implemented to ensure future ones.
Team work, ongoing dialogue and a better understanding of the disease

In most cases, the inflammatory process leaves few traces and re-establishes the organ’s ability to function normally. Unfortunately, the nervous system does not work in the same way. When it is the object of this kind of attack, the resulting lesions can have dramatic, long-lasting consequences that alter the normal functioning of neurons.

Nathalie Arbour, a researcher specialized in the field of neuroimmunology at the CRCHUM, is a world leader in multiple sclerosis (MS) research. From the time she began studying biology as a post-secondary student, she has nurtured a passion for understanding the body’s defence mechanisms against viral attacks and the onset of pathologies that affect the central nervous system. Her work focusses on the extremely complex dialogue between the CNS and defensive cells, especially with regard to the onset of neurological diseases such as multiple sclerosis.

There is no question here of doubting the usefulness of our immune system. However, after studying many MS patients, Arbour managed to isolate a subpopulation of white blood cells known as CD4/NKG2C+ lymphocytes, the toxicity of which is dangerous for the myelin sheath surrounding our neurons. Indeed, when white blood cells in great numbers are called upon to defend nerve cells, some of them appear to do the opposite and end up destroying rather than protecting.

This recently-published study provided the international research community with a new pharmacological target to be observed, with a view to specifically preventing these cells from attacking the central nervous system, without, however, inhibiting the beneficial work of other immune cells. Arbour is clearly one step ahead in this effort: her ongoing work is aimed at blocking the effects of this subpopulation of CD4 cells on the nervous systems of MS patients, and thereby offering new hope to patients for whom current treatments are not enough.

When asked why the CRCHUM is important to her, Arbour’s answer is not long in coming: “The CHUM has a multidisciplinary team that involves all those concerned and allows basic researchers like myself to stay in touch with the reality experienced by patients.”

“Dr. Nathalie Arbour”

Dr. Arbour’s work in the struggle against multiple sclerosis shows just how much basic research is not necessarily an isolated discipline. Quite the contrary, her efforts reveal the extent to which researchers’ actions and concerns can be harmoniously integrated with those of clinicians and healthcare professionals. In the final analysis, they all work together to ensure the wellbeing of patients and to find ways of countering this devastating disease.
Blocking the way for destructive cells: the search for new therapeutic targets

Dr. Alexandre Prat is the head of the CRCHUM’s neuroscience research theme. He is also a neurologist specialized in multiple sclerosis at the CHUM. His research focusses largely on the identification of new therapeutic targets with a view to improving treatments for many neurological diseases, multiple sclerosis in particular.

Immune cells travel from their sites of production to infected organs by using blood vessels as their means of locomotion. When an alert is sounded, immune cells can traverse blood vessel walls to reach the infected organ and stave off invasions. The nervous system is an organ that is particularly well-insulated from blood vessels by means of what is known as the blood-brain barrier. This natural bulwark made up a closely linked cells acts as a reinforced means of protection for the nervous system. In the event of an infection, immune cells have to cross this barrier to ensure that they can fulfill their defensive role. However, for reasons that are not understood, some of these cells attack neurons and degrade their protective myelin sheath.

Prat is particularly interested in all the events that occur following the appearance of a cerebral lesion caused by the infiltration of the blood-brain barrier by immune cells. His research has revealed the protective role played by this barrier and shown why its fragility could be the cause of the onset of multiple sclerosis. More recently, his team published an important study showing that certain nervous system cells called astrocytes naturally produce molecules that the cells coating blood vessels perceive as natural protectors against massive invasion by immune cells. With this important information in hand, Prat hopes to be able to specifically block myelin damaging cells in the central nervous system and ultimately block the very cause of multiple sclerosis. In this regard, his current research holds considerable hope for patients.

Prat continues his investigation of new research avenues with his laboratory, which is made up of seven doctoral students, eight postdoctoral fellows and three research assistants. He has submitted two patent applications for therapeutic targets that he discovered. The pharmaceutical industry is funding initial clinical trials of these targets with human subjects. The hope is that they will be able to offer two new treatments that will limit multiple sclerosis relapses and considerably reduce the side effects that typically accompany existing treatments. These major projects have also received funding from the Canadian Institutes for Health Research, the CRCHUM and the Multiple Sclerosis Society of Canada. This ongoing effort and major investments could make it possible for new therapies to see the light of day within the next five years.

Like other physicians and nurses at the CHUM’s Multiple Sclerosis Clinic, Prat is proud to be able to collaborate with a dynamic and inspiring team. Although most of time is spent in his laboratory, he makes every effort to maintain close links with patients. He is well aware that “while their needs provide me with the motivation to pursue my research activities, the fruit of my work – improved care for patients – remains the best legacy and the best reward.”

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In this regard, two complementary therapeutic approaches are now available:

The first approach, which has demonstrated its effectiveness in reducing the frequency and intensity of MS relapses and in some cases has even led to complete remission, involves injections consisting of interferon or glatiramer acetate. Unfortunately, this approach only works for the relapsing-remitting form of the disease. No treatments are available for the progression form.

The second approach consists of drugs aimed solely at alleviating the symptoms of the disease: loss of mobility and balance, spasms, pain, stiffness, dizziness, fatigue, memory loss, anxiety, depression, urinary infections, and so on. The multiplication of available treatments has, however, made it necessary to establish a high degree of cohesion and a dialogue among the various medical specialties involved in light of the enormous collateral damage resulting from multiple sclerosis. The emergence of this dialogue is a strength that has been developed with pride and success at the CHUM in the past few years.

Marc Girard was raised in a family that was directly affected by multiple sclerosis. As a budding biologist, he began at an early age to nurture the hope to be able to help and provide relief for people whose lives were turned upside down by this kind of disease. “I devoted my career to helping patients with multiple sclerosis with the hope that I would see a treatment for the disease before the end of my career,” says Girard. Hopefully, the patients who place their faith in him will work with him as a team to ensure that this wish becomes a reality.

Helping patients learn how to live with multiple sclerosis

Poirier is also well-informed about advances in multiple sclerosis research. She gives advice to patients and refers those who agree to participate in new research protocols to a research nurse. Throughout the treatment period, she can then monitor how symptoms progress and provide valuable information to clinical and basic researchers about the effectiveness of experimental drugs. Moreover, her pivotal position enables her to ensure close relations among physicians, researchers and patients.

In light of her vast experience, Josée Poirier has become a reference for people with multiple sclerosis as well as for various healthcare professionals in local community service centres and the Multiple Sclerosis Society of Canada, which continually ask her for references and information about the many patients under her daily care.

Moreover, she received the 2004 Berlex MS Nursing Recognition Award, presented by Berlex Canada (Bayer), and in 2005, she received the June Halper Award for Excellence in MS Nursing from the International Organization of Multiple Sclerosis Nurses. These awards testify to her untiring commitment, leadership and creativity in helping multiple sclerosis patients.
Immune therapy for triple-negative breast cancer

We now know that our body has a natural ability to defend itself against certain kinds of cancer. However, in the event of unfavorable environmental or genetic factors, for example, cancer cells find flaws and ways to get around our natural defences in order to develop. For the past several decades, chemotherapy and radiotherapy have been effective in treating cancer, but often entail devastating side effects, given that they act not only on tumours, but also on surrounding tissues.

In 1999, Dr. John Stagg began his doctoral studies at McGill University and quickly developed a passion for cancer therapies. Little did he know at the time, but he would become a part of a veritable explosion in the development of anticancer immune therapy research. This field of biology consists in stimulating our body’s natural defence system to fight against cancer cell and tumour growth, while limiting the side effects associated with chemotherapy.

Hundreds of researchers across throughout the world are actively searching for natural targets in the immune system with a view to designing synthetic molecules to stimulate them. To date, only around a dozen such targets have been identified. John Stagg is one of the pioneers in this field and plans to continue his research in this regard.

During his postdoctoral research in Melbourne, Australia, Stagg came up with the idea of combining conventional chemotherapy and immune therapy to treat breast cancer. This idea came about after identifying the role of CD73, a natural component of the immune cells involved in the body’s anticancer defence.

Following these studies, he was recruited by the CRCHUM, with generous support from the Montreal Cancer Institute. Since his recruitment, he has validated the CD73 molecule as a promising immune therapy target and shown that its mechanism of action can in certain cases foster tumour growth!

There are no specific treatments for breast cancer treatment. For the past 20 years, anthracyclins and hormone therapies have shown themselves to be good chemotherapeutic tools and have yielded good results in terms of cancer remission. For his part, Dr. Stagg focusses on a subpopulation of breast cancer patients (10%-15%) whose genetic particularities inhibit hormone therapies. More specifically, these patients have what is called triple-negative breast cancer which is generally associated with a poor outlook. Given the inefficacy of hormone therapy for this cancer, the medical community relies on anthracyclin-based treatment as a last resort.

Following his study of the cases of 6,000 women with triple-negative breast cancer, Stagg discovered that patients who overexpressed the CD73 molecule (which can favour tumour growth) are also those for whom anthracyclin is the least effective. In other words, he showed that if the expression of CD73 is too strong, it limits the action of one of the only available treatments for this cancer. In an article recently published in prestigious Proceedings of the National Academy of Sciences of the United States, Stagg presented the CD73 molecule as a promising target, stressing that its action needs to be limited in order to bolster the efficacy of anthracyclin-based treatments.

He is now in discussions with pharmaceutical companies to develop pharmacological agents able to modulate CD73’s action.

While continuing his research on this molecule’s mechanism of action, Stagg is convinced that more funding is needed to conduct tests of a series of molecules already approved by the Food and Drug Administration of the United States. These candidate molecules could turn out to be effective and hold out hope for effective treatment or remission for women with triple-negative breast cancer.

By Laurent Salez
Inhibiting cell death to improve cancer treatments

Some of anticancer treatments seek to inhibit the progression of certain forms of cancer by inducing cell death. However, “the death of some cells can foster the survival of others, but not necessarily the right ones,” explains Dr. Jean-François Cailhier.

Cailhier’s team would like to improve the effectiveness of anticancer treatments by improving our understanding of the link between apoptosis (programmed cell death) and our immune system’s ability to fight against cancer. More precisely, Cailhier studies MFG-E8 (Milk Fat Globule-EGF factor 8), a molecule released by cells dying by apoptosis. The presence of this molecule could affect the effectiveness of treatments for certain forms of cancer by inducing an inflammatory reaction and by reducing the antitumoral immune response.

APOPTOSIS IN ANTICANCER TREATMENTS

Some anticancer treatments favour apoptosis. This physiological process involves a kind of cellular suicide in response to a signal. All cells have the potential to self-destruct. It is a natural and common phenomenon that ensures our own survival. For example, in the developing foetus, apoptosis makes it possible to create the spaces between the fingers and enables them to individualize.

As such, certain apoptosis-based treatments (for example, certain hormone therapies and chemotherapies) favour the recruitment of cells called macrophages, which are responsible for ridding our body of dead cells. When they are activated, however, macrophages release MFG-E8 which clings to these cells enabling the macrophage to ingest them. Following this cell clean-up, the macrophage becomes immune-suppressive. That is, it inhibits the immune response, thereby reducing its ability to fight against tumours.

Dr. Cailhier’s results reveal that apoptotic cells can also release certain quantities of MFG-E8, which both facilitates the work of macrophages and, unfortunately, slows the immune system’s fight against cancer since once the macrophage’s work is done, it basically turns off the immune system. These results, which were confirmed in laboratory experiments, will subsequently be confirmed in human subjects.

However, in other forms of so-called pro-inflammatory cancer, such as prostate and colon cancer, inflammation induces disease progression. In these cases, anticancer treatments that foster apoptosis could be more effective since they reduce inflammation.

TRANSIENTAL RESEARCH

Dr. Cailhier will adopt a translational approach – i.e., going from research results to patients and back again – to confirm his laboratory results.

On the one hand, he will work with prostate cancer patients who have become resistant to hormone therapy and are now being treated with chemotherapy aimed at inducing apoptosis. “In the first weeks of treatment, we will identify markers of apoptosis, such as MFG-E8, to help us identify patients who will respond to the treatment as well as those who won’t. Doing so will enable patients to avoid this particularly invasive treatment,” explains Cailhier. If his hypothesis is confirmed, a simple blood sample from patients with pro-inflammatory cancer will make it possible to determine whether anticancer therapies that induce apoptotic cell death will favour long-term healing.

All cells have the potential to self-destruct. It is a natural and common phenomenon that ensures our own survival.

For cancers that are not pro-inflammatory, other forms of treatment that do not induce this kind of cell death could be used. These include those that induce autophagy, a process by which cells self-degrade, which, in turn, induces a stronger and more effective anticancer immune response.

In both cases, the patient will come out on top.
Improving the life expectancy of schizophrenic patients

The life expectancy of schizophrenics is nine to thirteen years shorter than the general population. The main causes of mortality among this group are diabetes, hypercholesterolemia and related cardiovascular risks. The most striking observation in this patient group is increased appetite. Although a sedentary life style, poverty and poor eating habits are the typical causes of these diseases, is there a cognitive dimension, such as poor control over dietary modulation, to this phenomenon, especially among schizophrenics? This and other related questions lie at the heart of Dr. Emmanuel Stip’s research.

By Olivier Dilain

**A HIGHER INCIDENCE OF METABOLIC DISORDERS AMONG SCHIZOPHRENICS**

Dr. Stip’s laboratory studied 14,000 people to assess the effects of antipsychotics on schizophrenic patients and those with affective disorders (depression or bipolar disorder). With the same drug, schizophrenic patients experience more metabolic problems than patients with affective disorders.

His laboratory then closely examined the cognitive processes involved in schizophrenia by observing cerebral activity when patients were shown appetizing images. The study consisted in showing a series of appetizing and neutral images to a group of schizophrenic patients and to a control group (healthy subjects).

The two groups displayed differences in the brain areas that were activated upon seeing these images. They were either activated in one group but not the other, or were activated in different regions of the brain. One thing is certain, however: modifications in appetite control are not the same in schizophrenic patients as in the population in general.

The study also revealed that cerebral activation increased among schizophrenic patients as the exposure time to appetizing images went on, whereas in the control group, activation remained nearly identical regardless of the nature of the images. “It’s as if there is an inhibition problem with regard to appetizing stimuli,” notes Stip.

**NEURON NETWORKS AND APPETITE CONTROL**

To confirm this hypothesis, Stip’s team conducted a study in which olanzapine, an effective antipsychotic, was administered to subjects. This 16-week experiment revealed the persistence of cerebral activation following exposure to appetizing images, in addition to the activations induced by the drug.

This result led Stip to wonder whether one of the factors that lead to metabolic disorders is a modification of the neuron networks involved in appetitive stimuli that contributes to problems in dietary modulation.

Dr. Emmanuel Stip

“...the overall goal is to find ways of increasing the life expectancy of patients by decreasing diabetes, hypertriglyceridemia, hypercholesterolemia and cardiovascular risks,” explains Dr. Stip. One step in this direction has been revealed in preliminary studies showing that when patients engage in sports activities, some aspects of their metabolic disorders can be improved.

In all cases, Stip’s research has shown the limits of medication has made a dialogue with pharmaceutical companies possible, with a view to seeing whether there are antipsychotic drugs that could favour improved modulation of cognitive activations vis-à-vis appetizing stimuli. “This kind of research could lead to better adapted drugs,” concludes Dr. Stip.