IQ
INNOVATION QUEST
Food for thought
IN THIS ISSUE: exploring nutrition, activity and health
McMaster University's Research News magazine
Volume 1, Issue 2, Fall/Winter 2010
Welcome back to IQ – McMaster’s research newsmagazine. We promised we’d explore a variety of issues that affect your lives either directly or indirectly – and with that in mind, I’m pleased to give you a glimpse into the work our researchers are undertaking in the areas of nutrition, activity and health.

Food is not just a dinner table conversation any more. The importance of food and nutrition in our society – and their impact on our health – are part of the daily conversation everywhere, it seems, and are often headline makers in the news. From politicians talking about nutritious snacks for schoolchildren, to “foodies” promoting the locavore diet, to supermarkets plugging the benefits of probiotic foods, to shoppers fearing the dangers of certain bacteria, like Listeria or E. coli, the talk on food is everywhere. Indeed, Health Canada’s online site has several pages on food and nutrition, including advice on nutrients, research programs in concert with industry and universities, and even on genetically modified and other novel foods.

At McMaster University, those themes and others are part of the fare at labs and in ongoing research studies all over the campus. Across our departments, our researchers are bringing their expertise to bear on investigations under the broad umbrella of nutrition, activity and health. They’re a remarkable group doing remarkable things, all in an effort to improve the health and well-being of Canadians.

Mo Elbestawi
Vice-President
Research & International Affairs

On the cover: Drs. Steve Collins and John Wallace of the new Farncombe Family Digestive Health Research Institute at McMaster University.

INQUIRE
IQ is published three times a year by the Office of the Vice-President (Research & International Affairs)

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Contributors Danielle D’Alvise, Mike Pettapiece, Chantal Van Raay
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Please forward inquiries to:
IQ Office of the Vice-President (Research & International Affairs)
Gilmour Hall 208, McMaster University, 1280 Main Street West
Hamilton ON CANADA L8S 4L8
(905) 525-9140 ext. 27002 | iq@mcmaster.ca | mcmaster.ca/research

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Too tired. Too stressed. Not enough time. Martin Gibala has heard the excuses, in fact, he’s guilty of giving them. But his research has shown it takes just 5 to 10 minutes of exercise a day to reap results, and that’s where his empathy stops.

“With children my life gets busy and I’m certainly not always able to devote an hour or 90 minutes a day to exercise,” says the chair of kinesiology. “So I applied an interval training approach that we have investigated in the lab and have found I’ve been able to maintain fitness even though I’m training less than I would have when I was younger. When you see the results yourself it really drives home the point that it is effective.”

Gibala’s research questions how much exercise is required to promote health benefits. It has shown that very short intense bursts of activity can be beneficial, both for athletic performance and also in treating Type 2 diabetes, through changes in skeletal muscle and improvements in blood sugar levels.

Unfortunately, he says, many people disregard public health guidelines that say exercise is essential to maintaining health. He hopes his studies, eight in all ranging from college-age adults to sedentary older adults to those with Type 2 diabetes, is taken seriously.

“Our research has been widely applied,” says Gibala, adding that researchers in Norway and Australia are conducting similar studies with those suffering from heart disease. “There is growing appreciation for the fact that interval training is not just for elite athletes but it can be applied safely and effectively with many different populations.”

Interval training is just one area of Gibala’s research. Through a new Nutrition, Activity and Health initiative, Gibala and others are exploring how nutrition can modify the adaptive response to exercise and reduce the risk for chronic disease.

Over the next few years and in collaboration with researchers from kinesiology, chemical biology and medicine, Gibala hopes to elucidate specific patterns of eating or functional foods that act synergistically with exercise to promote health in various populations. He points to recent work by colleague Stuart Phillips that showed when overweight women consumed a high protein diet during an exercise and diet-induced weight loss program, they retained more lean muscle and lost more fat as compared to a group who consumed a lower protein diet.

“We are really just scratching the surface in terms of how to fuel the body before, during and after exercise in order to optimize the beneficial effects of various types of training.”

The researchers hope to capitalize on the rapidly emerging field of metabolomics, which combines strategies to identify and quantify cellular metabolites using sophisticated analytical technologies with the application of statistical methods for information extraction and data interpretation. Conceptual approaches include metabolomic fingerprinting, which essentially involves the generation of a metabolic “signature” from a biological sample such as blood or urine.

Evaluation of how fingerprints differ between groups or change in response to specific interventions may provide valuable insight into human health and disease prevention, Gibala says. “This new and exciting area of research has unlimited possibilities. The potential for breakthroughs is substantial and with the expertise available at McMaster we will undoubtedly be at the forefront in breaking ground.”

Nutrition, activity and health: a new McMaster initiative

“...apparently less can be more! McMaster researchers prove the benefits of short term high-intensity interval training as a time-efficient but safe alternative to traditional types of moderate long term exercise.

Gibala and his research team have shown that interval training does not have to be ‘all out’ in order to be effective. He says doing 10 one-minute sprints on a standard stationary bike with about one minute of rest in between, three times a week, works as well in improving muscle as many hours of conventional long term biking less strenuously.

“...there is growing appreciation for the fact that interval training is not just for elite athletes.”

■ Martin Gibala practises what he preaches in one of McMaster’s kinesiology labs.
Fighting disease one ingredient at a time

Grocery store shelves will soon be lined with new and healthier products, capable of fighting some of the deadliest diseases. That’s according to Stuart Phillips, professor of kinesiology, who says future foods will include more detailed labels outlining health benefits – a trend widespread throughout Europe and only a matter of time before hitting Canadian shelves.

“Regulation for labeling will soon become much stricter,” predicts Phillips, a key player in a new cutting-edge Nutrition, Activity and Health initiative, aimed at studying the benefits of a healthy diet combined with regular exercise. “We know that adding a nutrition claim such as ‘a good source of calcium, high in protein, low in cholesterol, zero trans fats’ increases the salability of a food. We’re talking about proving through clinical studies that by consuming three servings of ‘food x’ you will cut your risk of developing a disease.”

Phillips begins by looking at milk. By breaking down milk into its constituent ingredients, his team is finding ways to enhance its functional properties. Milk, he explains, contains calcium, protein and naturally occurring sugar, but he is exploring other ingredients and properties that can be added to milk to augment its health benefits and ability to fight disease.

“The increasing number of regulations to make a health claim about a food really is what is driving us,” he says. “We want to create bona fide evidence that it is a health promoting food. You can’t just slap on a label that this will cure this or get rid of that. There already are labels that bear the Health and Stroke symbol. What we’re looking at is creating foods with a legitimate health claim because they were tested.”

Phillips and his team are partnering with industry to bring new items to market. A recent contract with Nestlé, for example, will allow them to fine tune ingredients in its Powerbar™ line to benefit high performance athletes. They also have contracts with and have received funding from granting agencies, such as the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research and the U.S. National Dairy Council.

Eating health promoting foods is only one piece of the puzzle – a healthy lifestyle also requires physical activity. Phillips says McMaster researchers have begun to notice that the two, when combined, are not only adaptive in terms of their benefits but are synergistic – one enhances the other. “We’re not really sure which one does what,” Phillips says, “but layering the timing of good nutrition relative to exercise appears to have some tremendous benefits.”

By working with a cross-section of researchers from across campus, including biochemistry, health sciences and biomedical engineering, Phillips hopes to investigate these issues from every angle. “We want to be able to provide evidence not just that the change happened but the mechanistic piece of evidence to back up the claim,” Phillips says, adding their research will be wide-ranging, from the performance standpoint of an athlete, to a 75-year-old who wants to maintain mobility.

Continued vigilance is needed to remind society of the important role nutrition and physical activity play in maintaining health. Phillips adds, “We haven’t invented a pill that comes anywhere close to doing everything that physical activity can do for you from a physiological and psychological perspective. He says, “Pills for all kinds of chronic diseases can help you stay alive, but if you can’t bend down to tie your shoe, play with your grandkids, go for a walk with your spouse, or simply climb a flight of stairs, then the pill has bought you time, but not quality time.”

Understanding the impact of diet and exercise on society are invigorating the breakdowns in our bodies caused by aging and disease.

Now, a recent McMaster University study aims to look into the body to see how diet, nutrition and exercise keep the muscle mass in our bodies functioning – and, as a consequence, arrest lean tissue and bone density loss, and the onset of such diseases as Type II diabetes.

That’s important as Canada ages: one estimate is that, within 20 years, the elderly will make up one-quarter of the population. And the research takes on a whole other dimension when one considers the growing problem of obesity in children and young adults.

“The bottom line is this: older adults lose muscle mass, with huge consequences. We need to better understand how and why this happens,” says Gianni Parise, assistant professor of kinesiology and a leader in the three-year study. “In my opinion, this is an enormous question. It really has an impact on every individual in society.”

It is anticipated the researchers will recruit...
They are not your every day, run of the mill lab mice. Despite looking completely normal, these genetically modified mice are unable to run even for short periods of time. Greg Steinberg, associate professor of medicine and Canada Research Chair in Metabolism, Obesity and Type 2 Diabetes, coins them “the ultimate couch potatoes.”

In addition to being unable to exercise, these mice also have high levels of glucose, an indicator of diabetes. When you exercise, even if you are obese with Type 2 diabetes, it causes glucose levels to drop into normal range, Steinberg says, “and that is why exercise is so powerful.”

Not only does his research benefit those with diabetes, but other health issues including heart disease and cancer, all of which are on a steady incline. The fast rise of these disease rates over the last 20 years directly mirrors the development of obesity, he explains. “If we look back at history we didn’t have an obesity epidemic until the last 10 or 15 years. We can’t really say our genes have changed. We’re the same people and our kids have the same genes as we had. It has to be lifestyle related.”

He uses his daughters as an example. While they eat healthy and play several sports, among their peers, they are the exception and part of a smaller percentage of today’s youth expected to live as long as their parents. An increasing number of young people are on path to shorter, unhealthier futures due to inactivity and unhealthy eating, he says. “If the obesity epidemic isn’t treated the current generation could have a shorter lifespan than their parents for the first time.”

Steinberg is working with researchers across McMaster to understand how obesity causes Type 2 diabetes and other diseases and the role nutrition and exercise play in maintaining good health. Through a new Nutrition, Activity and Health initiative, this cross-section of researchers are exploring a signature of metabolites that exercise regulates, hopeful they can one day develop a therapy that can mimic the positive effects of exercise. “By screening we can identify unique ways that exercise can regulate metabolism at the molecular level,” Steinberg says. “We have all the models and tools in place – that is completely unique to McMaster and that can give us a huge edge over what others have done.”

The researchers also hope to understand how obesity, disease, and in particular Type 2 diabetes and inactivity run parallel. Clinical trials and studies with genetically modified mice will continue to show that inflammation plays an important role in the development of many diseases, Steinberg says. “We believe that by targeting nutrition and exercise we might be able to suppress inflammation and this may be important for preventing disease.”

Steinberg takes his research to heart, not only for his children’s sake, but his grandmother was a diabetic and one of more than one million Canadians suffering from the disease.

While he was taught the importance of staying active from a young age by his parents he feels this message is now lost. “Kids spend more time in front of computers and gaming units” he says. “We also had high calorie foods, like McDonalds; so really, the activity levels are what has dropped off dramatically because of the constant need for entertainment. That’s what makes it an important issue for me to try to get a handle on. We don’t want to go down in history as the generation that let our kids have a shorter lifespan than ourselves. And unless we find a treatment for obesity and its complications, that’s what might happen.”

Battling the obesity epidemic

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Hamilton-area residents in various studies examining the impacts of diet and nutrition – along with resistance and cardiovascular exercise – on the function of muscle stem cells and related metabolic processes. The more scientists understand the dynamics of these relationships, the more they can provide answers to this “enormous question.”

Although the researchers are “really at the grassroots level,” Parisie cautions, they want to look at optimum diet and nutrition regimens – right down to the composition of proteins, fats, and carbohydrates, vitamins and other supplements – and their impacts on muscle stem cell function. If the data at the other end of the study prove significant, the researchers hope to secure further funding to extend their work. Although it’s still early days, the study might consider prepackaged food and meal offerings for the participants if that is feasible. Exercise training would be, of course, a central part of the exploration. While scientists know that preventative strategies arrest the aging process, they don’t have a lot of data that show what is happening, what molecular and cellular adaptations are occurring, what various diet and exercise inputs actually do within muscle metabolic pathways. They do know that muscle stem cell dysfunction ramps up in the absence of exercise and healthy diet structures, no matter what your genetic inheritance might be.

“It’s really never too late,” says Parisie, a fan of both running and weight training. “There’s a lot of power in physical activity.”
On the third floor of McMaster’s Health Sciences Centre, scientists are studying the tiniest of communities, intestinal flora, that thrive at the very centre of human health.

The Farncombe Family Digestive Health Research Institute is home to more than 100 people, working on discoveries that affect both the belly and the brain.

It’s fair to say that researchers here sit at the very top in Canada in terms of publications and citations. In one survey, three Farncombe members – John Wallace, Stephen Collins, and Richard Hunt – occupied the top spots in a research-impact analysis done of Canadian scientists by Net Q+A Inc., a Toronto-based consulting firm.

The survey looked at research findings published from 1976 to 2009 that dealt with digestive disease research data. The top placing accorded the three was indicative of “outstanding scientists likely to be found only at the major research laboratories”, said the survey. Overall, 12 McMaster researchers in the digestive-health field were listed among the 71 counted in the survey.

Created only two years ago thanks to a $15 million gift from the Farncombe family of Oakville, the institute builds on what was already a leading intestinal disease research program. Now, all that intellectual property on the third floor is fashioning a global ‘brand’ of excellence.

“Already we have seen the Farncombe Institute get ‘high billing’ on search engines, such as Google,” says Wallace, director of the institute. “Next year, we will host the first Farncombe Symposium – a relatively small but important international conference focused on digestive health. The CBC recently approached us to be the focus of a radio program on digestive health.”

A raised profile leads to more funding, more contacts with industry, and more collaboration with others – often international – academic research partners. It also leads to recruitment of other top-flight researchers.

Wallace counts as his favourite single achievement to date the hiring of microbiologist Michael Surette, of the University of Calgary. Wallace’s former school. He credits top McMaster scientists Stephen Collins, Eric Brown and Gerry Wright with playing major roles in bringing Surette to McMaster.

It’s early days at this point in looking for drug spinoffs from the Farncombe. Wallace notes that Hamilton-based Antibe Therapeutics, founded last year, has anti-inflammatory drugs in the pipeline that show “tremendous potential”. One, dubbed ATB-346, he calls the “shining star”. It is at the pre-clinical stage but “has performed better than any other nonsteroidal anti-inflammatory drug yet developed.” The market for this type of drug, he says, is $12 billion a year, and growing.

Investigating the workings of the GI tract disorders is a huge research arena worldwide. Gastrointestinal disorders and diseases – such as irritable bowel syndrome, Crohn’s disease and ulcerative colitis – come with a large cost to personal health, the health system, and to the economy at large.

One estimate is that they are responsible for 15 per cent of all health-care costs in Canada and for more than $1 billion in lost productivity annually. For whatever reasons, inflammatory bowel disease is more common in Canada than in any other nation.

Exploring the workings of the GI tract is in a way like tackling a great unknown frontier. More than 75 per cent of the microorganisms in the digestive system remain unidentified. They are in fact the subject of extensive genomic research around the world into the microbiome,
as scientists seek to tilt the composition of such microbial communities towards a favourable balance.

McMaster researchers have played key roles in novel digestive health studies. They were instrumental in setting up a long-term study of victims of the Walkerton tragedy in 2000, one of the worst bacterial outbreaks in Canadian history. Bacteria-contaminated water claimed seven lives and left about 2,500 ill in the Ontario town. But for years afterward, dyspepsia – chronic or recurrent digestivetract pain – lingered for many Walkerton residents. The McMaster-McGill University study showed, in many victims, that DNA variations – genetic risk factors – increased the possibility of developing post-infectious irritable bowel syndrome. McMaster has also been a leader in the brain-body connection, the sweeping somewhat revolutionary research that shows the influence of intestinal microbiota on a broad array of host organs that include the gut and the brain. Disruption of the balance between the host and the microbiota results, at least in some people, in mucosal immune system changes that cause overt inflammation, as seen in Crohn’s Disease. In turn, this dysbiosis in some irritable bowel syndrome sufferers can lead to behavioural changes and to psychiatric co-morbidity.

For years, McMaster has been a leader in the study of how probiotics benefit intestinal health. Doctors such as Collins, Elena Verdu, and Waliul Khan are uncovering the effects of probiotic administration on the immune system, on bacterial infections, and on the reduction of inflammation in the GI tract. But they’ve also been looking for some time into perturbation of gut microflora and its impact on behavioural changes and on general well-being. They have seen effects on brain neurotransmitters and impacts on appetite-control centres. Probiotic use has a demonstrated profound impact on improving the behavioural patterns of rodent subjects in the lab.

**DISCOVERY** – Unmasking the microbial world within our bodies

**One of McMaster University’s most influential research champions is fascinated with knowing the world right under his nose, or his skin, or under his breath. Michael Surette, Canada Research Chair in Interdisciplinary Microbiome Research, is internationally known for his work in showing how the presence and interactions among such bacterial pathogens as Pseudomonas aeruginosa and commensal bacteria – many of which are resistant to antibiotics – can aggravate the ravages of cystic fibrosis and contribute to other diseases, such as pneumonia.

It was Surette and colleague Harvey Rabin in Calgary who investigated the bacteria that live in lungs and air passages of cystic fibrosis sufferers. They found a previously overlooked and undetected pathogen, Streptococcus milleri (SMG). By using drugs that target SMG, and disrupting the bacterial microbiome community, severe lung infections could be controlled.

The cystic fibrosis researchers also found that seemingly benign or even beneficial microorganisms can sometimes make a pathogen more virulent. This reinforcing role had been missed by many clinicians. There was an assumption that normal microbiota did not engage in such a deadly synergistic partnership. This commensal-pathogen link will be further investigated, thanks to a $2.5 million investment this fall by the Canadian Institutes of Health Research to a McMaster-University of Calgary team led by Surette. The team will try “to understand how bacteria interact with each other and our immune system,” according to a CIHR release.

“I do believe that the findings in CF can be extrapolated to other airway infections,” said Surette, who comes to McMaster from the University of Calgary. “So we will be working to expand our studies into other respiratory infections. However, the research methodology that we use to study the airway microbiome is readily applicable to the gut.”

That means he will work with the university’s gastrointestinal scientists, many of them in the Farncombe Family Digestive Health Research Institute, who study the billions of microbes within the GI tract. Their research includes inflammation within the tract, how the gut interacts with the brain, and how understanding metabolic pathways may lead to new drugs to treat diseases.

Surette will also work with members of the Centre for Microbial Chemical Biology. That centre supports cross-disciplinary research in such departments as biology, biochemistry and biomedical sciences, chemistry, and geography and earth sciences.

“One of my primary interests is microbiome-to-microbe interactions through small molecules (chemical signals and chemical warfare). So the strengths here in microbial chemical biology provide another area of collaboration for my group. The attraction of McMaster to me as a researcher is that this is one of the few places that brings this all together.”

Scientists get down into this ultra-tiny microbe world through different routes. They can use high-throughput sequencing technology to paint the genetic landscape of a microbial strain, microbial communities at large, and their metabolites.

In addition to using a variety of these high-throughput technologies, the Surette labs are also committed to culturing the human microbiome including rare and unusual organisms.

“Understanding the complex relationship between the microbes and between the microbial community and the host will require multiple approaches.”
Can food change our behaviour?

We’ve all heard phrases such as “mood food” and “You are what you eat.” But do we really understand them? It’s true that certain foods – coffee and chocolate are examples – contain chemicals that stimulate the brain. Now, emerging evidence indicates that food may play a more subtle role in actually modulating our behaviour by influencing the composition and activity of bacteria hosted by the human body.

The gut contains vast communities of bacteria that reside in harmony with our bodies. We share our diets with these microbes and the nature of our diet influences the types of bacteria that we harbour. Recent work by researchers in the Farncombe Family Digestive Health Research Institute and in the Brain Body Institute has provided clear evidence that these resident bacteria influence brain function. For example, young mice raised in a germ-free environment have a different chemical profile in the brain and show less anxiety than mice raised under normal circumstances. In addition, the behaviour of adult mice can be changed by perturbing their resident bacterial composition, such as by administering oral antibiotics.

These observations show that our gut bacteria influence brain function, most likely via the production of metabolites. This research has therapeutic potential for the management of behavioural disorders. Studies from the laboratory of Drs. Premek Bercik and Stephen Collins have shown that specific commensal bacteria, administered as food additives in the form of probiotics, can induce changes in brain chemistry and reduce anxiety-like behaviour in mice. The researchers – in collaboration with Dr. Elena Verdu – have also shown that specific probiotic bacteria can restore normal feeding behaviour in mice whose eating patterns had become distorted after a stomach infection.

Thus, it may be possible to influence a spectrum of behaviours, ranging from appetite to mood, by providing specific probiotic bacteria or by promoting the selective growth of these within the gut by modifying dietary components.

Bercik is now conducting a clinical trial of a probiotic on Irritable Bowel Syndrome (IBS), the most common gastrointestinal condition seen in our society. Up to 60 per cent of IBS patients exhibit such behaviours as anxiety or depression. Bercik will determine whether this Lactobacillus probiotic will improve not only gastrointestinal symptoms but also psychiatric symptoms.

“The notion that our resident gut bacteria might influence brain chemistry and behaviour is novel and much of our original work has been conducted here at McMaster” says Collins. “The possibility that we may be able to alter behaviour by modifying the bacterial composition of the gut, using probiotics or dietary modification, is exciting. But I have to stress that we must be cautious in extrapolating our work into humans at this time. We must await the results of clinical studies.”

HIGHLIGHTS

Food intolerance

Complaints of intolerance to certain foods are increasingly common in our society and may reflect a number of mechanisms, most of which are poorly understood, says Dr. Elena Verdu, of the Farncombe Family Digestive Health Research Institute.

The term, food hypersensitivity, covers a number of adverse reactions to food. Peanut allergy is an example of a potentially life-threatening food allergy with rapidly developing symptoms. There is another type of hypersensitivity that develops more subtly and does not involve allergic reactions.

Many people eat wheat and other cereals. For some genetically predisposed persons, a diet that includes large amounts of gluten, the protein in wheat, causes celiac disease. Ingestion of wheat, barley and rye causes damage to the lining of the gut, and impairs the absorption of nutrients. Recent research offers the hope of treatment for people with gluten sensitivity.

Celiac disease is very common worldwide. In North America, the disease affects one in 100 people. Studies have shown that celiac disease is four times more common than it was 50 years ago.

Symptoms can range from diarrhea, weight loss, malnutrition and anemia to neurological symptoms and mood disorders. Hypersensitivity to gluten can contribute to many illnesses, including Type 1 diabetes. And celiac disease can be a silent killer if left undiagnosed.

Animal model studies of gluten sensitivity performed in Verdu’s laboratory have demonstrated that gut dysfunction can be triggered by gluten, even in the absence of overt celiac disease. This has been recently confirmed in clinical studies that show that, in a proportion of patients with Irritable Bowel Syndrome (IBS), gluten ingestion contributes to generation of gut symptoms.

When gluten-containing foods are identified as aggravating symptoms in a patient with IBS, physicians may advise on lifestyle and dietary changes, such as a gluten-free diet. However, that is a challenging diet – it is both expensive and can cause constipation because of its low fibre content.

Many aspects of how gluten causes damage and dysfunction to the gut have been unravelled. This research means that implementation of treatment and prevention strategies is a feasible goal. Verdu asks: “Is it possible then to develop a pill that could be taken before a meal rich in gluten, or when the gluten content of a meal cannot be ascertained?”

Such an approach has been successful with lactose intolerance. She has tested the efficacy of one gluten treatment, based on the binding of gluten by a specific polymer. While polymer therapy is in a pre-clinical discovery phase, such an approach would allow much greater diet freedom for those with celiac disease and gluten-sensitive IBS.
Anthropologist Tina Moffat often goes off campus and into elementary schools with her food and nutrition teachings. That way, she makes sure her message gets home.

She talks to parents and primary school educators, to community leaders and politicians, about the need for changes in how we eat, what we consume, and about the growing menace of obesity. “What I try to do is to give people the information they can use to create a new program in the schools, to create a policy change,” says the associate professor in the department of anthropology.

It’s an outreach she has been engaged in for years, here in Canada and even in Nepal. The idea is to gather research and to use that research to help change public policies, cultural mores, and bad eating habits wherever possible.

“As humans, we tend to want to acquire as much high-density food, such as fat and sugars, as we can – without expending a lot of energy to do it.” That, and other factors, such as aisles full of fast and processed foods, have led toward this march to obesity and related diseases.

Now, politicians are promoting nutritious snacks or milk programs for kids and schools are junking pop vending machines. In the U.K., the government has banned television ads that hype unhealthy foods in children’s programming. She suggests that we should consider these kinds of policy changes in Canada.

Moffat and colleagues at universities in Calgary and Toronto are currently doing focus groups and other data-gathering research on another food-related problem, the deficiency of Vitamin D stores in the body and in daily diets.

That has led to rickets in some children, even in a developed nation such as Canada, especially among many new Canadians. For example, breast-fed babies of new immigrants may not be getting enough Vitamin D. Long winter months, with inadequate sunshine – ultraviolet light in the sun’s rays helps the body produce Vitamin D – exacerbate the problem in northern latitudes.

So Moffat and others, such as the Canadian Paediatric Society and the Canadian Cancer Society, are urging that Canadians, especially pregnant women, take more Vitamin D supplements. Her studies and subsequent research reports in scientific journals – she and colleague Tracy Prowse have also written a book looking at diet and nutrition from past to present – have taken Moffat from schools in Hamilton to rural villages in Kathmandu, Nepal. In Hamilton, she has looked at how life in socially and economically contrasting neighbourhoods affects children’s body size, diet and physical activity. In Nepal, she studied the nutritional and health status of children under age five, whose mothers worked as weavers and spinners in the carpet-making industry.

Poor sanitary conditions in Nepal was a prime factor in chronic childhood illnesses such as diarrhea, respiratory infections, and the presence of gastrointestinal parasites.

It is rewarding, she says, to get inquiries and thank you notes from people after the fact. Aid workers in Nepal have written to ask for her data to help mount campaigns for change and make social and physical infrastructure gains.

Sometimes, the intensity of her research has led her to challenge some societal orthodoxies. For example, she questions what is often a medical take on obesity: let’s find a new drug, let’s bring on a dietary intervention program.

“My take on this is that we need to talk to each other. Let’s take a step back and not do quick fixes, quick solutions.”

Such answers seem to her to miss the larger picture of making changes in political, economic, and sociocultural beliefs and practices. Bring good food health closer to home, she says. One way, she adds, is through the locavore movement, which stresses eating fruits and vegetables grown closer to home and not trucked in from Mexico or California.

“Not only does local food taste better, it allows us and our children to understand where food comes from and how it’s produced, which leads to healthier eating.”

■
In her research, microbiologist Lori Burrows often runs head-on into an irony of our hurry-up world: we love packaged conveniences, like sandwich meats or prepared snacks, but pay a price when these wonders of food technology become high-risk hosts of foodborne illnesses.

Indeed, Canadians have been thrown into panic by news of foodborne illnesses. Recent examples include the 2008 Listeria outbreak, linked to a Toronto meat-packing plant, that caused several deaths, the infected salami made by another Toronto factory in 2009 and, in mid-November this year, when some ham and cheese sandwiches in the Maritimes reportedly were contaminated with Listeria monocytogenes.

“People eat more prepared foods now than perhaps, say, 30 years ago when people ate more cooked foods,” says Burrows. Even salt, which controls Listeria growth, no longer shows up in the same quantities today, as governments regulate sodium content in prepared foods. Listeria also survives refrigerated temperatures well.

The intracellular bacterium, Listeria, is the causative agent of listeriosis, an often-fatal disease. For those who become infected, Listeria fatality rates exceed those of Salmonella. This foodborne pathogen can wreak havoc on people with immuno-compromised systems, such as those in nursing homes. It can lead to spontaneous abortions or stillbirths in some pregnant women. Monocytogenes easily make themselves at home in human gastrointestinal tracts.

A similarly opportunistic and deadly pathogen, Pseudomonas aeruginosa, is found in soil, water, skin flora, and human-created environments. Pseudomonas thrives on most surfaces and is a particular problem in hospitals and clinics, where the bacterium can be found on devices such as catheters. Both Listeria and Pseudomonas have shown increasing resistance to antibiotics in recent years.

Which means Burrows has to invade Listeria’s nano-world via electron microscopy to shadow the micron-long bacterium. (A micron is a unit of length equal to one millionth of a metre.) She uses the university’s high-throughput drug-screening technology to search for compounds that impact formation of biofilms. These are the self-produced matrix of bacterial colonies, in which cells adhere to each other or to a surface, even to stainless steel.

“The search can seem riddled with contradiction. For example, Burrows and others – a Master’s student in her lab is studying listeria biofilms under a two-year program sponsored by the Canadian Food Inspection Agency – look at compounds that can inhibit or accelerate biofilm stimulation. If you can understand the impact of accelerants – scientists have found that some anti-cancer drugs affect biofilm generation – you may get insights into the biochemical pathways of growth. These insights might lead to innovation in new drugs. ■

■ Electron micrograph of Listeria monocytogenes biofilms grown on stainless steel.
Photo: Uyen Nguyen
The quick and upfront response by Maple Leaf Foods, crossing up to a disastrous health scare in 2008 remains a Canadian case study of doing the right thing. “They were fighting for survival,” says Terry Flynn, assistant professor in communications management at the DeGroote School of Business. “If they couldn’t have garnered public trust, they were finished. Because the switching costs (buying another brand) are so minimal for consumers.”

Maple Leaf Foods was at the eye of a storm when a listeriosis outbreak became very public in August 2008. Ultimately, more than 20 people died and many others became ill. The illness was caused by the Listeria monocytogenes bacterium, which was found on meat-cutting equipment in a company plant in Toronto. The panic battered the company’s reputation, its employees, and its stock price.

The Maple Leaf Foods (MLF) story accorded well with a predictive model of corporate survival developed by Flynn. A specialist in crisis-management situations, he looked at such factors as a company’s openness and communicative policies, its high-crisis mindset, and its values approach to doing business. Simplified, Flynn’s model suggested that a company with inherent transparent values would be most likely to come out the other end of an organizational disaster.

The MLF saga gave him a unique ability to test his model. As a member of Leger Marketing’s scientifi c advisory panel, Flynn benefitted from Leger’s national opinion surveys done in the months after the crisis. Those surveys gauged how consumers reacted to the company’s messages.

MLF recalled more than 240 types of meat offerings, recorded video news releases, bought advertising, and posted videos on YouTube. Class-action lawsuits were settled quickly. CEO Michael McCain held press conferences and posted an apology on the company’s website. Leger’s surveys showed that, within a month of the recall, Canadian opinion of MLF was on the rise. The polling backed up Flynn’s predictive model. MLF did not fail.

Crossing over to nutraceutical research is a natural fit for chemical engineering professor Todd Hoare, whose research focus has been on the potential use of gel nanoparticles to deliver ‘smart’ medicines to sites within the body that need treatment for disease, infection or tumours. He engineers on the nano-scale, creating tiny polymer delivery vehicles that act as containers for drugs that can be time-released, activated with elevated body temperature, or triggered upon exposure to a particular biological environment inside the body.

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