Informing OHS Action

2021
Activity Report







irsst Institut de recherche Robert-Sauvé en santé et en sécurité du travail

DECLARATION OF DATA RELIABILITY

I declare that I have every reason to believe that the observable facts and measurable data presented in this activity report accurately reflect the situation at December 31, 2021.
This information falls under my responsibility as president and CEO of the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST). I hereby attest to its accuracy and the reliability of the controls relating thereto. The indicators retained are developed using reliable and accurate data, and allow us to assess the IRSST's production over the course of the year. Recommended by the members of the Institute's Scientific Advisory Board and approved by the Board of Directors, the 2021 Activity Report faithfully describes the Institute's mission, vision and principal achievements.

Lyne Sauvageau

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Mission

In keeping with the spirit of the *Act respecting occupational health and safety* (AOHS) and the *Act respecting industrial accidents and occupational diseases* (AIAOD), the IRSST's mission is:

To contribute to workers' health and safety through research, its laboratories' expertise, and knowledge dissemination and transfer, with a view to promoting prevention and sustainable return to work.

Vision

- **A leader** in the advancement and mobilization of scientific and technical knowledge in occupational health and safety (OHS), we are recognized at the national and international levels for the quality and relevance of our achievements;
- **Present and influential** on our OHS partners and in the public sphere, our expertise informs our actions aimed at improving the health and safety of Québec workers;
- A **forum for collaboration, creativity and innovation,** we offer a healthy and exemplary work environment that supports initiative and the recognition of individual and collective achievements.

Values

Proud of our mission and committed to achieving our vision, we embody the following values:

- **Excellence,** as the foundation of the IRSST's credibility and leadership;
- **Agility,** to anticipate and respond to needs and emerging problems;
- **Openness,** to capitalize on the diversity of people, ideas and disciplines;
- **Integrity and transparency,** as the heart of our work, exchanges and actions.

Message from the President and CEO

Credit: IRSST

Lyne Sauvageau,
President and CEO,
IRSST

Since its founding, the IRSST has worked in an ever-changing environment reflecting sociodemographic, technological, regulatory and normative changes in the workplace. The year 2021 was highly noteworthy in this respect. It was marked not only by the need to tackle the many challenges arising from both the COVID-19 pandemic and the major legislative amendments associated with the adoption of Québec's *Act to modernize the occupational health and safety regime*, but also by major changes within the Institute itself.

The restructuring carried out in February 2021 led to a clearer definition of the mandates of the IRSST's four main scientific levers (research, knowledge mobilization, laboratory services, funding programs) and to their official identification within the organizational structure. This restructuring was motivated by a firm resolve to enable us to select the best lever(s) for responding to new knowledge needs and informing OHS action. In addition to consolidating the mandates of the Institute's different divisions, it encouraged ongoing collaboration among the divisions and identified the partnerships to be prioritized or reinforced to support all our scientific activities.

Likewise, the Scientific Advisory Board was asked to play a greater role and provide more input. With the Board's in-depth knowledge of current and emerging OHS issues and problems, it will be able to help and guide those in charge of the four main scientific levers in terms of their strategic choices. This expanded role was already evidenced during this past year in the very first Research Project Grant competition.

We also had the opportunity to look to the future when writing our 2022–2025 Strategic Plan. Adopted at year-end by our Board of Directors, this plan was the result of an in-depth reflection process and broad consultation with our personnel, stakeholders and partners. It presents an updated version of our mission, vision and values, and defines the main areas of action to be prioritized for the next four years. Research remains at the heart of our mission, along with our laboratories' expertise and the dissemination and transfer of knowledge.

The 2021 year was also filled with a host of achievements, including our successful virtual colloquium. Held under the theme *La recherche en SST au service des milieux de travail en période de pandémie* [OHS research serving workplaces during a pandemic], it cast the spotlight on our initial research results arising from our call for proposals on COVID-19-related projects. Other concrete examples were the launch of the *L'incapacité et le retour au travail* [disability and return to work] Web site, designed for the different actors involved in rehabilitation and return to work, and the reactivation of our grants program in a new form.

Last but not least, I wish to pay tribute to the memory of our very first CEO, Yves Martin, who left us in February 2021. Over 40 years ago, he devised the unique model that still characterizes the Institute today, an important legacy for the entire OHS community.

In closing, I am very proud of our many accomplishments in 2021, largely attributable to the talents, expertise, commitment and mobilization of the IRSST's personnel. I am also confident that we will fulfill our ambitions in the years ahead in order to carry out this most-cherished mission with the collaboration of our scientific partners and the workplace community.

Lyne Sauvageau

2021 in Numbers

Research

110 active research projects

- **13** begun (5 joint, 7 external, 1 internal)
- **22** completed
- **75** in progress

245 external researchers

from **25** universities, **15** research centres and **4** college centres for the transfer of technologies (CCTSs) formed part of the IRSST's network of scientific collaborators.

49 IRSST researchers and scientific professionals

participated in research projects in 2021.

Our laboratories

37, 234 analyses

environmental, toxicological and microbiological analyses were performed in response to all our clients' requests.

Nearly 6,520 hours were devoted

to calibrating, maintaining and repairing direct-reading and sampling instruments.

38 activities were carried out

to develop analytical and testing methods

Communications, strategic watch and knowledge mobilization

89 IRSST-produced materials

- **32** research and expertise reports, including **23** in French and **9** in English
- **18** guides and technical and awareness-raising tools, including **15** in French and **1** in English, as well as **2** Web-based fact sheets
- **8** laboratory methods
- **31** videos (lectures and news reports)

490 media activities

- **104** mentions in the traditional media
- **252** mentions on the social networks
- **39** mentions on Web sites and in newsletters
- **77** interview or information requests received by our experts
- **18** news releases issued

78 scientific publications

related to projects carried out or funded by the IRSST:

- **51** peer-reviewed journal articles
- **11** peer-reviewed articles published in conference proceedings
- **16** book chapters

29 lectures

given by IRSST personnel or IRSST-funded researchers at congresses, scientific conferences or events organized by partners.

4 issues of *Prévention au travail*,

the magazine published jointly by the CNESST and IRSST:

- **19** simplified articles
- **+ 22** news briefs published in the «Actualités» column of the magazine

Web and social networks

- **768,274** sessions on the IRSST's Web sites
- **1,005,832** unique downloads of IRSST publications
- **62,501** views of IRSST-produced videos on our various platforms
- **7,005** subscribers to *InfoIRSST*, the Institute's electronic newsletter
- **26,644** subscribers to the IRSST's various social networks

Scholarships and fellowships

33 graduate scholarships and postdoctoral fellowships

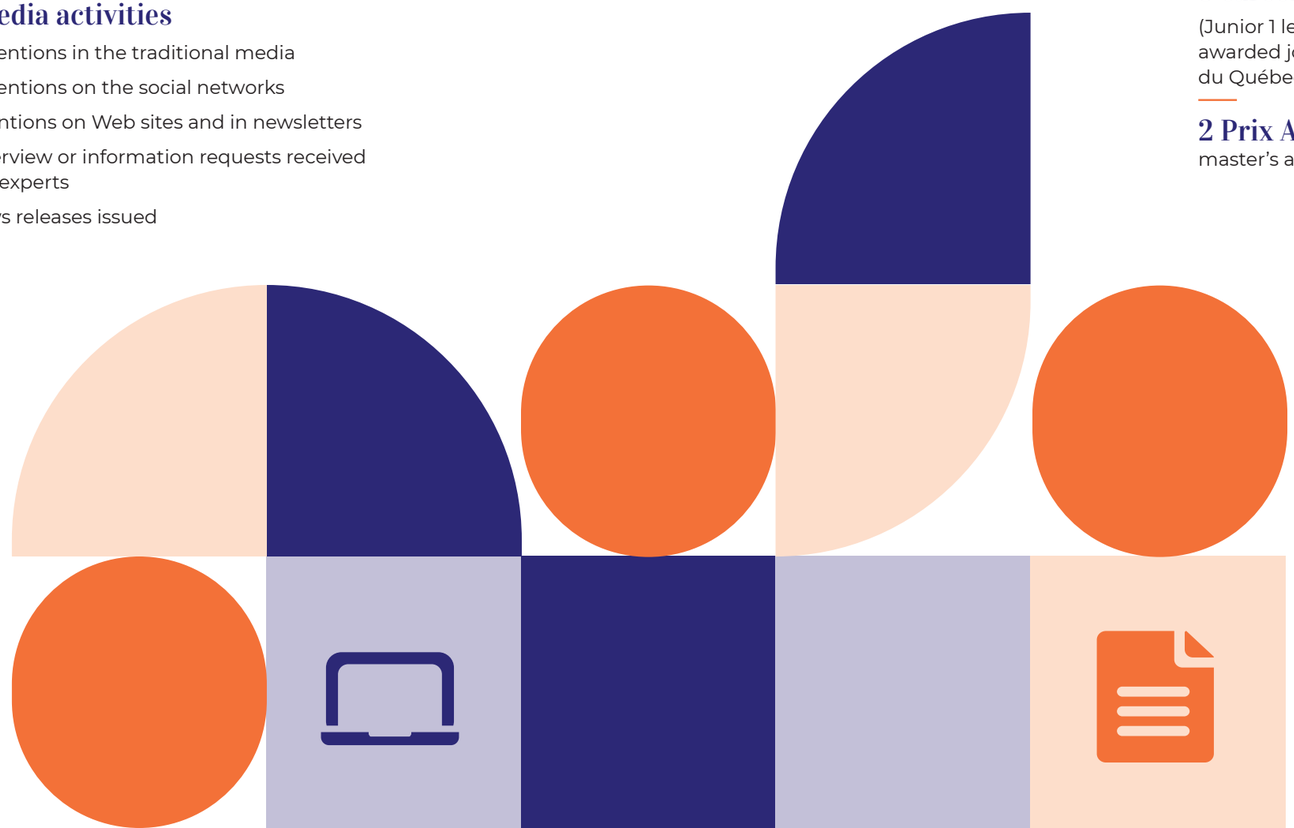
awarded to master's, doctoral and postdoctoral candidates whose research programs related specifically to the prevention of industrial accidents and occupational diseases or the rehabilitation of affected workers.

3 career scholarships

(Junior 1 level) in occupational health and safety awarded jointly with the Fonds de recherche du Québec (FRQ)

2 Prix Acfas-IRSST,

master's and doctoral levels



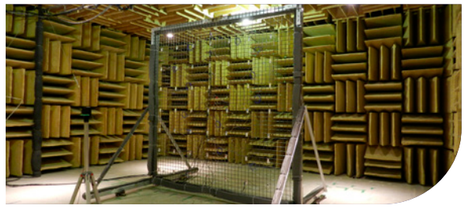
Credit: Pierre-Luc Dufour

Research

Every year, the IRSST's scientists and the external researchers whose work it funds conduct research and publish results that help advance occupational health and safety (OHS) knowledge, with a view to promoting prevention and sustainable return to work.

In 2021, **110 research projects** were under way, with **22 of them** reaching completion. Examples of projects whose results were published in 2021 are provided in this section.

Noise



Credit: Olivier Robin

Innovation for backup alarms

The use of backup alarms is mandatory on most heavy vehicles and remains a widely used means of alerting nearby workers. However, several IRSST studies have shown limitations in the effectiveness of these alarms in terms of minimizing the risks to worker safety. In Report R-1117-fr, titled *Étude de l'applicabilité de haut-parleurs paramétriques au développement de nouveaux concepts d'alarmes de recul* [study of the applicability of parametric speakers to the development of new backup alarm concepts], **Alain Berry** and **Olivier Robin**, researchers at Université de Sherbrooke, and **Hugues Nélisse**, a researcher at the IRSST, showed that the use of this type of speaker offers a promising avenue for developing backup alarms with significant advantages. Even so, their immediate application still faces numerous hurdles, including the low volume level of the prototype developed compared to that of existing alarms.

Occlusion effect

Wearing hearing protectors or hearing aids obstructs the ear canal and can cause an unpleasant effect known as the "occlusion effect." This manifests as a sensation that one's own voice sounds different and distorted, with the lower frequencies amplified. Many workers complain about the discomfort caused by the occlusion effect of wearing hearing protectors, and as a result, tend to use them less or not at all. Although methods exist for measuring this effect, there is no consensus in the scientific community on the best method to use, nor has any method been standardized. In Report R-1118-fr, titled *Mise au point d'une méthode de mesure objective de l'effet d'occlusion basée sur la voix* [development of a voice-based method for objective occlusion effect measurement], **Hugues Nélisse** and **Franck Sgard** of the IRSST, in collaboration with researchers at

Franck Sgard

Hugues Nélisse

École de technologie supérieure (ÉTS), tested a unique approach that involves measuring this effect with miniature microphones placed in the ear canal and using the wearer's own voice as the source of excitation. The researchers consider this method well suited to potential use in the field and as possibly leading to the development of a standardized method.

Measuring sound exposure

Headed by **Hugues Nélisse**, an IRSST-funded research team developed and evaluated a method, based on in-ear dosimetry, for accurately measuring the actual individual in-ear noise exposure experienced in the workplace. Through a variety of tests conducted on human subjects, the researchers created in-ear devices for this purpose, and developed algorithms indicating the sound exposure in order to detect, and if need be, exclude noise disturbances that wearers may emit themselves when wearing an in-ear dosimeter. The conclusions of this study are presented in Report R-1126-fr, titled *Développement d'une méthode de mesure de l'exposition sonore effective intraauriculaire pour une utilisation en milieu de travail* [development of an effective in-ear method for measuring sound exposure, for use in the workplace].

Exposure to chemical products

Thermal stress and chemical products

Thermoregulation refers to the body's internal mechanism for regulating body temperature. Many of the physiological changes associated with thermoregulation, such as alveolar ventilation and the redistribution of blood flow to organs, can influence the kinetics of chemical compounds in the body. The accompanying exposure to heat and volatile chemicals can result in variations in inhalation absorption and in the kinetics of these compounds. **Sami Haddad**, a researcher at Université de Montréal, conducted an IRSST-funded study to assess the influence of temperature on various physiological parameters and on the kinetics of three volatile industrial solvents (toluene, acetone and dichloromethane). Report R-1105-fr, titled *Impact d'un stress thermique représentatif des milieux de travail sur l'absorption pulmonaire et la toxicocinétique de trois solvants organiques* [investigating the impact of typical workplace thermal stress on the pulmonary absorption and toxicokinetics of three organic solvents], concludes that the interpretation of biological exposure index values should take should take exposure temperature into account, particularly for the interpretation of blood concentrations.

Skin exposure to pesticides

The potential effects of pesticides on worker health have been widely reported in the scientific literature, and skin contact is often mentioned as a significant pesticide exposure route. IRSST ergonomist **Caroline Jolly** and her research team developed a mixed methodology (combining ergonomics and exposure science) for documenting potential external skin exposure, exposure situations and prevention practices associated with apple producers. Report R-1132-fr, titled *Mise en visibilité des situations d'exposition cutanée aux pesticides et des pratiques de prevention : développement méthodologique réalisé en collaboration avec des producteurs de pommes québécois* [raising awareness of skin exposure to pesticides and prevention practices: methodological development undertaken with Québec apple producers], describes exposure situations and prevention practices, the basis for potentially envisaging actions to promote the reduction of skin exposure to pesticides. The range of work situations and exposure highlights the importance of taking the actual work activity of apple growers into account when developing prevention methods.

Caroline Jolly

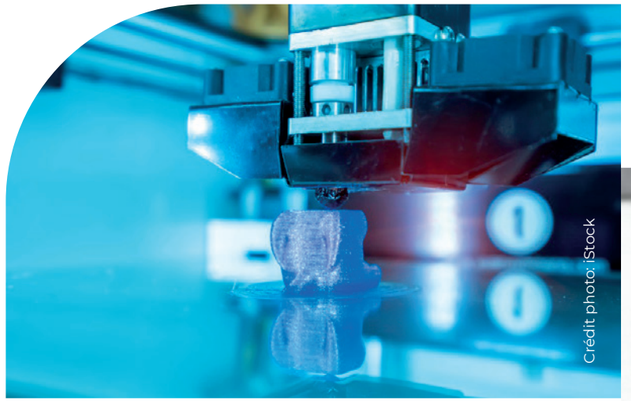
Credit: iStock

New risks

Human presence detection technologies

Despite the many safety measures put in place on construction worksites, accidents involving collisions between workers and mobile machinery unfortunately still occur. The CNESST therefore asked the IRSST for a report on this ongoing problem. **Alireza Saidi**, a researcher at the Institute, responded by preparing Report QR-1120-fr, titled *État de l'art portant sur les technologies de détection de personnes applicables aux chantiers de construction* [state of the art of human presence detection technologies applicable to construction sites]. It discusses the standards and regulations in force regarding proximity detection systems, as well as most of the technologies for detecting human presence in the vicinity of mobile machinery, and includes an exhaustive list of commercially available systems for equipment used in construction and related sectors. It also provides an overview of the main research on this issue in occupational health and safety research centres around the world, and presents the advantages, limitations and costs of each technology.

Alireza Saidi



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3D printing

While 3D printing (known as additive manufacturing) is increasingly widespread in workplaces, it is still difficult to identify the affiliated occupations and assess the number of workers affected by this new technology. Two literature reviews performed by **Mohamed Zemzem** (a postdoctoral researcher affiliated with Université de Montréal's École de santé publique), **Ludwig Vinches** (from the same institution) and **Stéphane Hallé** (from the ÉTS) compiled all possible information on 3D printing and its implications for workplaces, specifically regarding exposure to ultrafine particles (UFPs) and volatile organic compounds (VOCs). The researchers identified seven of the major additive manufacturing technologies used in the workplace. They found that workers' risk of exposure was greatly increased by the wide variety of printable materials used. They also noted that the parameters of use, such as extrusion temperature and speed, play a major role in workers' exposure to UFPs and VOCs. All these issues are discussed in Report R-1122-fr, titled *Exposition des travailleurs aux particules ultrafines et aux composés organiques volatils émis lors d'un processus d'impression 3D : État des lieux au Québec* [worker exposure to ultrafine particles and volatile organic compounds emitted during 3D printing: process inventory in Quebec].

The body at work

Crédit photo: iStock

Foot movements of material handlers

In Report R-1134-fr, titled *Développement, validation et application d'une méthode quantitative pour évaluer les déplacements des pieds des manutentionnaires* [development, validation and application of a quantitative method for assessing material handlers' foot movements], IRSST researcher **André Plamondon** and his team described the improvement and validation of an existing approach to quantifying material handlers' foot movements. Using earlier data obtained in laboratory studies on expert and novice handlers, they validated the improved method, which automatically classifies foot placement strategies through observation. This study also generated new knowledge that can be used to enhance training programs for material handlers.

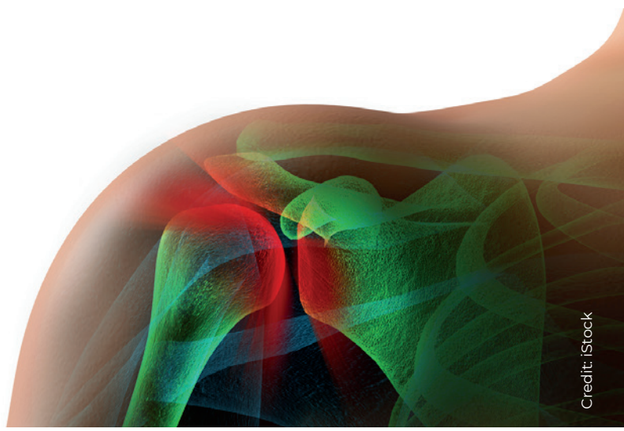
Shoulder injuries

Musculoskeletal shoulder injuries are a frequent occurrence among workers. They cause long work absences, reduce productivity and sometimes lead to early retirement. Lacking a standardized approach for evaluating and managing these injuries, clinicians base many of their clinical decisions on intuition and experience rather than scientific evidence. To remedy this situation, an IRSST-funded research team headed by **François Desmeules**, a researcher at Université de Montréal, produced a series of documents providing recommendations and decision-making algorithms based on the best available evidence and adapted to the Québec context. Five documents (R-1119-fr, RA-1119-fr, DT-1119-fr, RG-1119-fr and RG2-1119-fr) were made available for use by workplaces and clinical practitioners.

André Plamondon

Elbow pathology

Lateral epicondylitis of the elbow, commonly known as "tennis elbow," is a frequent, painful and debilitating condition associated with overuse of the wrist and forearm. The medical treatment combining ergonomics with a recommended exercise program facilitates healing in 80% of patients at 12 months. However, surgery is indicated when this option fails. A new procedure called ultrasound-guided fenestration may also be proposed to patients. An IRSST-funded study headed by **Nathalie J. Bureau** of the Centre de recherche du Centre hospitalier de l'Université de Montréal (CRCHUM) assessed the therapeutic efficacy of this technique compared to that of open-release surgery in workers suffering from chronic epicondylitis who had not responded to at least six months of medical treatment. The researchers also assessed the impact of these two treatment options on various aspects of occupational activity. The results of this study are presented in Report R-1128-fr, titled *Traitement de l'épicondylose latérale chronique du coude. Essai clinique randomisé à simple insu évaluant l'efficacité de la fenestration écho-guidée et celle de la chirurgie par approche ouverte* [treatment of chronic lateral epicondylitis of the elbow: single-blinded randomized clinical trial to assess the effectiveness of ultrasound-guided fenestration versus that of open surgery].



Credit: iStock

Soils

Be careful, it's slippery!

Many workers rely on their work boots to keep them from slipping in winter. Report R-1136-en, titled *Evaluation of Test Methods for Determining Footwear Slip Resistance on Ice Surfaces*, describes how **Chantal Gauvin**, a scientific professional at the IRSST, together with researchers from the Kite Research Institute in Toronto, developed and evaluated a mechanical test method using the SATRA STM 603 measuring device to determine footwear slip resistance on icy surfaces.
They compared this method to the Maximum Achievable Angle (MAA) test developed by KITE. This study also assessed the overall performance of several models of boots to help workers make better choices of footwear.

Particularities of Québec soils

Trench excavation work exposes workers to numerous risks, such as cave-ins. In Québec, while trench work is regulated, the regulation does not include a soil classification that would allow for implementation of a strategy to eliminate the risks associated with this type of event at the source.
IRSST researcher **Bertrand Galy** and his team reviewed and updated methods for calculating trench excavations to take into account the specific geotechnical nature of Québec soils.
In Report R-1144-fr, titled *Classification des sols et sélection des systèmes d'étançonnement pour l'excavation des tranchées* [soil classification and selection of shoring systems for trench excavation] and in a supplemental document (RA-1144-fr), the researchers proposed a soil classification adapted to Québec's geotechnical conditions and made recommendations, notably regarding safe slope angles for unshored excavations.

Bertrand Galy

Marc-Antoine Busque

Chantal Gauvin

Statistical surveillance

Change in numbers of occupational injuries

The number of lost-time occupational injuries trended downward in Québec from the end of the 1980s to the mid-2010s, as in the rest of Canada. In fact, in Québec, the number dropped from 218,700 in 1989 to 73,900 in 2017, representing a decrease of 66.2%. A team of IRSST scientists composed of **Marc-Antoine Busque**, **Martin Lebeau** and **Alexandre Boucher** examined data for the 2005–2007, 2010–2012 and 2015–2017 periods to find out how the relative distribution of the labour force, the average annual number of hours worked and the specific injury frequency rates observed might have influenced the change in the number of occupational injuries reported and accepted at the CNESST. The results of their analysis are presented in Report R-1140-fr, titled *Évolution du nombre de lésions professionnelles acceptées survenues de 2005 à 2017 : effet de l'évolution de la main-d'œuvre et des taux de fréquence de lésions* [change in the number of occupational injuries accepted from 2005 to 2017: the impact of changes in the labour force and injury frequency rates].

Credit: iStock

The cost of work-related road accidents

Work-related road accidents (WRRAs) are particularly costly owing to the severity of the injuries they cause. They are also one of the rare types of accidents involving workers and people who are not working. These other victims make the WRRA burden even heavier. **Martin Lebeau**, an economist at the IRSST, and his colleague **Patrice Duguay** published Report R-1145-fr, titled *Le coût des accidents routiers au travail survenus au Québec de 2001 à 2015* [the cost of work-related road accidents in Québec from 2001 to 2015]. Not only does it provide a better understanding of the consequences of WRRAs for Québec society, but it also identifies the characteristics and groups of workers associated with the costliest WRRAs.

COVID-19: Returning to the office

Headed by IRSST researcher **Bénédicte Calvet**, this study sought to improve understanding of issues related to the organization of work and the arrangement of work spaces and to facilitate the return to offices following the COVID-19 health crisis. The results and findings obtained led to the publication of Guide DT-1146-fr, titled *Le retour au bureau à la suite de la crise sanitaire de la COVID-19: démarche pour une transition vers de Nouvelles organisations du travail*, designed for those responsible for returning staff to the office.

The guide was presented numerous times in 2021, including to the Public Service Alliance of Canada in November. Speakers **Maud Gonella**, a scientific professional at the IRSST, and **Martin Chadoin**, a professor at UQÀM, presented the main points to a bilingual audience of more than 100 attendees. It was translated into English (Guide DT-1146-en) and titled *Returning to the Office After the COVID-19 Health Crisis: An Approach to Transitioning to a New Organization of Work*.

Martin Lebeau

Bénédicte Calvet

Maud Gonella

Disability and return to work

Despite the vast scientific knowledge available on work disability, it is often hard to disseminate it to the workplaces and actors concerned. One research team worked to create a new Web site on disability and return to work to fill this gap. Under the leadership of IRSST researcher **Christian Larivière**, with the participation of the Réseau provincial de recherche en adaptation-réadaptation (REPAR), this Web site (retourautravail.irsst.qc.ca) was designed for the various actors involved in rehabilitation and return to work, and provides a wide range of information to prepare them to implement their process.

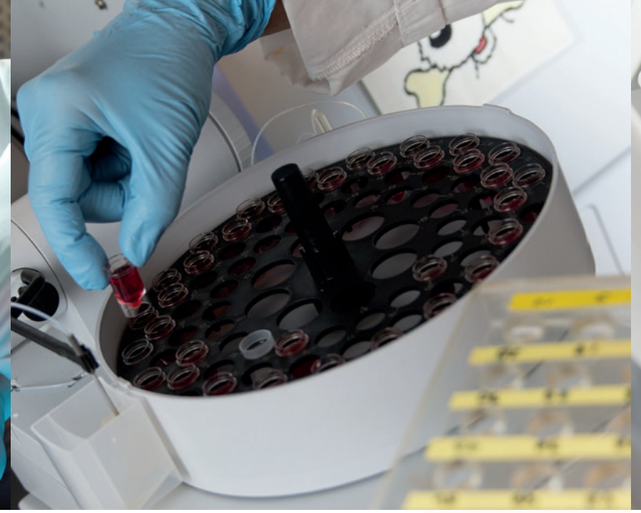
Christian Larivière

Credit: IRSST

Our Laboratories

Each year, while responding to requests for environmental, microbiological and toxicological analyses from the CNESST and its network, the staff of the IRSST's laboratories also carry out a variety of activities and take part in research projects that would be impossible without their occupational hygiene expertise.

Credit: Pierre-Luc Dufour



Development activities and Schedule 1 of the ROHS

Always striving to remain at the vanguard of analytical and testing methods in occupational health and safety and to provide optimal support to all its clients, the Laboratory Division put forward a plan for developing its methods. These activities address regulatory amendments, specifically those made to Schedule 1 of the *Regulation respecting occupational health and safety* (ROHS), as well as technological and IT changes, the deployment of new services and questions related to COVID-19. The Laboratory Division's scientific and technical team thus began or completed **38 development activities.**

Our laboratories' expertise

The IRSST's scientific and technical expertise was sought in 2021 for a quick evaluation of the toxicological risk to human health of wearing procedure masks that contain graphene nanoparticles**. Simon Aubin**, the assistant director for research in the Laboratory, along with colleagues in the Research and the Communications, Strategic Watch and Knowledge Mobilization divisions, contributed to the publication and dissemination of the fact sheet titled *Les masques jetables gris contenant des nanoparticules de graphène sont-ils dangereux pour la santé ?* [are disposable grey masks containing graphene nanoparticles harmful to health?]

Accreditations

AIHA LAP, LLC audit:

The American Industrial Hygiene Association (AIHA) audited several sectors of the Laboratory Division in March 2021 through its Laboratory Accreditation Program (AIHA LAP, LLC). Upon completion of the audit, the complete scope of our laboratories accreditation was renewed, attesting to the high quality work done by their team of professionals and all their technicians, and to the constant, enlightening support of the quality assurance team. This recognition, which reflects on the IRSST as a whole, concerns more specifically the asbestos, metal (including beryllium), silica, solvent, ion, compressed breathing air and microbiology sectors.

Renewal of accreditations:

- Those of the Standards Council of Canada for the calibration laboratories (Acoustics and Vibration, Electrical, Frequency and Time, Dimensional) following an audit under the CLAS program of the National Research Council of Canada (NRCC).
- That of the laboratory accreditation program of the Wadsworth Center of the New York State Department of Health (NYSDOH ELAP) for the analysis of asbestos fibres by transmission electron microscopy in non-friable, organically bound bulk materials.

Expanded service offer

The IRSST mobilized its forces in the pandemic context to, among other things, develop and offer a service that evaluates the performance and efficiency of respiratory protective devices (RPDs). In 2021, the Laboratory Division performed **several hundred analyses** of barrier masks and N95-type RPDs. The IRSST also obtained accreditation from the Standards Council of Canada concerning evaluation of the filtration efficiency and differential pressures of filtering facepiece respirators (FFRs) according to IRSST procedure I-APR-001 and the method described in Annex A of the attestation document BNQ 1922-900.

The Research Fund

The IRSST has played an essential role in building and maintaining an occupational health and safety research community in Québec for four decades. The Institute attracts OHS researchers and orients their work toward priority areas by offering a variety of programs to the scientific community (regular grant programs and special competitions).

Created in 2021, the IRSST's Research Fund Division implemented a variety of grant programs to:

- promote the advancement of theoretical and practical knowledge of interest for occupational health and safety (OHS) research;
- maximize the practical benefits for workplaces or the OHS network;
- encourage the training of highly qualified OHS research personnel;
- facilitate knowledge dissemination and transfer and;
- support the training of students during research projects.

Launch of two new research grant competitions

The IRSST launched two competitions as part of its new research support programs: the **Research Project Grants** competition, designed to support studies on questions that the Institute deems priority, on innovative subjects or on emerging OHS problems; and the **Research Program Grants** competition, designed to support a scientific team in conducting an ongoing, structuring program on a research subject and that includes medium and long-term objectives.

Establishment of OHS research partnerships

As part of the new funding programs launched in 2021, a new initiative was implemented by the IRSST's Research Fund Division to establish research partnerships with other research centres, as well as with public and private organizations. These collaborations include the co-funding of OHS research projects aimed at developing scientific knowledge and potential benefits for workplaces. Nearly 15 organizations showed interest in this new formula, which generates a lever effect for both the IRSST and these partners. The annual budget for this initiative was $100,000 in 2021 and 2022.

The new OHS generation

The IRSST uses all means at its disposal to steer a competent and creative new generation toward OHS careers. Thus, in addition to hosting students, trainees and collaborators, in 2021 it awarded **33 scholarships and fellowships** to students through its graduate studies scholarship and postdoctoral fellowship program.

The Institute also awards scholarships in partnership with other organizations that share the mandate of ensuring a high-quality new scientific generation. For example, it worked with the Fonds de recherche du Québec (FRQ) to offer three career scholarships (Junior 1 level) in occupational health and safety beginning in 2019 and extending over a four-year period, for a total of $530,000.

Changes to the IRSST's graduate studies scholarship and postdoctoral fellowship program

Seeking to enhance its power to attract the most promising candidates and determined to offer them the best possible support during their university studies, the IRSST made changes to its scholarship and fellowship program in 2021:

- for doctoral scholarship applicants, by allowing them to receive one instalment while completing an internship—whether remunerated or not—that is a compulsory part of their program;
- for postdoctoral fellowship applicants, by relaxing the conditions related to the eligibility period; and
- for foreign applicants to the postdoctoral fellowship program, by removing the obligation to have obtained their PhD at a university outside Québec.

Prix Acfas-IRSST

Acfas PRIX 2021

Again this year, the IRSST partnered with the Association francophone pour le savoir (Acfas) to hand out awards designed to foster the next generation of scientists and underscore the excellence of two university students, one each at the master's and doctoral levels.

- **The *Prix Acfas-IRSST Santé et sécurité du travail – Maîtrise* went to Marie-Anne Landry-Duval**, a student in the *sciences de l'activité physique* [human kinetics] program, ergonomics profile, at Université du Québec à Montréal. The recipient hopes that her project will yield innovative solutions to prevent the consequences of heat stress in firefighters.
- **The *Prix Acfas-IRSST Santé et sécurité du travail travail – Doctorat*** was awarded to **Alexis Pinsonnault-Skvarenina**, a student in the speech therapy and audiology program at Université de Montréal. The research work of this award-winner, who is interested in "hidden" hearing loss, is aimed at the implementation of a prevention and hearing safety approach in the workplace.

Alexis Pinsonnault-Skvarenina

Marie-Anne Landry-Duval

Communications, Strategic Watch and Knowledge Mobilization

The Communications, Strategic Watch and Knowledge Mobilization Division is responsible for meeting workplace needs by keeping a strategic lookout for, producing, implementing and disseminating knowledge mobilization and transfer strategies.

A pioneer in knowledge transfer, the IRSST made knowledge transmission an official organizational priority back in 2006. Over and above dissemination to the scientific community, the Institute thus goes a step further to make the results of its work accessible and comprehensible to, and usable by, its partners and workplaces. In 2021, the Institute strengthened its team in order to expand its mandate by including the development of knowledge mobilization strategies.

Sharing the many different forms of knowledge with a wide range of publics is essential to informing both reflection and action. The IRSST also has a mandate to disseminate knowledge arising from studies in the working world and scientific community, and to keep a strategic watch for new knowledge and issues in order to anticipate and respond to any emerging needs for new OHS knowledge.

François-Étienne Paré, host of *Facteurs de risque*

Meeting workplace needs

18 requests from workplaces

addressed through knowledge mobilization activities

71 requests for expert reports

27 committees

included at least one IRSST representative: **11** committees of the Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST) and its network and **16** national or international standardization committees.

8 thematic committees

created to provide a forum for the exchange of information and knowledge between social and scientific partners.

Greater visibility

Risk factors

A Savoir média–IRSST co-production, the first season of the *Facteurs de risque* series was broadcast in 2020. Production of the second season began with filming in the summer of 2021. A total of six new episodes and one *Extra* news capsule were broadcast in April 2022, representing an original way of promoting occupational health and safety research.

Since it was first launched in 2020, *Facteurs de risque* has attracted:

- **1,020,419** unique television viewers;
- **26,397** views on the Web platform;
- **37,001** views on YouTube; and
- **229,600** people reached on the social networks.

In addition to *Facteurs de risque*, the IRSST's experts gave numerous interviews in the media, including Radio-Canada, Noovo Info, *La Presse* and *Le Devoir*, generating a total of **365 mentions** in the traditional media, on social networks and Web sites, and in various organizational newsletters.

The IRSST also organizes and participates in events where OHS knowledge is disseminated. Examples from 2021 include the following:

- The Institute's annual colloquium was held on September 13, 14 and 15, 2021 under the theme *La recherche en SST au service des milieux du travail en période de pandémie* [OHS research serving workplaces during a pandemic], on a virtual platform and free of charge. No fewer than **839** participants tuned in to view one or another of the **10** presentations given by around a dozen researchers.
- The *Rendez-vous de la science* (RVS) program held **12** sessions in 2021, all virtual, attracting an average of over 200 people.

Knowledge mobilization

Knowledge mobilization at the IRSST is a dynamic and interactive process driven by the parity principle and designed to meet the needs for occupational health and safety knowledge (OHS) identified by the Institute or expressed by its partners.

In 2021, **20** fact sheets, guides and other knowledge mobilization documents were published or updated on the IRSST's Web site.

Highlights

A new organizational structure at the IRSST

The Institute adopted a new organizational structure at the beginning of 2021 to ensure a better distribution of its main functions (research centre, liaison and transfer centre, funding agency, laboratories) and to avoid overlaps in the mandates of the different divisions. This restructuring was also designed to increase the links between the research and laboratory teams, and to strengthen, expand and target preferred partnerships relating to the Institute's functions. The ultimate aim is to enable us to provide the most appropriate and promptest responses to workplace needs.

Simon Aubin

Loïc Wingert

Sébastien Gagné

A glimpse at some of our scientific publications

Alireza Saidi, researcher, and **Chantal Gauvin**, scientific professional—both of the IRSST—published an exhaustive review of the literature on the use of advanced functional materials for intelligent thermoregulation in personal protective equipment. The article titled *Advanced Functional Materials for Intelligent Thermoregulation in Personal Protective Equipment* is available as an Open Access document. It was produced under research project 2019-0036, *State of the Art on Current Technologies Facilitating Smart Heat Management in Personal Protective Equipment*.

A scientific article resulting from a collaborative undertaking by members of the IRSST's Laboratory and Research divisions, and researchers at Université du Québec à Montréal (UQÀM), was published in the journal *Environment Science: Process and Impact*. The first author of this article is Simon Aubin, who is both assistant director for research in our Laboratory Division and a doctoral student in chemistry at UQÀM. **Loïc Wingert** and **Sébastien Gagné**—both scientific professionals at the Institute—and Livain Breau and Jacques Lesage from UQÀM, co-authored the article titled *Development and characterization of an adaptable aerosolized methylene diphenyl diisocyanate generation system*. It was based on the results of research conducted by Simon Aubin during his doctoral studies.

Damien Burlet-Vienney, an IRSST researcher; **Andrés González-Cortés**, a doctoral student; **Yuvin Chinniah**, a professor; **Abdallah Ben Mosbah**, a research associate at Polytechnique Montréal; **Ali Bahloul**, a researcher; and **Capucine Ouellet**, an industrial hygienist at the IRSST, published an article titled *Inherently Safer Design (ISD) solutions in confined spaces: Experts' practical feedback in Quebec, Canada* in *Process Safety and Environmental Protection*. This article was the result of the *Confined Space Risk Management—Study on the Use of Permanent Collective Protection Measures* research project.

Participation in committees

Sabrina Jocelyn, a researcher on the Chemical, Biological, Mechanical and Physical Risk Prevention team, represented the IRSST on the ISO/TC 299 – Robotics and ISO/TC 199 – Safety of Machinery technical committees. In the first committee, she participated in the activities of the working group on industrial safety. In the second, she contributed to three working groups: 1) Safe control systems, 2) Safety distances and ergonomic aspects and 3) Human-machine interactions.

Ali Bahloul, an IRSST researcher, was invited to participate in the work of the Comité de veille scientifique of the Réseau Québécois COVID – Pandémie (RQCP). This committee of researchers and clinical experts was mandated to produce summaries of the evidence on SARS-CoV-2 and COVID-19, an important tool for providing the different institutions concerned with sound information and promoting informed decision making. Titled *Notes d'information du comité de veille scientifique du RQCP* [information notes of the RQCP's scientific watch committee], the network published these different states of knowledge on its Web site.

Ali Bahloul was also called upon to participate in the work of developing a new national CSA standard Z94.4 on performance requirements for filtering respirators. The Z94.4 Technical Rewrite Subcommittee was formed, under the jurisdiction of the Technical Committee on Selection, Use and Care of Respirators, to agree on this new standard and develop its content.

Moreover, in January 2021, the document titled *Ventilation et transmission de la COVID-19 en milieu scolaire et en soin – Rapport du Groupe d'experts scientifiques et techniques* [ventilation and COVID-19 transmission in schools and care facilities – Report of the Group of scientific and technical experts] was published on the Web site of Québec's Ministère de la Santé et des Services sociaux (MSSS). The report was made possible through the collaboration of a multidisciplinary group of scientific and technical experts, including Ali Bahloul, whom the MSSS had invited to make recommendations regarding ventilation and COVID-19 transmission.

Laurent Giraud, a researcher in the Communications, Strategic Watch and Knowledge Mobilization Division, sat on a multidisciplinary committee responsible for evaluating requests submitted under the IMPULSION–Agri-food funding program offered by the Fonds de recherche du Québec, Nature and Technologies (FRQNT) in the 2021–2022 competition. The program was structured around four calls for proposals whose main aim was to put in place conditions and environments favourable to economic recovery in the agri-food, education, green energy and ageing sectors.

Damien Burlet-Vienney, a researcher on the Chemical, Biological, Mechanical and Physical Risk Prevention team, sat on the scientific committee of the SIAS 10th International Conference on Safety of Industrial Automated Systems hosted by Japan's National Institute of Occupational Safety and Health (JNIOSH) and its collaborators. Initially planned for 2020, the conference took place online on July 6 and 7, 2021.

Damien Burlet-Vienney also sat on the subcommittee responsible for amending Québec's *Regulation respecting occupational health and safety* (ROHS), *Division XXI – Machines*.

Ali Bahloul

Damien Burlet-Vienney

Laurent Giraud

Lectures

Controlling energies

Hydro-Québec invited Damien Burlet-Vienney to give a lecture titled *Contrôle des énergies : Cadenassage et autres méthodes* [controlling energies: lockout and other methods] at its annual meeting of safety advisors on February 16, 2021.

UPA-IRSST webinar on pesticides

The IRSST's scientists delivered the following lectures during the March 29, 2021 *Protégez vos cultures, protégez votre santé* [protect your crops, protect your health] webinar:

- Potential health effects of pesticides, **France Labrèche**, epidemiologist, IRSST
- Understanding skin exposure for self-protection, **Caroline Jolly**, ergonomist, IRSST
- Implementing prevention, **Capucine Ouellet**, occupational hygienist, ROH, IRSST

Noon lectures by the AQHSST

At the *Midi-conférence scientifique* event held on June 9, 2021 by the Association québécoise pour l'hygiène, la santé et la sécurité du travail (AQHSST), **Sabrina Gravel**, a researcher on the IRSST's Chemical, Biological, Mechanical and Physical Risk Prevention team, gave a lecture on chemical exposures and working conditions in Québec's electronic material (e-waste) recycling sector. Her area of expertise is the toxicodynamics of chemical substances in the body, or the health effects of occupational exposures to chemical contaminants.


Bruno Ponsard


Charles Gagné

Centre patronal SST

The Centre patronal SST, formation et expertise (CPSSTQ) held a Web-based event in collaboration with the IRSST on June 16, 2021. **Bruno Ponsard**, director of the IRSST's Laboratory Division, **Capucine Ouellet**, a registered occupational hygienist (ROH) and scientific professional at the IRSST, and **Dany Nadeau-Dupuis**, an occupational hygiene technician in the Laboratory Division, spoke about standards pertaining to air quality, noise, lighting, the atmosphere in confined spaces, asbestos dusts and numerous other aspects of workplace safety. The event was organized by **Charles Gagné**, director of the Communications, Strategic Watch and Knowledge Mobilization Division, in collaboration with Denis Dubreuil of the CPSSTQ.

Les Grandes Rencontres CNESST

In the context of *Les Grandes Rencontres CNESST*, the teams that organize *Le Grand Rendez-vous* and the regional symposiums on occupational health and safety put together a program of six lectures on prevention activities in workplaces. On June 17, 2021, **Capucine Ouellet** delivered a lecture on heat stresses and how to avoid being hot or cold, also taking the opportunity to provide an overview of the IRSST's Web-based tools for evaluating workplace heat stress.

AQHSST webinars

The AQHSST partnered with the IRSST to present three virtual seminars in November and December 2021 on permissible exposure values (PEVs), measuring exposure and the IRSST's role in supporting Québec's *Regulation respecting occupational health and safety*. Eagerly awaited due to the changing regulatory context in Québec, these presentations were prepared by **Simon Aubin**, assistant director for research in the Laboratory Division, with the support of numerous scientific professionals. Approximately 200 people attended each of the three seminars, which were co-hosted by **André Tartre**, vice-president of the AQHSST.

A book publication

The Association québécoise pour l'hygiène, la santé et la sécurité du travail (AQHSST) released a second edition of the book *Hygiène du travail, du diagnostic à la maîtrise des facteurs de risque* on May 19, 2021. The IRSST made significant contributions to this update. In fact, 20 of our employees contributed—through their knowledge, expertise and interest—to the writing and revision of several chapters of the new edition. The preface was penned by **Lyne Sauvageau** the IRSST's president and CEO. **Charles Gagné**, director of the Communications, Strategic Watch and Knowledge Mobilization Division, sat on the editorial committee responsible for coordinating the book's production.

Appointments

- **Lyne Sauvageau**, IRSST president and CEO, was appointed to the Board of Directors of the Fonds de recherche du Québec – Health, by the Québec Cabinet.
- **Michel Asselin**, director of the Chemical, Biological, Mechanical and Physical Risk Prevention department, was appointed to the Board of Governors of Université du Québec by the Québec Cabinet.
- **Alessia Negrini**, an IRSST researcher, saw her status of associate researcher renewed at the Centre de recherche de l'Institut universitaire en santé mentale de Montréal (CR-IUSMM).
- **Sabrina Jocelyn**, a researcher on the Chemical, Biological, Mechanical and Physical Risk Prevention team, was appointed adjunct professor in the Department of Mechanical Engineering at Université Laval. She continues her functions as adjunct professor in the Systems Engineering Department at École de technologie supérieure (ÉTS).
- **Ali Bahloul**, an IRSST researcher, was appointed adjunct professor at Université de Québec à Chicoutimi (UQÀC) and also joined UQÀC's Applied Sciences Department.


Michel Asselin


Alessia Negrini


Sabrina Jocelyn

Research Partnerships

Despite the COVID-19 context in 2021, the IRSST maintained and expanded its agreements with no fewer than **35 partner organizations** in Québec, the rest of Canada and around the world.

While most of the agreements that continued in 2021 involved existing partnerships, a new collaboration agreement was signed with the Fonds de recherche du Québec – Society and Culture (FRQSC) for the September 2021 launch of a joint action on occupational psychological health called the *Action concertée sur la santé psychologique au travail*. This agreement provides for a financial contribution from the IRSST over a three-year period (2021 to 2023); it supplements those from numerous other partners, including the CNESST, Ministère de la Santé et des Services sociaux (MSSS), Ministère du Travail, de l'Emploi et de la Solidarité sociale (MTESS), Secrétariat à la Condition féminine (SCF), Secrétariat du Conseil du trésor (SCT), Régie de l'assurance maladie du Québec (RAMQ) and Revenu Québec.

Furthermore, in September 2021, Japan's National Institute of Occupational Safety and Health (JNIOSH) and the IRSST renewed their framework agreement on bilateral cooperation initiatives through to 2026, setting forth the mechanisms for bilateral cooperation on occupational health and safety research and expertise. Since the initial agreement was signed in 2009, working meetings in Japan and Québec have led to a variety of activities. Examples include the organization of a workshop on the health effects of nanoparticles, which in turn prompted the translation of an IRSST report into Japanese, as well as the sharing of knowledge and expertise on the risks associated with trench and excavation work and led to the testing of a JNIOSH-produced safety alert system in Québec.

Human Resources

The Institute's most valuable asset is its personnel, with their expertise in disciplines as diverse as ergonomics, anthropokinetics, biomechanics, occupational hygiene, physics, biology, microbiology, toxicology, epidemiology, engineering, anthropology, demography, psychology, management and economics. As at December 31, 2021, they numbered **141** people, two-thirds of whom were scientific personnel, including **20** researchers, **44** professionals and **26** technicians.

In 2021, the IRSST hired **20** new regular employees and **10** other people to meet one-off needs. In addition to these new resources, it hosted **18** trainees (namely master's, doctoral or postdoctoral students), **5** collaborators and **1** guest professor in its offices and laboratories.

In terms of internal succession, **Bénédicte Calvet** was offered a researcher position in the OHS Problem Prevention and Rehabilitation department after earning her interdisciplinary doctorate in health and society.

Additionally, **two employees** continued their doctoral studies with a view to pursuing a researcher career at the IRSST:

- **Caroline Jolly**, from the OHS Problem Prevention and Rehabilitation department, was studying in an interdisciplinary doctoral program in health and society.
- **Simon Aubin**, from the Laboratory Division, was studying in a doctoral program in analytical chemistry.

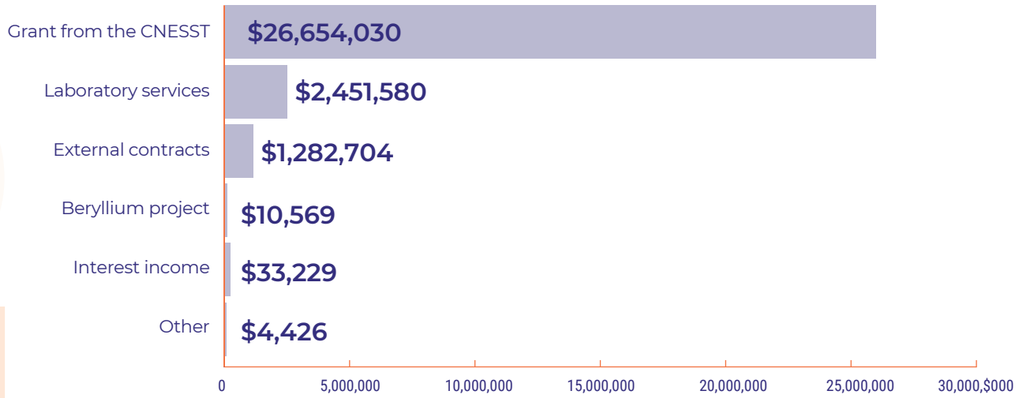
Caroline Jolly

Simon Aubin

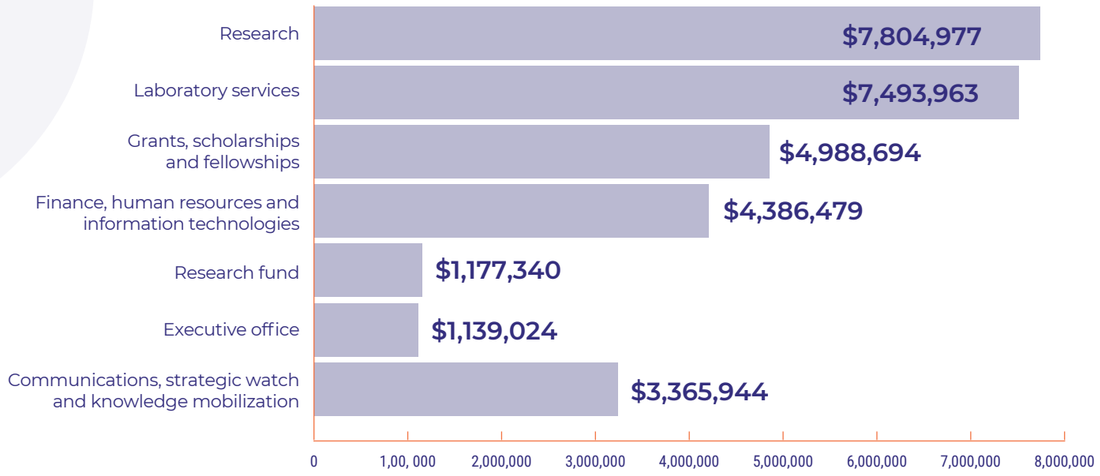
Bénédicte Calvet

Financial Results

Total revenues of $30,436,538 distributed as follows:



Total expenditures of $30,356,421 distributed as follows:



Governance

Board of Directors

The Board of Directors is composed of **seven** employer representatives, **seven** worker representatives and a chair. It operates on the parity principle (equal labour/management representation). Appointed by the Québec government, its members manage the Institute's affairs, including its strategic orientations, development framework and funding.

The members of the Board of Directors and those of the Executive Committee met **six** and **nine** times respectively in 2021.

Chair

Manuelle Oudar*

Employer representatives

Yves-Thomas Dorval*
Karolyne Gagnon
Patricia Jean
Josée Méthot
Isabelle Leclerc
Charles Milliard*
François Vincent

Worker representatives

Kaven Bissonnette
David Bergeron-Cyr
Daniel Boyer*
Dominic Lemieux
Simon Lévesque
Caroline Senneville*
Carole Neill

IRSST representative

Lyne Sauvageau

Observer

Anne Racine

Appointments

Karolyne Gagnon, Josée Méthot, David Bergeron-Cyr, Dominic Lemieux, Carole Neill

Departures

France Dupéré, Norma Kozhaya, Jean Lacharité, Benoît Bouchard

* Members of the Executive Committee

Scientific Advisory Board

The Scientific Advisory Board (SAB) is composed of **four** employer representatives, **four** worker representatives and **six** representatives of the scientific and technical community. Chaired by the Institute's president and CEO, the SAB's role is to issue opinions on the organization's general and budgetary orientations; the determination of its research priorities, programs and projects; the awarding of scholarships and fellowships; and policies related to how the IRSST's scientific activities are carried out.

The SAB met **12 times** in 2021.

Chair

Lyne Sauvageau

Employer representatives

Lionel Bernier
Annick Delisle
Gilles Rousseau
Marie-France Turcotte

Worker representatives

Annie Landry
Denis Mailloux
François Ouellet
Benoît Laberge

Scientific and technical representatives

André-Pierre Contandriopoulos
Denis Harrisson
Benoit Lévesque
Alain Rondeau
Joseph Hubert
Vacant post (1)

Observer

Luc Castonguay

Nominations

Joseph Hubert

Departures

Dominique Malo, Jean Dussault, Ana-Maria Seifert, Christophe Guy, Paul-Joseph Villeneuve

Organization Chart

As at December 31, 2021

- Board of Directors
  - Executive Committee
    - Executive Office — Lyne Sauvageau
      - Scientific Advisory Board
      - Laboratory Division — Bruno Ponsard
        - Cross-Cutting Operations — Marie-Claude Barette
        - Chemistry — Mickaël Calosso
        - Microbiology and Instrumentation — Alberto Morales
      - Research Fund Division — Sylvain Pelletier
      - Research Division — Michel Asselin (Interim)
        - OHS Problem Prevention and Rehabilitation — Geneviève Pinard
        - Chemical, Biological, Mechanical and Physical Risk Prevention — Michel Asselin
      - Communication, Strategic Watch and Knowledge Mobilization Division — Charles Gagné
      - Finance and Procurement Division — Ingrid Dallaire
      - Human Ressources Division — Lise Toupin
      - Information Technologies Division — Louis-Alexandre Taillon

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ISSN: 2816-5330 (PDF)
ISBN: 978-2-89797-212-7 (PDF)

Institut de recherche
Robert-Sauvé en santé
et en sécurité du travail