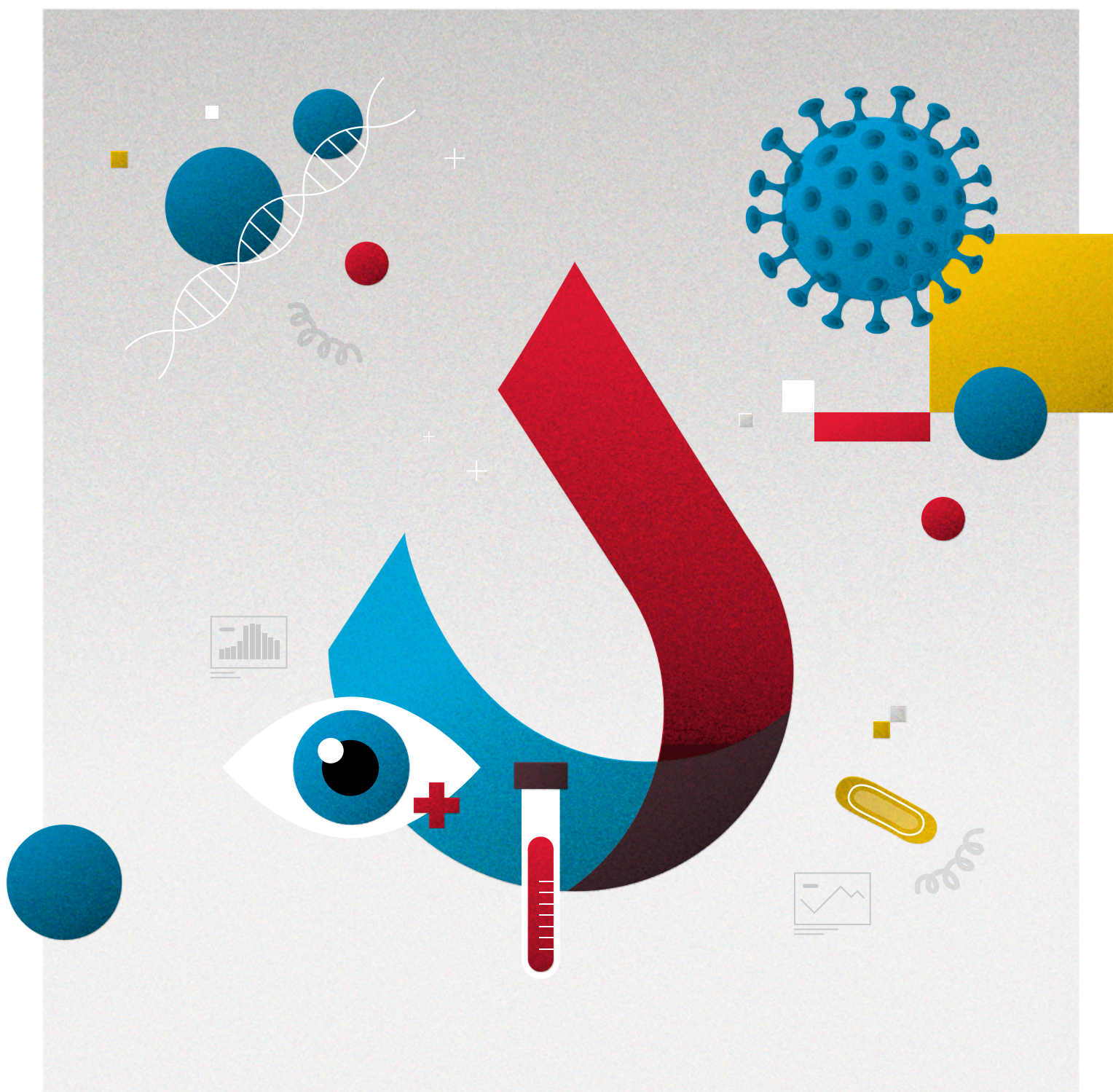


# ANNUAL REPORT 2020





# ANNUAL REPORT 2020





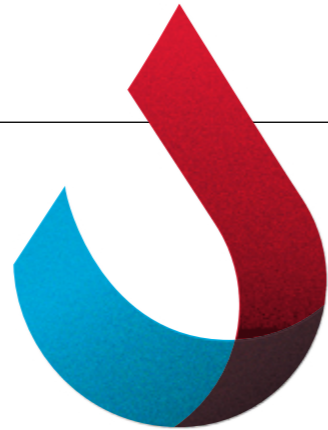
# SUMMARY

<b>FOREWORD</b>	4
<b>1.0 MANAGEMENT</b>	8
Highlights	18
The Covid-19 Timeline	20
<b>2.0 LABORATOIRE NATIONAL DE SANTÉ</b>	22
2.1 Microbiology	22
2.2 Health Protection	32
2.3 Medical Biology	40
2.4 Forensic Medicine	48
2.5 National Center of Pathology	56
2.6 National Center of Genetics	64
2.7 Administration, Finance & Support Services	72
<b>3.0 KEY FIGURES 2020</b>	88
<b>4.0 LNS IN SHORT</b>	96
<b>5.0 PUBLICATIONS</b>	102



**2020 was a challenging year.**  
 The inspiration we received from everywhere was all the more important for it. We especially appreciated "Les petites pierres précieuses" (group photo taken before the COVID-19 crisis) - little artists from Esch created cards and pictures showing the everyday life of medical staff in Luxembourg. Many thanks for this.

# FOREWORD



**“IN 2020, THE LNS WAS IN THE EYE OF THE PANDEMIC STORM. WE TOO HAD TO ADJUST VERY QUICKLY TO WHAT HAD BEEN UNPREDICTABLE ONLY SHORTLY BEFOREHAND – AND REINVENT OURSELVES AS A TEAM TO SERVE COUNTRY AND PEOPLE.”**

Dear Reader,

2020 is a year none of us will be forgetting any time soon. In every respect, it was a year of radical change. A year of profound upheaval. 2020 will have changed the world permanently, and in ways it had probably never changed before. How exactly, we cannot yet fully predict today – no more than we could predict in late 2019 what would happen in the following months – what would happen in the world at large, in Luxembourg, or at the LNS.

COVID-19 was everywhere in 2020. No region of the world remained virus-free. No area of life was spared the consequences. This applied to people's most private surroundings as well as to the global economy, and all levels of politics. Of course, the healthcare system, and with it the LNS, was in the eye of the pandemic storm. Around spring, we too had to adjust very quickly to what had been unpredictable only shortly beforehand. We had to switch our operations to crisis mode – and reinvent ourselves as a team.

The best example of this is our Department of Microbiology. Over the course of the year, this department became one of Luxembourg's central contact points for all kind of questions about COVID-19 – and, as such, even more of an essential backbone of the country's health system. This is one of the ways we were able to visibly demonstrate what we mean when we speak of international expertise dedicated to serving the country and its people.

That being said, all our other departments also proved that they can deal with crises, be it by being active in COVID-19 matters, or by developing further, despite – or precisely because of – the rampant virus. When such exceptional situations arise, it is crucial to fight the crisis in every way possible – sometimes in completely new ways – all the while consistently pursuing the path already taken. In 2020, the LNS and all its departments admirably succeeded in doing both.

The “2020 story” of our Administration, Finance & Support Services Department, for instance, is a fine example of holistic crisis management. Our team of experts from the areas of HR, IT, finance and supply chain management ensured that all processes were quickly adapted to the new situation – and that effective crisis management became possible. In the process, people and technology went hand in hand; the expertise of the LNS team was further strengthened, and digitalisation was consistently advanced.

The digital element was also lastingly strengthened at the National Center of Genetics (NCG), and that too with a view to facilitating human contact: in order to maintain genetic counselling services even in times of social distancing, the NCG started using the then still novel tool of video conferencing in spring 2020 already – an approach that was well received by patients.

Social distancing also became a central topic for our forensic doctors, albeit in a completely different context: since COVID-19 also meant an increased risk of infection during autopsies, a completely new approach was required – with many unknowns at the beginning. In the end, drawing on our laboratory's high-end technology in combination with exchanges with our international partners proved to be the right approach.

The National Center of Pathology, meanwhile, consistently pursued the path of innovation that it had already embarked on in previous years. During the summer, this department – the LNS's largest – saw its authorisation renewed for four years, as did the LNS's National Center of Genetics. Epigenetic services, first introduced in 2019, were extended to cover sarcomas – the next step in diagnostics excellence.

The Department of Biological Medicine also continued on its long-term innovation path. Its ISO15189 standard accreditation was extended; moreover, the very first accreditation procedure for separative methods coupled with different detection principles was successfully completed. In parallel, the department was involved in the fight against COVID-19 from the beginning, together with other partners, as part of the international DISCOVERY study.

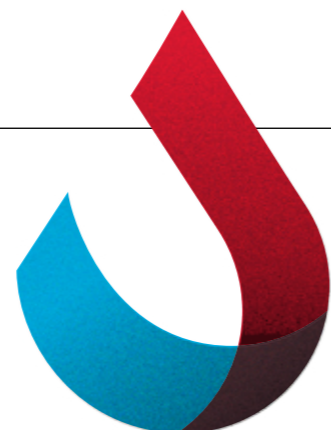
These introductory words already show the multifaceted role that the LNS plays in Luxembourg's healthcare system in general, and how practically oriented and innovative our team is in serving the country and its people. They also show how our experts became COVID-19 Fighters. That is to say: part of a whole whose work is based on the LNS's value system.

The following pages give a detailed account of what this all looked like. They provide insights into our work, our inner life; into our long-term development and into individual moments full of professionalism and humanity; but also uncertainty, and tragedy. Because we shouldn't forget: 2020 was a tragic year for many people, and our mission as a leading health player is to alleviate and, ideally, prevent such tragedies.

**Prof. Dr Evelin Schröck**  
President of the Board of Directors



# AVANT-PROPOS



Chère lectrice, cher lecteur,

2020 était une année qu'aucun d'entre nous n'oubliera de sitôt. À tous égards, ce fut une année de changement radical. Une année de profonds bouleversements. 2020 aura changé le monde pour toujours et tel qu'il n'avait probablement jamais changé auparavant. Comment exactement ? Nous ne pouvons pas encore le prédire totalement aujourd'hui - pas plus que nous ne pouvions prédire fin 2019 ce qui se passerait dans les mois suivants - ce qui arriverait dans le monde en général, au Luxembourg ou au LNS.

La COVID-19 était partout en 2020. Aucune région du monde n'a été préservée du virus. Aucun aspect de la vie n'a été épargné par ses conséquences. Cela s'applique autant à la vie privée des personnes qu'à l'économie mondiale et à tous les niveaux de la politique. Bien entendu, le système de santé, et le LNS avec lui, a été dans l'œil du cyclone de la pandémie. Au printemps, nous avons, nous aussi, dû nous adapter très rapidement à ce qui était imprévisible peu de temps auparavant. Nous avons dû passer nos opérations en mode « crise » et nous réinventer en tant qu'équipe.

Le meilleur exemple est notre département de microbiologie. Au cours de l'année, ce département est devenu l'un des points de contact centraux du Luxembourg pour de nombreuses questions sur la COVID-19 et, à ce titre, un pilier essentiel du système de santé du pays. C'est l'une des manières pour nous de démontrer ce que nous appelons « expertise internationale au service du pays et de ses habitants ».

Ceci étant dit, tous nos autres départements ont également prouvé qu'ils pouvaient faire face aux crises, que ce soit en étant actifs sur les questions liées à la COVID-19, ou en se développant davantage, malgré la propagation du virus, ou précisément à cause de lui. Lorsque de telles situations exceptionnelles se présentent, il est crucial de combattre la crise de toutes les façons possibles - parfois de manière totalement nouvelle - tout en poursuivant avec cohérence la voie déjà empruntée. En 2020, le LNS et tous ses départements ont admirablement réussi à faire les deux.

**“EN 2020, LE LNS A ÉTÉ DANS L'ŒIL DU CYCLONE DE LA PANDÉMIE. NOUS AVONS DÛ NOUS ADAPTER TRÈS RAPIDEMENT À CE QUI ÉTAIT IMPRÉVISIBLE PEU DE TEMPS AUPARAVANT - ET NOUS RÉINVENTER EN TANT QU'ÉQUIPE POUR SERVIR LE PAYS ET LA POPULATION.”**

« L'histoire 2020 » de notre département administration, finances et services support, par exemple, est un bel exemple de gestion de crise holistique. Notre équipe d'experts dans les domaines des RH, de l'informatique, des finances et de la gestion de la chaîne d'approvisionnement a veillé à ce que tous les processus soient rapidement adaptés à la nouvelle situation, et à ce qu'une gestion de crise efficace devienne possible. L'homme et la technologie ont avancé main dans la main : l'expertise de l'équipe LNS a été renforcée et la numérisation a progressé de manière conséquente.

Le virage numérique a également été durablement renforcé au National Center of Genetics (NCG), et ce dans le but de faciliter le contact humain : afin de maintenir les services de conseil génétique même en période de distanciation sociale, le NCG a commencé à utiliser l'outil - encore nouveau - de la vidéoconférence dès le printemps 2020. Une approche qui a été bien accueillie par les patients.

La distanciation sociale est également devenue un sujet central pour nos médecins légistes, bien que dans un contexte complètement différent : étant donné que la COVID-19 signifiait également un risque accru d'infection lors des autopsies, une approche complètement nouvelle était nécessaire, avec de nombreuses inconnues au départ. Finalement, l'utilisation de la technologie de pointe de notre laboratoire, combinée à des échanges avec nos partenaires internationaux, s'est avérée être la bonne approche.

Le National Center of Pathology (NCP), quant à lui, a poursuivi de manière cohérente la voie de l'innovation qu'il avait déjà empruntée les années précédentes. Durant l'été, ce département - le plus grand du LNS - a vu son autorisation d'exploitation renouvelée pour quatre ans, tout comme le National Center of Genetics du LNS. Les services d'épigénétique, introduits pour la première fois en 2019, ont été étendus aux sarcomes - la prochaine étape dans l'excellence diagnostique.

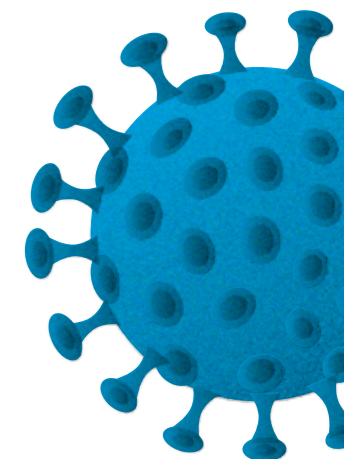
Le département de médecine biologique a également poursuivi son chemin en matière d'innovation à long terme. Son accréditation à la norme ISO15189 a été prolongée ; en outre, la toute première procédure d'accréditation pour les méthodes séparatives couplées à différents principes de détection a été menée à bien. Parallèlement, le département a été impliqué dès le début dans la lutte contre la COVID-19, avec d'autres partenaires, dans le cadre de l'étude internationale DISCOVERY.

Ces quelques mots d'introduction montrent déjà le rôle multiforme que joue le LNS dans le système de santé luxembourgeois en général, ainsi que l'orientation pratique et l'innovation de notre équipe au service du pays et de ses habitants. Ils montrent également comment nos experts sont devenus des « COVID-19 Fighters ». C'est-à-dire une partie d'un tout dont le travail est basé sur le système de valeurs du LNS.

Les pages suivantes donnent un compte-rendu détaillé de ces actions. Elles donnent un aperçu de notre travail, de notre vie intérieure, de notre développement à long terme et de moments individuels empreints de professionnalisme et d'humanité, mais aussi d'incertitude et de tragédie. Car il ne faut pas l'oublier, 2020 a été une année tragique pour de nombreuses personnes, et notre mission, en tant qu'acteur majeur de la santé, est d'atténuer et, idéalement, de prévenir de telles tragédies.

**Pr Dr Evelin Schröck**

Présidente du Conseil d'Administration





# 1.0 MANAGEMENT



„Wéi déi alleréischte Unzeechen op eng Pandemie higewisen hunn, huet alles weltwäit ugefaangen auseneen ze falen. Eise Wäerte System „Togehter LNS“ huet eis gehollef zesammen des speziell Situatioun duerch ze stoen.“

Prof. Dr Friedrich Mühlshlegel  
Director LNS



+



# THE ‘TOGETHER LNS’ SPIRIT PROVES ITS WORTH IN TIMES OF CRISIS: A VALUE SYSTEM THAT ROSE TO THE CHALLENGE POSED BY COVID-19

If an organisation wants to be able to perform in a crisis, it needs to be prepared. At the LNS, just as everywhere else, no-one knew until the beginning of 2020 that COVID-19 would change the world – and with it of course work at the LNS itself. Nevertheless, the team was prepared for the unforeseeable – not least thanks to the ‘Together LNS’ value system.



“When, at the end of January 2020, the very first signs pointed towards a pandemic, everything that is usually called normality began to falter worldwide”, recalls LNS Director Prof. Dr Friedrich Mühlshlegel. “In such situations, it is all too human at first to hold on to one’s habits and close one’s eyes to the unknown and hope it goes away overnight. Whilst this is happening, in parallel, all efforts must be combined quickly and concrete measures introduced – and I am very pleased to say we succeeded in doing just that. Together LNS helped the LNS to operate as a values-driven, high-standard, transparent partnership”.

**Prof. Dr Friedrich Mühlshlegel**  
doing COVID-19 sampling at  
the Centre de prélèvement  
Kirchberg



**Teamwork: LNS volunteers**  
assembled test kits for the  
national program to detect  
COVID-19 in care of the  
elderly facilities.

## GUIDANCE RIGHT FROM THE START

According to Friedrich Mühlshlegel, what helped was the fact that ‘Together LNS’ was a value system that had already been introduced and that staff at all levels already lived by before COVID-19: “‘Together LNS’ is much more than just a vague philosophy. It is a common foundation of concrete values that guide us every day as health professionals and as people. At the beginning of the pandemic especially, it also served us as a reliable source of guidance in what was a very unpredictable situation.”

In retrospect, he sees the months from February to April 2020 as particularly crucial in this context. Things became very challenging for the LNS as a whole, as well as for each individual employee: “From February onwards, it was clear that the pandemic would not pass Luxembourg by. For us, as one of the leading players in the national health system, this meant that we had to prepare for a lot of work – and also reinvent ourselves to some extent.”

## CONSTANTLY GROWING AS A TEAM

Friedrich Mühlshlegel adds that it was precisely in this process of adaptation to a fast-changing environment that the value system that had been gradually developed over the previous two years was of great avail:

“‘Together LNS’ was, after all, intended as part of a kind of redefinition and was accordingly approached with the long term in mind. In 2018, we initiated the first steps at management and head of department level, and then brought the employees on board in 2019 to jointly establish binding values. These then helped us grow as a team during the crisis in 2020.”

Trust, Teamwork and Respect; Professionalism, Transparency and Excellence: these are the six values of the LNS, and they serve as a beacon for the entire team, which has grown up to 363 employees during 2020. Together, these highly skilled people from 20 countries ensure that the laboratory can provide excellent health services to the people of Luxembourg. Health experts are just as much a part of this as lawyers, finance professionals, or hygiene and logistics specialists.





## COMMUNICATION AND IDENTITY AS AN ORGANIZATION

Friedrich Mühlischlegel comments: "With COVID-19, all of us at the LNS were put to the test in several respects. As healthcare professionals, we were on the very front line from the very beginning, but we also had to switch to crisis mode very quickly as an organisation in March 2020. The fact that we were able to manage all of this successfully was also a result of our value system. Thanks to the LNS's strategy, we were able to take advantage of the crisis and take the step from professionalism to true excellence."

Friedrich Mühlischlegel believes that his team's 'COVID-19 Fighter' "brand" also contributed to this. The LNS team took this "code name" right from the start and interpreted it in a very creative way: "When our crisis team began its work, the question arose as to how further initiatives could be rolled out to foster a sustainable team spirit in this context. The result was a mixture of interactions among individuals and the creation of a common identity."

## INTERNAL EXCHANGES, EXTERNAL VISIBILITY

"Lunchtime video chats, for example, allowed for those interactions, and a visual that quickly became popular provided that common identity," adds Frédérique Theisen, Communication Manager at the LNS. "Since many colleagues worked from home for weeks and months, one goal of the COVID-19 Fighter initiative was to avoid the danger of long-term social distancing. This was the main focus of our internal communication. Our visual, in turn, became a bit of a "cult item" as a sticker outside the LNS as well, and was also used to spice up our vans, our social media profiles and various other gadgets. This is probably why the campaign was intensively covered in the media."

According to Friedrich Mühlischlegel, the deliberately lively design is one of the things that contributed to this cult status: "Every single employee of the LNS is certainly on the one hand an essential part of the Luxembourg health system, but also on the other simply a human being. With our COVID-19 Fighter campaign, we brought both together – and thus created a little bit of light-heartedness, which is particularly important in difficult times." Friedrich Mühlischlegel concludes: "Clinical excellence, teaching, training, research - it's the LNS way."



The team of the executive committee: Dr Tamir Abdelrahman, Dr Andreas Schuff, Dr Barbara Klink, Prof. Dr Friedrich Mühlischlegel, Prof. Dr An Van Nieuwenhuysse, Dr pharm., Dr sc. Patricia Borde and Prof. Dr Michel Mittelbronn.

## RÉSUMÉ EN FRANÇAIS

### L'ESPRIT « TOGETHER LNS » FAIT SES PREUVES EN TEMPS DE CRISE : UN SYSTÈME DE VALEURS À LA HAUTEUR DU DÉFI POSÉ PAR LA COVID-19

Si une organisation veut pouvoir être performante en cas de crise, elle doit être préparée. Au LNS, comme ailleurs, personne ne savait jusqu'au début de l'année 2020 que la COVID-19 allait changer le monde - et avec lui, bien sûr, le travail au LNS lui-même. Néanmoins, l'équipe était préparée à l'imprévisible, notamment grâce au système de valeurs « Together LNS ».

« Lorsque les tout premiers signes ont indiqué une pandémie, tout ce que l'on appelle habituellement la normalité a commencé à vaciller dans le monde entier », se souvient le directeur du LNS, le professeur Dr Friedrich Mühlischlegel. « Dans de telles situations, il convient de conjuguer rapidement tous les efforts et d'introduire des mesures concrètes - et je suis heureux de dire que nous y sommes parvenus. « Together LNS » nous a aidés à fonctionner comme un partenariat fondé sur des valeurs, de haut niveau et transparent. »

### UNE ORIENTATION DÈS LE DÉPART

Selon Friedrich Mühlischlegel, ce qui a aidé, c'est le fait que « Together LNS » est un système de valeurs qui avait déjà été adopté et que le personnel à tous les niveaux vivait déjà avant la COVID-19 : « Together LNS » est un socle de valeurs concrètes qui nous guident chaque jour en tant que professionnels et en tant que personnes. Au début de la pandémie en particulier, il nous a servi de source d'orientation dans ce qui était une situation très imprévisible. »

Avec le recul, il considère les mois de février à avril 2020 comme cruciaux. Les choses sont devenues difficiles pour le LNS dans son ensemble, ainsi que pour chaque employé : « À partir de février, il était clair que la pandémie n'épargnerait pas le Luxembourg. Pour nous, l'un des principaux acteurs du système de santé, cela signifiait que nous devions nous préparer à beaucoup de travail, et aussi nous réinventer dans une certaine mesure. »

### UNE ÉQUIPE EN CONSTANTE ÉVOLUTION

Friedrich Mühlischlegel ajoute que c'est précisément dans ce processus d'adaptation à un environnement en pleine mutation que le système de valeurs a été d'une grande utilité : « Together LNS » s'inscrivait dans une perspective de redéfinition et a donc été abordé dans une optique de long terme. En 2018, nous avons initié les premières démarches au niveau du Comité de direction et des chefs de service, puis nous avons embarqué les collaborateurs. Ces valeurs nous ont ensuite aidés à grandir en tant qu'équipe pendant la crise de 2020. »

Confiance, collaboration, respect, conscience professionnelle, transparence et excellence : telles sont les six valeurs qui servent de guide à toute l'équipe, qui est passée à 363 employés au cours de l'année 2020. Ensemble, ces personnes hautement qualifiées, originaires de 20 pays, veillent à ce que le laboratoire puisse fournir d'excellents services de santé à l'ensemble de la population du Luxembourg. Les experts de la santé en font tout autant partie que les avocats, les professionnels de la finance ou les spécialistes de l'hygiène et de la logistique.

### COMMUNICATION ET IDENTITÉ EN TANT QU'ORGANISATION

Friedrich Mühlischlegel commente : « Avec la COVID-19, nous avons tous été mis à l'épreuve à plusieurs égards. En tant que professionnels de la santé, nous étions en première ligne dès le début, mais nous avons également dû passer très rapidement en mode crise en tant qu'organisation en mars 2020. Le fait que nous ayons pu gérer tout cela avec succès est aussi le résultat de notre système de valeurs. »

Friedrich Mühlischlegel estime que la campagne « COVID-19 Fighters » y a également contribué. L'équipe du LNS s'est approprié dès le début ce nom de code et l'a interprété de manière créative : « Lorsque notre équipe de crise a commencé son travail, la question s'est posée de savoir comment déployer des initiatives pour favoriser un esprit d'équipe durable. Le résultat a été un mélange d'interactions entre les individus et la création d'une identité commune. »

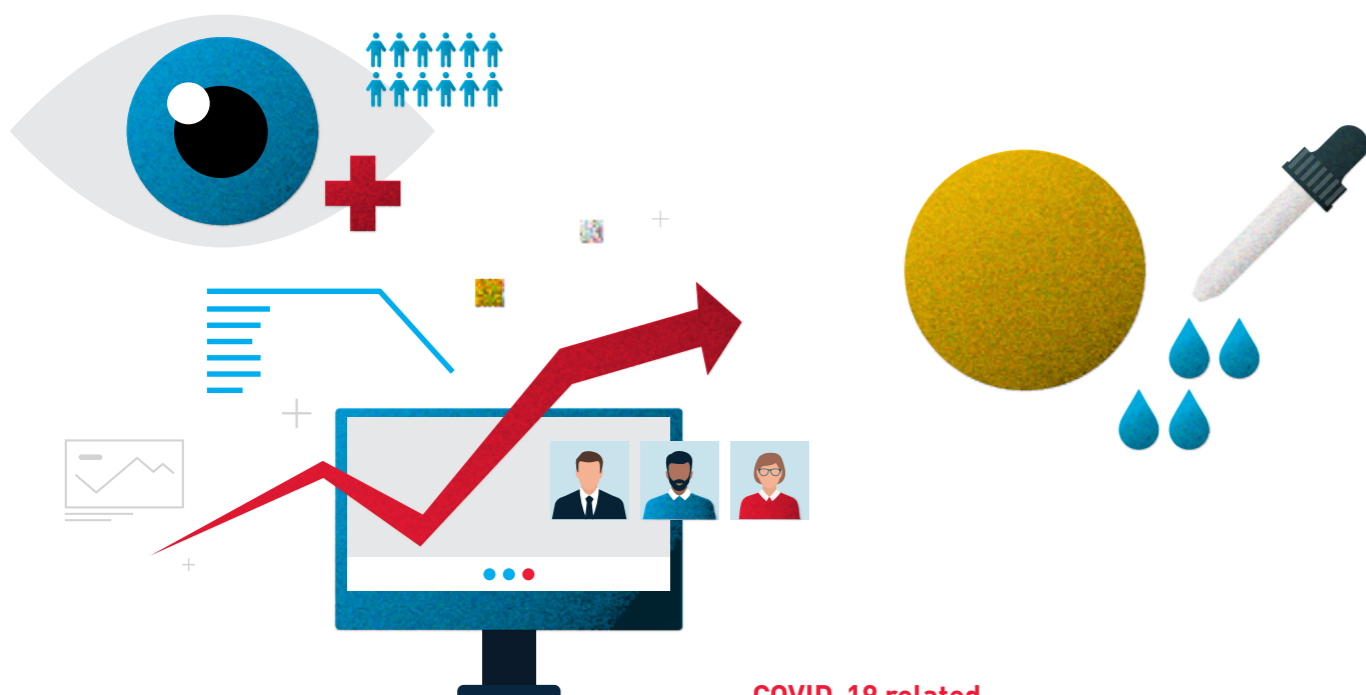
### ÉCHANGES INTERNES, VISIBILITÉ EXTERNE

« Les chats vidéo du midi ont permis ces interactions, et un visuel qui est rapidement devenu populaire a fourni cette identité commune », ajoute Frédérique Theisen, responsable de la communication au LNS. « L'un des objectifs de l'initiative « COVID-19 Fighters » était d'éviter le danger d'une distanciation sociale. Notre visuel, à son tour, est devenu une sorte d'objet culte en tant qu'autocollant à l'extérieur du LNS également, et a été utilisé pour agrémenter nos camionnettes, nos profils sur les réseaux sociaux et d'autres gadgets. C'est probablement la raison pour laquelle la campagne a été intensivement couverte par les médias. »

Selon Friedrich Mühlischlegel, le design résolument dynamique est l'un des éléments qui ont contribué à ce statut culte : « Chaque employé du LNS est certes, d'une part, un élément essentiel du système de santé luxembourgeois mais aussi, d'autre part, tout simplement un être humain. Avec notre campagne « COVID-19 Fighters », nous avons réuni les deux et ainsi créé un peu de légèreté, ce qui est particulièrement important dans les moments difficiles. »



# KEY FACTS & FIGURES



## QUALITY, HYGIENE, SAFETY, ENVIRONMENT AND METROLOGY (QHSEM)

### Safety

- The Security Contact Point Team set-up was reviewed in order to improve follow-up and efficiency.
- Collaboration between the designated worker representatives and the safety representatives was strengthened.
- Follow-up on prevention measures taken within the unit took place.
- The Safety Unit was transferred to the Infrastructures and Logistics Service, and took also over the cleaning service.

The LNS was once again awarded the SDK label.

### COVID-19 related

- Participation in the implementation of measures specific to the health situation (crisis unit).
- Contact tracing and follow-up of positive cases (quarantine, assistance to Inspection Sanitaire, protecting staff from the pandemic).

### Quality

- A new quality governance strategy was put in place, with the creation of "CoDir-Quality" to give new impetus to the project of setting up a centralised quality management system.
- Implementation of a content-management tool, which had stopped due to the pandemic, resumed and is progressing rapidly.
- All accredited LNS laboratories successfully maintained their accreditation despite the exceptional context.
- Several new accreditation projects were started in 2020.

### Metrology

- In 2020, the organisation of the Metrology Unit took a different path.
- More technical trainings were provided to develop and manage metrology-related skills, and new projects were launched and rolled out in collaboration with units.
- Studies for a huge project to change the temperature tracking system were undertaken.
- The goal remains to centralise metrology processes so as to increase efficiency!

### REPORTING

#### Implementing the strategic plan for 2019-2022

- In 2020, all LNS departments worked together to implement the ongoing four-year strategic plan, which started in 2019. This collaborative effort was made possible thanks to all players having access to a common database where intra- and interdepartmental links between fixed objectives and subtasks are highlighted in a transparent manner. Regular tracking of each of the more than 100 objectives allows users to follow the progress status of the underlying managerial, technical and scientific activities.
- Despite the surge of the COVID-19 pandemic, most of the LNS succeeded in sustaining a steady, albeit more restrained development of the planned strategic expansion. However, in order to focus on urgently needed preventive measures for the Luxembourgish population during this health crisis, the Department of Microbiology had to put a third of its ongoing longer-term objectives on hold.
- Consistent follow-up of the LNS's overall achievement score for the strategic plan shows a median value of 44% by the end of 2020 with a 10% variation. For the mid-term, this figure perfectly fits the expected advancement of the development initiative.

### COMMUNICATION

#### Together LNS

- A staff meeting took place at the beginning of the year to present the new LNS vision and "Together LNS" values as part of the change management project.
- The Out of the Box virtual Christmas party was held via livestream in form of a talk show with Prof. Dr Evelin Schröck and Prof. Dr Friedrich Mühlischlegel, bookended by original songs performed by the LNS music band and followed by an online mystery game.
- There were guided tours of the labs for groups (staff and members of the public) before the lockdown.

#### Corporate Social Responsibility @LNS

- An LNS pastry amateur week (bake sale) was held to raise funds for the Fondatioun Kriibskrank Kanner and Europa Donna Luxembourg.
- The LNS participated in solidarity events like LëtZ Go Gold by Fondatioun Kriibskrank Kanner and Broschkriibslaf by Europa Donna Luxembourg.
- The LNS took part in the Advent calendar charity initiative to help the homeless, also during the pandemic.

#### Public Relations & Media Relations

- Organisation of the NCP & NCG press conference.
- Development of social media strategy.
- Management of ongoing media relations.

#### Internal Communication

- A "Journée d'information et de sensibilisation aux dangers du tabagisme" (Information and awareness day on the dangers of smoking) was put on for LNS staff at the beginning of 2020 in collaboration with the *Division de la médecine préventive de la Direction de la Santé and the Service de Pneumologie du Centre Hospitalier de Luxembourg* (CHL) to help our staff members keep up their new year's resolutions.
- The internal news channels were regularly updated with articles and other interesting topics regarding LNS workforce.
- The series « 20' from administration » presenting administrative topics to the staff was pursued.
- Production of the NCP presentation video.





### COVID-19 communication

- Support was given to the LNS COVID-19 Task Force, whose main task was to prepare the LNS for lockdown and keep all staff up to date with the measures in place at the LNS.
- The LNS COVID-19 Fighter campaign was developed to support LNS staff in carrying out their various daily tasks and to keep the team united.
- Regular communication was set up (written format, videos) with encouraging messages for the entire staff.
- A COVID-19 Fighter gadget sale was held to raise funds to support a number of charities.
- The LNS COVID-19 Fighter blog was created and updated.
- Support was given to the microbiology team in communicating on their various COVID-19 projects (LuxMicroHub online conferences, Drive-in COVID-19 sampling centre, online booking tool, ReViLux updates, school screening, etc.).
- A Welcome Day was held to introduce the new members of staff to the LNS during the COVID-19 pandemic.

### LEGAL AFFAIRS

#### Support was provided to the LNS on all legal questions and more particularly on:

- Health law,
- Contract law,
- Data protection law,
- Intellectual property law,
- Public tender law,
- Administrative law.

The LNS's departments received support in drafting, reviewing and signing all kind of agreements, among others:

- Collaboration agreements
  - CHARM (Cholesterol in HAiR Measurement) – CHL/LIH
  - APAST Project – Corps Grand-Ducal Incendie et Secours (CGDIS)
  - CON-VINCE project – LIH
  - Co-PhyloDyn project – University of Luxembourg
  - Visit to the LNS by Dr. David Bouvier – University of Luxembourg
  - INSITU – Solais project – University of Luxembourg



- Consortium agreements
  - CORONASTEP+ project – LIST
  - FNR Inter/Era CoSysMed – Hannover Medical School
- Grant agreements
  - CON-VINCE Project – FNR
  - Co-PhyloDyn project – FNR
  - FNR Inter/Era CoSysMed – FNR
  - COMPARE project – FNR
- Others
  - Term Sheet: Research, development and validation of CE IVD products in the context of the COVID-19 pandemic – Advanced Biological Laboratories S.A. (ABL)
  - Cooperation Agreement: Histologic and cytologist examinations and immunohistochemical examinations – Hôpitaux Robert Schuman, ProstataKarzinomZentrum
  - Agreements with the Ministry of Health in the context of COVID-19
  - Expert and services agreements
  - Maintenance agreements
  - Etc.

Support was given to all LNS departments in drafting and reviewing all their public tenders: open procedures and negotiated procedures.

### DATA PROTECTION OFFICER

- All contracts relating to the processing of personal data were reviewed (MISA, MENJE, Laboratoires Réunis, CHNP, CHdN). Compliance of those contracts with article 28 of the GDPR was checked.
- The Data Protection Impact Assessment, started in 2019, was finalised. This allows the LNS to have an overview of and control over risks affecting individuals.
- Treatments related to the COVID-19 pandemic were analysed and their compliance was checked. Many players were involved and all actions were urgent. We all worked together to be able to react, all the while bearing compliance rules and people's data protection rights in mind.
- A plan to maintain the concept of privacy by design was created with the IT Service.
- Support was given in setting up a business continuity plan.
- The risk register was created and maintained.

### EXPERTISE & SKILLS

A scientific advisor/project coordinator joined the LNS at the end of 2020.







## 02. HIGHLIGHTS

# 01

JANUARY

**Administration, Finance and Support Services:** Kick-off of the continuous improvement of the overall performance evaluation system in conjunction with the end-of-year evaluation and target setting for 2021.

**Management:** Staff meeting at the beginning of the year to present the new LNS vision and "Together LNS" values as part of the change management project.

**Together LNS:** Guided tours of the labs for groups (staff and members of the public) until March (lockdown).

**Together LNS:** Journée d'information et de sensibilisation aux dangers du tabagisme (Information and awareness day on the dangers of smoking) for LNS staff at the start of 2020 in collaboration with the Division de

la médecine préventive de la Direction de la Santé and the Service de Pneumologie du Centre Hospitalier de Luxembourg (CHL) to help our staff members keep their new year's resolutions.

**NCP:** The NCP played a key role in establishing the first molecular pathology National Tumour Committee.

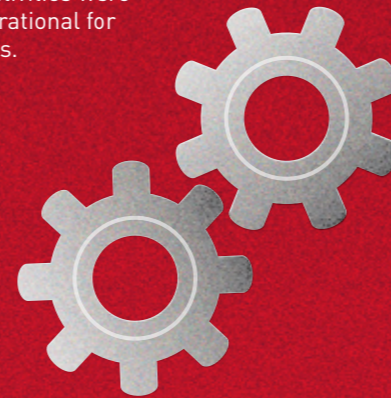
**NCP:** Prof. Dr Michel Mittelbronn, head of the NCP becomes a founding member and associate editor of the new non-profit, open-access journal.

**NCP:** With electron microscopy and the epigenetics platform, two new activities were introduced and are now fully operational for diagnostic and research purposes.

# 02/03

FEBRUARY & MARCH

**CSR @LNS:** LNS amateur pastry week (bake sale) to raise funds for the Fondatioun Kriibskrank Kanner & Europa Donna Luxembourg.



# 07

JULY

**Management:** A new quality governance approach was put in place with the creation of the CoDir-Quality to give a new impetus to the project of setting up a centralised quality management system.

**Microbiology:** Start of the MIRABANK project (ECDC project), in collaboration with IBBL, aimed at creating a bank of multi-resistant bacterial strains from 36 European countries, strains that are resistant to carbapenems and/or colistin (antibiotics of last resort in human pathology).

**Health Protection:** Officially appointed as National Reference Laboratory (NRL) for food-borne viruses.

**Health Protection:** Exponential development in the field of organic compounds in air and deposited dust; taking over all field sampling from July, as requested by MISA (Ministry of Health).

# 08

AUGUST

**NCP:** The NCP played a key role in establishing the first National Tumour Committee for neuro-oncology.

# 09

SEPTEMBER

**Forensic Medicine:** Scientific study of the impact of thermic straightening on opiate and methadone content in hair in of cooperation with the University of Metz. Results were presented during a convention in Spain.

# 09/10

SEPTEMBER & OCTOBER

**CSR @LNS:** participation in solidarity events like LëtZ Go Gold by Fondatioun Kriibskrank Kanner and Broschkriibslaf by Europa Donna Luxembourg.

# 04

APRIL

**Health Protection:** Officially appointed as National Reference Laboratory (NRL) for plant toxins.

**Administration, Finance and Support Services:** Digital Report for Patients: the IT service drove the development of a secure electronic transmission system allowing patients to download reports immediately after their biological validation.

# 05

MAY

**Health Protection:** Appointed by the European Commission as a validated service provider for reference material certification projects (DNA quantification).

# 06

JUNE

**Board:** The staff representative to the Board (Jessica Tapp) was elected to replace the predecessor who retired.

**NCG:** The NCG received approval for its activities for four more years from the Ministry of Health.

**NCG:** Clinical geneticist, Dr Arthur Sorlin, was recruited to strengthen clinical capabilities.

**NCP:** The NCP received approval for its activities from the Ministry of Health for four more years.

# 11

NOVEMBER

**Microbiology:** Audit on the expansion of ISO 15189 accredited testing, mainly in the field of mycology and molecular biology, which has extended the service to 90% of accredited analyses. Accreditation was approved in January 2021.

**Medical Biology:** The validity period of our ISO15189 accreditation was extended, and the first stage of accreditation for separative methods coupled with several means of detection was successful.

# 12

DECEMBER

**NCG:** Installation of sequencing equipment. NovaSeq6000, a production-scale sequencer, will allow for the implementation of larger Next Generation Sequencing (NGS) tests, such as exome sequencing, large tumour fusion panels, and whole genome sequencing. In addition, it will advance research activity for the LNS and in Luxembourg at large.

**Together LNS:** the Out of the Box virtual Christmas party was held via livestream in form of a talk show with Prof. Dr Evelin Schröck and Prof. Dr Friedrich Mühlshlegel, bookended by original songs performed by the LNS music band and followed by an online mystery game.



# 03. THE COVID-19 TIMELINE

Serving the country: The “COVID-19 year” at the LNS

## JANUARY

### LUXEMBOURG

- Consultations among health players on COVID-19 and related risks

### LNS

- Participation in the national crisis management
- Development of SARS-CoV-2 RT-PCR diagnostic assay

## MARCH

### LUXEMBOURG

- First wave and lockdown mid-march
- Launch of the Research Luxembourg COVID-19 Taskforce

### LNS

- Crisis mode implemented, kick-off LNS COVID-19 Fighters

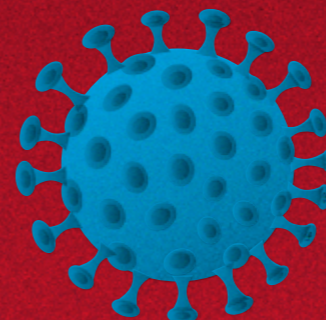
## MAY

### LUXEMBOURG

- Relaxation of lockdown related measures
- Launch of the Large Scale Testing campaign

### LNS

- National testing initiative in nursing homes in collaboration with Inspection Sanitaire



## SEPTEMBER

### LUXEMBOURG

- Launch of Large Scale Testing phase II

### LNS

- Implementation of serological testing of anti-SARS-CoV-2 using ELISA technique



## NOVEMBER

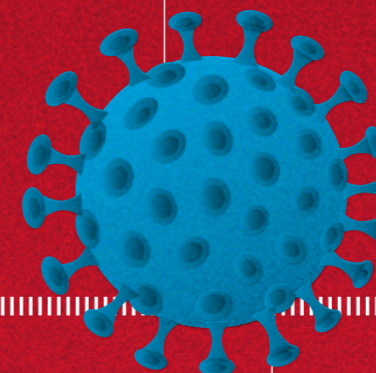
### LNS

- Launch of national school testing program in collaboration with Ministry of Education, Children and Youth (MENJE)
- Opening of the LNS COVID-19 testing center in Dudelange

## JULY

### LNS

- Establishment of COVID+ diagnostic program to improve diagnostic tools in Luxembourg



## FEBRUARY

### LUXEMBOURG

- Preparations for the expected pandemic start

### LNS

- National laboratory testing for SARS-CoV-2 offering services to hospitals and Inspection Sanitaire

## APRIL

### LUXEMBOURG

- Launch of the CON-VINCE study

### LNS

- Development of SARS-CoV-2 whole genome sequencing workflow
- Recognition of LNS as COVID19 supportive laboratory by ECDC

## JUNE

### LNS

- Launch of LuxMicroBiobank as a national biorepository for SARS-CoV-2 positive samples

## AUGUST

### LNS

- Implementation of Respiratory viruses surveillance program for 52 weeks in collaboration with Direction de la santé



## OCTOBER

### LUXEMBOURG

- Number of infections and thus also demand for tests rose very quickly

### LNS

- Launch of Respiratory Viruses Surveillance Newsletter (ReViLux)
- Offering SARS-CoV-2 diagnostic support to Consultation Covid Center (CCC) at Kirchberg

## DECEMBER

### LNS

- Launch of COVID+ Genomics study to investigate the circulating variants in Luxembourg
- SARS-COV-2 testing service to children 2-6 years old in collaboration with the Ligue Médico-Sociale

The act of helping is always something that is shared, and so it was in 2020. In order to be able to help the country and its people, we also relied on the help of others. A perfect example of this is the solidarity action “Kochen für Helden” (Cooking for Heroes). On behalf of our LNS heroes, we would like to thank Mrs Susanne Thébert from Deutsche Bank Luxembourg SA and Fresh & Flavour Restaurant GmbH once again for their support.



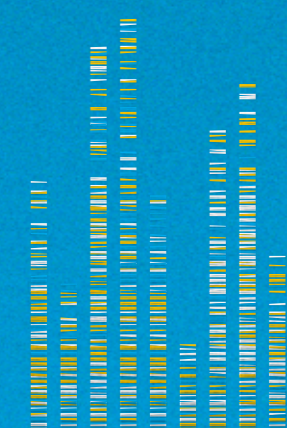
# 2.1

## MICROBIOLOGY



“Eis Virologe stoungen am Zentrum vun der Aarbecht vum Departement. Zesummen hu mir eng ganz wichteg Roll fir dat gantz Land gespilt, an dëst zanter dem Ufank vun der Kris.“

Dr Trung Nguyen Nguyen  
Head of service







# DAY-TO-DAY AND RESEARCH PROJECTS: THE VARIED ROLE OF THE DEPARTMENT OF MICROBIOLOGY IN 2020

The year 2020 was defined by COVID-19. If there is one department of LNS for which this was especially true, it is Microbiology. Last year, each and every member of the department's staff was in demand and the team as a whole was put to the test.

The microbiologists' tasks were very varied and evolved continuously over the course of the year. Firstly, the team played a key role in the day-to-day, operational reality of the fight against the virus. At the same time, the department's expertise was also in demand for research projects – across borders and, what's more, from the very beginning. Our microbiologists were thrown in at the deep end.

## A KEY ROLE FROM THE BEGINNING

"From the moment we entered into crisis mode and began our joint fight against COVID-19 in the spring, our virologists were at the heart of the work of this department," remembers Dr Trung Nguyen Nguyen, head of the Virology and Serology Service. "Our team performed the tests that arrived at the LNS. Our department's two other services, just like the LNS's other departments, supported their virologist colleagues on a technical and scientific level. Together, we thus played a key role for the whole country from the beginning of the crisis."

## SERVING ALL GENERATIONS

This role included a whole range of concrete measures on the ground, which was adapted to the evolving situation, continues Trung Nguyen Nguyen: "During the spring, we carried out systematic tests in the retirement and care establishments of Luxembourg on behalf of the Direction de la santé, to counteract the spread of the virus in that vulnerable environment. Approximately 10,000 tests were carried out on both the residents of the establishments and their nursing staff."

The younger generations were the focus of a joint initiative by the LNS and the Ligue Médico-Sociale (Ligue) in November: "A testing campaign, aimed at children aged between two and six, was carried out in the Ligue's Centres Médicaux-Sociaux (CMS) by specially trained paediatric nurses from the Ligue taking nasal swabs. The samples were then transported to our laboratory, where we tested them."

## COMPLEMENTARY COOPERATION

In addition to the microbiologists' ability to react quickly, both of the actions described above showcase cooperation between the LNS and other players in the health system. This is also reflected in other initiatives. During the autumn, LNS employees conducted tests in the test centre, located in the former building of the National Library on the Kirchberg. 3,038 tests were taken there between 19 and 26 October alone, 411 of them coming back positive. As of November 5th, the LNS's drive-through test centre opened at the Dudelange site, where at peak times more than 300 swabs were taken every day. In total the LNS performed 10,879 test throughout the opened 2 months of 2020.

The very rapid adoption of these initiatives was made possible by the complementary skills available at the LNS, as well as by advance planning, as Trung Nguyen Nguyen explains: "To ensure excellence and professionalism in this difficult situation, the LNS used the potential of its international team and its modern infrastructure. This is how we were able to provide the population with reliable testing with as little waiting time as possible. Besides, we started preparing for the most likely scenarios early on. This enabled us to attract the additional specialist staff we needed."

LNS team conducting the tests at the COVID-19 Test Center at Kirchberg.



## EXCELLENCE AND TECHNOLOGY

However, the microbiologists of the LNS did not only make this expertise available for the deployment on the ground, as Dr Tamir Abdelrahman, head of the Microbiology Department explains: "Since the identification of the first case of SARS-CoV-2 in Luxembourg, we had implemented a plan to characterise the variants, circulating in the country variants, based on all samples available or referred to LNS. This made Luxembourg one of the first European countries to align with the recommendations of the ECDC to sequence 10% of all positive cases. Among others we confirmed the switch of different variants between the first two waves, which allowed us to be at the forefront of the variant tracking activities in Europe."

The bottom line, Tamir Abdelrahman continues, is that the LNS Microbiology Department redefined excellence in its sequencing services, being one of the very few laboratories providing medical reports which detail the detected, thanks to a state of the art platform implemented in the established Microbial Genomic Unit (Lux-GEM). These excellent services were recognised at European level; ECDC cited our Virology Service as one of only four European laboratories nominated supportive lab for COVID19.

## A PARTNER IN NATIONAL STUDIES

Against this background, the microbiologists of the LNS also became sought-after research partners during the coronavirus crisis. At national level, the LNS had led the COVID+ genomics study where the team established a retrospective study to characterise the circulating SARS-CoV-2 variants. The team also contributed its expertise and the molecular microbiology platform to the CON-VINCE study. This research project, launched in April under the auspices of the Research Luxembourg COVID-19 Task Force, studied the spread of SARS-CoV-2 in the Grand Duchy.

The CON-VINCE study was carried out by a consortium of national research institutes, led by the Luxembourg Institute of Health (LIH), the Luxembourg Center for Systems Biomedicine (LCSB), as well as the associated partners TNS-Ilres and the Ketterthill, Laboratoires Réunis and BioneXt LAB laboratories.

## INTERNATIONAL RESEARCH ACTIVITIES

The expertise of LNS microbiologists on COVID-19 was also in demand internationally in 2020. Guillaume Fournier of the Virology and Serology Unit, and Joël Mossong, Catherine Ragimbeau and Anke Wienecke-Baldacchino of the Epidemiology and Microbial Genomics Unit contributed to a study on "Geographical and temporal distribution of SARS-CoV-2 clades in the WHO European Region". Over a period running from March to June 2020, they provided SARS-CoV-2 full-genome sequencing data for Luxembourg. This was covered in an article published in September in *Eurosurveillance*, an international journal specialised in infectious disease surveillance, epidemiology, prevention and control.

Also in September, Tamir Abdelrahman gave a presentation during the ECCVID conference. This yearly conference is organized by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID). Tamir Abdelrahman: "ESCMID is one of the most important platforms worldwide for exchanges between microbiologists. As a part of its efforts to share knowledge among international experts, ESCMID organised ECCVID as a virtual event to address COVID-19-related work. ECCVID featured a comprehensive scientific program that spanned a wide range of topics surrounding this emerging threat, and offered opportunities to showcase the latest findings, share experiences and knowledge, and demonstrate practical techniques and guidance."

## TWO LNS COVID-19 FIGHTERS TELL THEIR STORY

Experiences and knowledge, practical techniques and guidance – these were generally the magic words that led to success in the fight against the virus. Building on this, and inspired by the values of Together LNS, every single team member became a COVID-19 Fighter – most visibly in the Microbiology Department. What this meant in individual cases is shown representatively by the two accounts of Guillaume Fournier and Anke Wienecke-Baldacchino, which reflect much of the tense atmosphere, but also the motivation present during the pandemic.



### GUILLAUME FOURNIER: SCIENTIFIC MANAGER AT THE MICROBIOLOGY DEPARTMENT

"I am a veterinarian by training, but also a virologist with solid experience in influenza. I joined the LNS three years ago as an assistant in the Virology Service and am currently working as the Scientific Manager of the Microbiology Department.

Like everyone else in the department, I contributed to the fight against COVID-19, notably by setting up the very first diagnostic method available in Luxembourg, as well as the protocols for handling SARS-CoV2 samples in the BSL III laboratory at a time when there was still little knowledge of how dangerous the virus could be. Setting up the LuxMicroBiobank also proved to be essential to manage the increasing influx of SARS-CoV-2 samples.

None of this would have been possible without the great spirit of mutual aid and collaboration found within the LNS – with its centralised reception, its IT and logistics services and at countless individual levels – but also within Luxembourg, with the various research projects I was fortunate enough to take part in, or at the international level to validate diagnostic methods and exchange knowledge."



### ANKE WIENECKE- BALDACCHINO: BIOINFORMATICIAN AT THE MICROBIOLOGY DEPARTMENT

"After school I always wanted to be a virologist, as I was always fascinated by those tiny, little things, being able to do that much harm. In the end, I studied biotechnology, bioinformatics and epidemiology. I am hence not a virologist, but I am – among others – working with virus-related data and provide Luxembourg with the variant distribution data of SARS-CoV-2. For me it's like closing the loop, and in that sense one can call me a COVID-19 Fighter.

I see this fight as a duty with impact. I remember that I first read in December 2019 about a new lung disease in Wuhan. In February 2020, I participated in a training in Genomics and Clinical Virology in the UK. Being back on the 29th of February, I was confronted with the first SARS-CoV-2 sample in Luxembourg and the request to implement an analysis pipeline for the protocol I "imported" from UK to our lab.

From this day on, my work shifted to SARS-CoV-2 data analysis, which remained until today one of my major duties. I see the impact and recognition of these efforts, which is very satisfying and motivating. What's more: I also made my first experiences with radio and TV interviews, which had never been on any of my to do lists before. I had the opportunity to closely work with the wet-lab team, external partners and in particular our IT Service. All these collaborations formed and still form a nice experience; they follow all a common mission. As we say in German, one grows with his or her tasks – and considering my tasks in 2020, I should have grown a lot."

# LE QUOTIDIEN ET LES PROJETS DE RECHERCHE : LE RÔLE DU DÉPARTEMENT DE MICROBIOLOGIE EN 2020

L'année 2020 a été marquée par la COVID-19. Et s'il y a un département du LNS pour lequel cela a été particulièrement vrai, c'est bien celui de la microbiologie.

Les tâches des équipes de microbiologie étaient très variées et n'ont cessé d'évoluer au cours de l'année. Alors que le département a joué un rôle-clé dans la réalité quotidienne et opérationnelle de la lutte contre le virus, son expertise a également été sollicitée pour divers projets de recherche.

## UN RÔLE-CLÉ DÈS LE DÉBUT

« Dès le début de notre lutte contre la COVID-19, les virologues se sont retrouvés au cœur du travail du département », se souvient le Dr Trung Nguyen Nguyen, responsable du service de virologie et sérologie. « Notre équipe a effectué tous les tests transmis au LNS. Les deux autres services de notre département, ainsi que les autres départements du LNS, ont soutenu leurs collègues virologues aussi bien sur le plan technique que scientifique. »

## AU SERVICE DE TOUTES LES GÉNÉRATIONS

Ce rôle comprenait toute une série de mesures concrètes sur le terrain, adaptées à l'évolution de la situation, poursuit Trung Nguyen Nguyen : « Au printemps, nous avons effectué des tests dans l'ensemble des établissements de retraite et de soins du Luxembourg pour le compte de la Direction de la santé, afin de contrer la propagation du virus dans cet environnement vulnérable. Environ 10 000 tests ont ainsi été effectués, tant sur les résidents que sur le personnel soignant. »

Les plus jeunes ont fait l'objet d'une initiative conjointe du LNS et de la Ligue Médico-Sociale (Ligue) en novembre : « Une campagne de dépistage, destinée aux enfants âgés de deux à six ans, a été menée dans les Centres Médicaux-Sociaux (CMS) de la Ligue. Les échantillons ont ensuite été transportés au LNS, où nous avons procédé aux tests PCR. »



Les virologues ont effectué tous les tests transmis au LNS.

## UNE COOPÉRATION COMPLÉMENTAIRE

Au cours de l'automne, les collaborateurs du LNS étaient en charge des tests dans le centre de dépistage situé dans l'ancien bâtiment de la Bibliothèque nationale au Kirchberg. Rien qu'entre le 19 et le 26 octobre, 3 038 tests ont ainsi été effectués. Le 5 novembre, le centre de prélèvement du LNS a ouvert sur le site de Dudelange où, aux heures de pointe, plus de 300 prélèvements ont pu être effectués chaque jour. Au total, le LNS a traité 10 879 tests PCR pour les 2 mois d'ouverture en 2020.





**Garantir le professionnalisme en utilisant le potentiel de l'équipe et de l'infrastructure.**

## UN PARTENAIRE POUR LA RECHERCHE

Dans ce contexte, le département de microbiologie s'est largement impliqué dans la recherche. Au niveau national, le LNS a dirigé l'étude génomique COVID+, dans le cadre de laquelle l'équipe a mis en place une étude rétrospective pour caractériser les variants circulants du SRAS-CoV-2. L'équipe a également apporté son expertise et sa plateforme de microbiologie moléculaire à l'étude CON-VINCE, menée par un consortium d'instituts de recherche qui a étudié la propagation du SRAS-CoV-2 au Grand-Duché.

Au niveau international, Guillaume Fournier du service de virologie et de sérologie, et Joël Mossong, Catherine Ragimbeau et Anke Wienecke-Baldacchino du service d'épidémiologie et de génomique microbienne ont contribué à une étude sur la « Distribution géographique et temporelle des clades du SRAS-CoV-2 dans la région européenne de l'OMS ». Par ailleurs, Tamir Abdelrahman a fait une présentation lors de la conférence ECCVID, l'une des plus importantes plateformes mondiales d'échanges entre microbiologistes. Dans le cadre de ses efforts pour partager les connaissances entre experts internationaux, ESCMID a organisé l'ECCVID en tant qu'événement virtuel pour aborder les travaux relatifs à COVID-19.

L'adoption très rapide de ces initiatives a été rendue possible par les compétences complémentaires disponibles au LNS, ainsi que par une planification préalable, comme l'explique Trung Nguyen Nguyen : « Pour garantir l'excellence et le professionnalisme dans cette situation difficile, le LNS a utilisé le potentiel de son équipe internationale et de ses infrastructures modernes. C'est ainsi que nous avons pu fournir à l'ensemble de la population un système de tests fiables avec un temps d'attente aussi court que possible. »

## EXCELLENCE ET TECHNOLOGIE

Cependant, les microbiologistes du LNS n'ont pas seulement mis cette expertise à disposition du déploiement sur le terrain, comme l'explique le Dr Tamir Abdelrahman, chef du département : « Depuis la première identification du SRAS-CoV-2 au Luxembourg, nous avons mis en place un plan de caractérisation des variants circulant dans le pays, sur la base de tous les échantillons disponibles ou adressés au LNS. Cela a fait du Luxembourg l'un des premiers pays européens à s'aligner sur les recommandations de l'ECDC de séquencer 10% de tous les cas positifs - ce qui nous a permis d'être à l'avant-garde des activités de suivi des variants en Europe. »

L'essentiel, poursuit Tamir Abdelrahman, est que le département de microbiologie du LNS a su faire preuve d'excellence dans ses services de séquençage, étant l'un des rares laboratoires à fournir des rapports médicaux détaillant les cas détectés, grâce à une plateforme de pointe mise en place dans l'unité de génomique microbienne (Lux-GEM) : « L'ECDC a cité notre service de virologie comme l'un des quatre seuls laboratoires européens désignés comme laboratoire de soutien pour la COVID-19. »

## DEUX LNS COVID-19 FIGHTERS RACONTENT LEUR HISTOIRE

Expériences et connaissances, techniques pratiques et conseils - tels étaient généralement les mots magiques qui ont mené au succès dans la lutte contre le virus. Sur cette base, et inspiré par les valeurs de Together LNS, chaque membre de l'équipe est devenu un combattant de la COVID-19, le plus visible étant le département de microbiologie. Les témoignages de Guillaume Fournier et de Anke Wienecke-Baldacchino illustrent bien l'atmosphère tendue mais aussi la motivation qui régnait pendant la pandémie.



### GUILLAUME FOURNIER, RESPONSABLE SCIENTIFIQUE AU DÉPARTEMENT DE MICROBIOLOGIE

« Je suis vétérinaire de formation, mais aussi virologue avec une solide expérience sur la grippe. J'ai rejoint le LNS il y a trois ans en tant qu'adjoint au service de virologie et travaille actuellement en tant que responsable scientifique du département de microbiologie.

Comme tout le monde dans le département j'ai contribué à la lutte contre la COVID-19, en mettant notamment en place la toute première méthode de diagnostic disponible au Luxembourg ainsi que les protocoles pour manipuler les échantillons de SRAS-CoV-2 dans le laboratoire de sécurité de niveau 3 (BSL III) lorsque l'on avait encore peu de recul sur la dangerosité du virus. La mise en place de la LuxMicroBiobank a aussi été une activité indispensable pour gérer l'afflux croissant d'échantillons de SRAS-CoV-2.

Rien de cela n'aurait été possible sans le formidable esprit d'entraide et de collaboration que ce soit au sein du LNS avec la réception centralisée, l'informatique, la logistique et les nombreuses manifestations individuelles, mais également à l'échelle du Luxembourg pour différents projets de recherches auxquels j'ai eu la chance de prendre part ou encore au niveau international pour valider les méthodes diagnostiques et échanger les connaissances. »



### ANKE WIENECKE-BALDACCHINO, BIOINFORMATICIENNE AU DÉPARTEMENT DE MICROBIOLOGIE

« Après l'école, j'ai toujours voulu être virologue. Finalement, j'ai suivi ma voie en étudiant la biotechnologie, la bioinformatique et l'épidémiologie. Aujourd'hui, je travaille - entre autres - avec des données relatives aux virus et je fournis au Luxembourg les données de distribution des variants du SRAS-CoV-2.

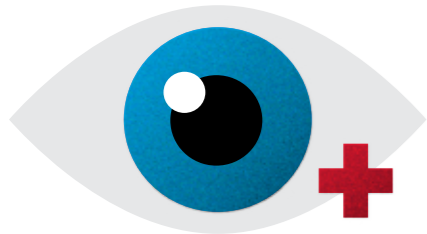
Je considère ce combat comme un devoir qui a un impact. En février 2020, j'ai participé à une formation en génomique et virologie clinique au Royaume-Uni. Une fois de retour, j'ai été confrontée au premier échantillon de SRAS-CoV-2 au Luxembourg et à la demande de mettre en place un pipeline d'analyse pour le protocole que j'ai « importé » du Royaume-Uni dans notre laboratoire.

À partir de ce jour, mon travail s'est orienté vers l'analyse des données sur le SRAS-CoV-2. Je constate l'impact et la reconnaissance de ces efforts. Qui plus est, j'ai eu l'occasion de collaborer étroitement avec l'équipe du laboratoire, les partenaires externes et en particulier notre service informatique. Toutes ces collaborations ont constitué et constituent encore une belle expérience. Elles forment une mission commune. »





# KEY FACTS & FIGURES



## EPIDEMIOLOGY AND MICROBIAL GENOMICS

### Main achievements in 2020

Establishing SARS-CoV-2 national genomic surveillance program including sequencing 3,974 samples using whole genome sequencing approach.

- Active participation in European foodborne pathogen surveillance based on whole genome sequencing: compared national data to 19 international outbreaks strains. 962 isolates sequenced by whole genome analysis.
- Active participation in the investigation of a multi-country outbreak of Salmonella enterica serotype Typhimurium.
- Sequencing of the seasonal flu for monitoring at the EU level: 135 processed.
- Oral presentation of the surveillance research work implemented in Luxembourg at the ECDC workshop entitled "Preparedness on Campylobacter from source attribution to multi-country outbreak detection" – 5-6 March 2020.
- Morgane Nennig (PhD student) and Ardashes Latsuzbaia (Postdoc researcher) were awarded the Luxembourg Society for Microbiology (LSfM) Conference Achievement Awards.
- 15 publications in peer-reviewed journals.

## VIROLOGY AND SEROLOGY

### Main achievements in 2020

Our Virology & Serology Service was at the heart of the fight against COVID-19 in 2020. Its work is therefore acknowledged in detail not only in this chapter, but also in the preceding COVID-19 timeline. In addition, the number of PCR analyses carried out in Virology speaks for itself.

# 112,733

PCR ANALYSES IN VIROLOGY

# 22,913

SEROLOGY ANALYSES

# 5,120

WHOLE GENOME ANALYSES INCLUDING 49 METAGENOMICS

## BACTERIOLOGY, MYCOLOGY, ANTIBIOTIC RESISTANCE AND HOSPITAL HYGIENE

### Main achievements in 2020

COVID-19 has of course had a significant impact on the service's activity: reduction in the number of analyses during the containment periods, temporary transfer of staff to Virology to face the influx of COVID-19 PCR requests.

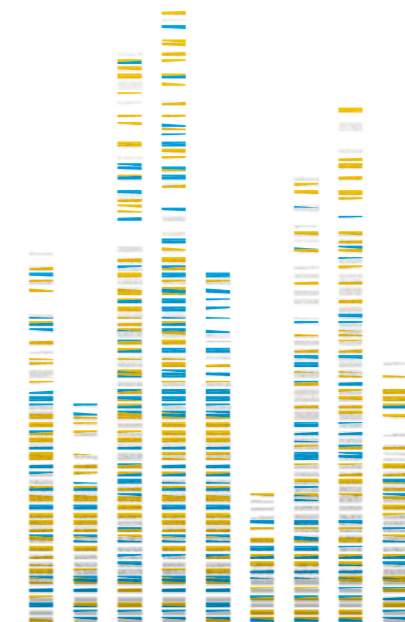
Nevertheless, the service has met five major challenges:

- Development of the mycology activity with the implementation of the identification of moulds by Maldi-Tof using an international database to which only a limited number of international labs have access.
- Expansion of ISO 15189 accredited testing, mainly in the field of mycology and molecular biology, so that the service has thus reached 90% of accredited analyses.
- Start of the MIRABANK project (ECDC project), in collaboration with IBBL, aimed at creating a bank of multi-resistant bacterial strains from 36 European countries, strains that are resistant to carbapenems and/or colistin (antibiotics of last resort in human pathology).

- Participation in 2 European studies:
  - IRIS Study, to evaluate the impact of COVID-19 on invasive bacterial infections
  - WHO NGS
- 4 publications in peer-reviewed journals, 3 presentations at international conferences.

# 35,069

ANALYSES





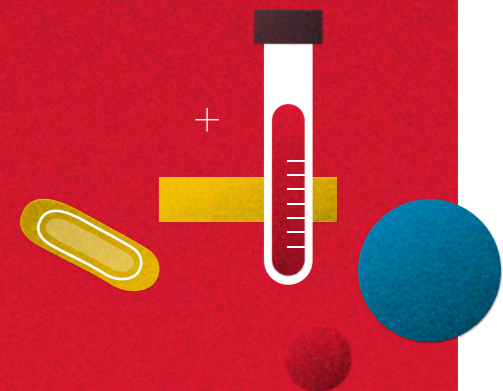
# 2.2

## HEALTH PROTECTION



“Mir schaffen ëmmer enk mat eise Stakeholder zesummen, an d’Erwaardunge vun eise Clientë waren de Kär vun eisem Restrukturationsprozess, iwwert deem mir eis dauernd ausgetosch hunn.”

Prof. Dr. An Van Nieuwenhuyse  
Head of departement





# CONCERTED ACTION AGAINST INDOOR POLLUTION: LNS AND DISA OFFER A HOLISTIC APPROACH TO OPTIMISE SUPPORT TO MEDICAL DOCTORS AND PATIENTS

Health protection: in 2020, this term was mainly associated with COVID-19. But the topic goes much further. This is especially true at the LNS, where the Health Protection Department was reorganised in 2019, and took over a central task for the national health system in 2020. As a result, indoor pollution related diseases can now be tracked even better where they originate, i.e. inside buildings.



## EXISTING TEAM SUPPLEMENTED

The restructuring process that the department underwent is part of a comprehensive strategy. In 2019, the main focus was on reorganising the entire Environmental Hygiene and Human Biological Monitoring Unit, while 2020 was about setting up a new team of field sampling nurses. The Environmental Hygiene and Human Biological Monitoring Unit, headed by Dr Radu Duca, is in charge of laboratory analyses for indoor pollution: as such, it analyses hazardous chemical substances in the indoor environment of private houses, offices and public buildings. In the near future, the LNS will also analyse mould in indoor household environments. For this purpose, a new laboratory is currently being built. Until the new lab is functional, the LNS will continue to outsource mould analyses.

For a long time, for private housing, the LNS has formed a fully synergetic tandem with the Health Directorate (DISA), who created twenty years ago the service "Emweltambulanz" and for which the LNS performed the laboratory analyses. This service allows private people, upon medical prescription, to ask for environmental analysis in their home in order to detect risk factors associated with indoor pollutants. Together with the Health Directorate, the LNS is now in charge of optimizing the service in order to better respond to the higher demand and specific needs of patients.

The new Medical Expertise and Data Intelligence Service team at the LNS.

## WORKING CLOSELY WITH STAKEHOLDERS

Prof. Dr An Van Nieuwenhuysse, head of the Health Protection Department, explains: "We always work closely with our various stakeholders, and our clients' expectations formed the core of our internal restructuring process, for which we have had constant exchanges, especially with Ministry of Health (MISA). We have worked with the ministry to redistribute tasks in order to optimise the service to both medical doctors and patients in Luxembourg in the area of indoor pollution. The LNS now has increased responsibilities. We implement the full service chain, from planning and sampling in the patients' homes to holistic reporting. DISA, as the competent authority for health in Luxembourg, remains in charge of the first and the last steps in this service chain. At the start of the process, DISA approves the medical prescription and gives the LNS the green light to go ahead with on-site sampling in the patient's home. LNS will assist DISA in the administrative processes to be carried out when the medical prescriptions come in. At the end of the process, DISA remains in charge of interpreting the results (raw data) and establishing the final reports with guidance and individualised recommendation. In the near future, however, the LNS will support DISA in this last step by integrating all results into a first report draft. DISA and LNS will then finalize together the interpretation of these results, the medical advice and the risk management options in terms of building hygiene."

For the purposes of this restructuring exercise, a new department structure was developed in 2020 to cover all the areas described above. As a first step, existing expertise was reallocated internally. Then, new members of staff were brought in. Three nurses have been recruited already, and two more will be recruited later on. These new hires are making comprehensive on-site action possible, the importance of which An Van Nieuwenhuysse points out: "Many illnesses arise where the sick person finds themselves most often, i.e. in their living environment. The clinical pictures can be as varied as the causes, going from respiratory complaints, including for example asthma or allergies, to neurological complaints, caused by exposure to chemical compounds or mould."

## PERFORMING COMPREHENSIVE TASKS ON-SITE

To do justice to this versatility, the tasks performed on-site must be comprehensive. An Van Nieuwenhuysse comments: "Our field sampling nurses take air, dust and mould samples on the premises, and will also start collecting biological samples including urine, blood and hair from patients in the near future. From these samples, the LNS will measure concentrations of hazardous chemical compounds or their metabolites that can form in the human

body. This will give us a better idea of what is really harming a patient's health. In addition, the field-sampling nurses will carry out detailed patient interviews and use questionnaires to collect health complaints in more detail and with further contextual information. In order to gather that contextual information, close relatives who live in the same house as patients will also be involved. All this will be done in order to determine causes that may not be obvious at first glance, and to ensure better-targeted patient and risk management for indoor pollution in Luxembourg. Finally, since MISA is in charge of the national monitoring programme for indoor pollution in the Grand Duchy, collected data will also enable us to create national reference databases for indoor pollution for the whole population. Through statistical analyses of these reference databases, we will be able to better identify the specific issues that really cause health complaints and diseases in the country's population. This will help MISA prioritize and focus on targeted surveillance and risk management campaigns – the next step in its action plan. All this shows that we now have a team in the field of health protection whose expertise and scope fully meet the challenges arising in Luxembourg."

## A HOLISTIC APPROACH DRIVEN BY THE LNS TEAM

This complete service chain has been complemented, since 2020, by a holistic overall approach. With the reorganisation of the department, the LNS is also taking over most of the executive tasks that were originally carried out by MISA. Whereas patients or doctors previously interacted exclusively with the health directorate, where everything was coordinated and organized, coordination and organization of field sampling now runs completely through the LNS. To ensure full transparency, the LNS and DISA are currently working towards an online tool that will allow patients, medical doctors and DISA to track each step in the service chain. This online tool will be hosted at the LNS. Patients and doctors will be able to go online to see if, and when DISA has authorized on-site investigations in a patients' home. After that, the LNS field sampling nurses will reach out to the patient to plan a visit. With the new organization of this service, DISA and the LNS are aiming to optimize the timeline between the moment a prescription is issued and the moment patients and doctors receive the results (which includes advice for further patient and risk management). The planned optimization of reporting will allow further pacing up. In the future, we want the time between the initial prescription and the moment the final report is sent to doctors and patients to be reduced to a maximum of 3 months."





Excellence meets technology in the LNS's Health Protection Department.

## DIRECT COOPERATION WITH DISA AND OTHER STAKEHOLDERS

An Van Nieuwenhuysse: "We are aiming to offer a complete solution from the initial request all the way to reporting. The competences of our field sampling nurses and the expertise of our team in Dudelange, as well as the infrastructure available there together form a package that is precisely tailored to current and future requirements in the field of indoor pollution. All this also puts us in a position to react quickly to new situations, with the added benefit of the direct and uncomplicated cooperation with DISA and other stakeholders and partners that is characteristic of Luxembourg. This has also allowed for an extremely fast restructuring process in the department."

### PARTICULAR CHALLENGES: INDOOR POLLUTION IN COVID TIMES

The COVID-19 pandemic also presented the LNS indoor pollution experts with new challenges. This was due, on the one hand, to the new hygiene requirements aimed at containing the virus and, on the other hand, to the special lockdown situation. An Van Nieuwenhuysse: "In 2020, people very often stayed inside and worked intensively in home offices. This has massively changed the hygiene conditions in living spaces. In addition, people tried to counteract the virus here and there by using particularly strong disinfectants, which then, in turn, led to a high concentration of chemicals."

## RÉSUMÉ EN FRANÇAIS

### UNE LUTTE CONJOINTE CONTRE LA POLLUTION INTÉRIEURE : LE LNS ET LA DISA PROPOSENT UNE APPROCHE HOLISTIQUE POUR OPTIMISER L'ACCOMPAGNEMENT DES MÉDECINS ET DES PATIENTS

Protection de la santé : en 2020, ce terme était principalement associé à la COVID-19. Mais le sujet va beaucoup plus loin. C'est particulièrement vrai au LNS, où le Département de Protection de la Santé a été réorganisé en 2019 et a repris une tâche centrale pour le système national de santé en 2020. Ainsi les maladies liées à la pollution intérieure peuvent désormais être traquées d'où qu'elles proviennent à l'intérieur des bâtiments.

#### L'ÉQUIPE EXISTANTE RENFORCÉE

Le processus de restructuration que le département a subi s'inscrit dans une stratégie globale. En 2019, l'accent a été mis sur la réorganisation de l'ensemble du service de surveillance de l'hygiène du milieu et de surveillance biologique, tandis que 2020 a donc été consacrée à la mise en place d'une nouvelle équipe d'infirmiers chargés des prélèvements sur le terrain. Le service de surveillance de l'hygiène du milieu et de surveillance biologique, dirigé par le Dr Radu Duca, est responsable des analyses de laboratoire pour la pollution intérieure. Le service analyse les substances chimiques dangereuses qui peuvent être présentes dans les environnements intérieurs des maisons privées, des bureaux et des bâtiments publics. Dans un avenir proche, le LNS analysera également les moisissures dans l'environnement intérieur des ménages. À cette fin, un nouveau laboratoire est en train d'être mis en place. Jusqu'à ce que le nouveau laboratoire soit fonctionnel, le LNS continuera à sous-traiter les analyses de moisissures. Pendant longtemps, pour les logements privés, le LNS a formé un tandem pleinement synergique avec la Direction de la santé (DISA), qui a créé il y a vingt ans le service « Umweltambulanz » et pour lequel le LNS a réalisé les analyses en laboratoire. Ce service permet aux particuliers, sur prescription médicale, de demander une analyse environnementale à leur domicile afin de détecter les facteurs de risque liés aux polluants intérieurs. En collaboration avec la Direction de la santé, le LNS est désormais en charge d'optimiser le service afin de mieux répondre à la demande accrue et aux besoins spécifiques des patients.

#### TRAVAILLER EN ÉTROITE COLLABORATION AVEC LES PARTIES PRENANTES

Le Prof. Dr An Van Nieuwenhuysse, chef du département des laboratoires de protection de la santé, explique : « Nous travaillons toujours en étroite collaboration avec nos différentes parties prenantes, et les attentes de nos clients ont été au cœur de notre processus de restructuration interne, pour lequel nous avons eu des échanges constants, notamment avec le ministère de la Santé (MISA). Nous avons travaillé avec le ministère pour redistribuer les tâches afin d'optimiser le service aux médecins et aux patients luxembourgeois dans le domaine de la pollution intérieure. Le LNS a désormais des responsabilités accrues. Nous mettons en œuvre la chaîne de services complète, de la planification et de l'échantillonnage au domicile des patients au rapport holistique. La DISA, en tant qu'autorité compétente en

matière de santé au Luxembourg, reste en charge de la première et de la dernière étape de cette chaîne de services. Au début du processus, la DISA valide la prescription médicale et donne le feu vert au LNS pour procéder au prélèvement sur place au domicile du patient. Le LNS assistera la DISA dans les démarches administratives à effectuer lors de l'arrivée des prescriptions médicales. En fin de démarche, la DISA reste en charge de l'interprétation des résultats (données brutes) et de l'établissement des rapports finaux avec accompagnement et recommandations individualisées. Dans un avenir proche, cependant, le LNS soutiendra la DISA dans cette dernière étape en intégrant tous les résultats dans un premier projet de rapport. La DISA et le LNS finaliseront ensuite ensemble l'interprétation de ces résultats, l'avis médical et les options de gestion des risques en matière d'hygiène du bâtiment. »

Aux fins de cet exercice de restructuration, une nouvelle structure de département a été développée en 2020 pour couvrir tous les domaines décrits ci-dessus. Dans un premier temps, l'expertise existante a été réaffectée en interne. Ensuite, de nouveaux membres du personnel ont été recrutés. Trois infirmiers ont déjà été embauchés et deux autres seront recrutés ultérieurement. Ces nouvelles embauches permettent une action globale sur le terrain, dont An Van Nieuwenhuysse souligne l'importance : « De nombreuses maladies surviennent là où la personne malade se retrouve le plus souvent, c'est-à-dire dans son milieu de vie. Les symptômes peuvent être aussi variés que les causes, allant des troubles respiratoires, y compris par exemple l'asthme ou les allergies, aux troubles neurologiques, causés par l'exposition à des composés chimiques ou à des moisissures. »

#### DES TÂCHES COMPLÈTES EXÉCUTÉES SUR PLACE

Pour rendre justice à cette polyvalence, les tâches effectuées sur site doivent être complètes. An Van Nieuwenhuysse commente : « Nos infirmiers chargés de l'échantillonnage sur le terrain prélèvent des échantillons d'air, de poussière et de moisissures sur place, et commenceront également à prélever des échantillons biologiques, y compris l'urine, le sang et les cheveux des patients dans un avenir proche. À partir de ces échantillons, le LNS mesurera les concentrations de composés chimiques dangereux ou de leurs métabolites pouvant se former dans le corps humain. Cela nous donnera une meilleure idée de ce qui nuit réellement à la santé d'un patient. En outre, les infirmiers chargés de l'échantillonnage sur le terrain mèneront des entretiens détaillés avec les patients et utiliseront des questionnaires pour recueillir des plaintes de santé plus en détail et avec des informations contextuelles supplémentaires. Afin de recueillir ces informations contextuelles, les membres de la famille qui vivent dans la même maison que les patients seront également impliqués. Tout cela sera fait afin de déterminer des causes qui peuvent ne pas être évidentes au premier coup d'œil, et d'assurer une gestion ciblée des patients et des risques de pollution intérieure au Luxembourg. Enfin, le MISA étant en charge du programme national de surveillance de la pollution intérieure au Grand-Duché, les données collectées permettront également de créer des bases de données nationales de référence sur la pollution intérieure pour l'ensemble de la population. Grâce à des analyses statistiques de ces bases de données de référence, nous pourrions mieux identifier les problèmes spécifiques qui causent réellement des problèmes de santé et des maladies dans la population du pays. Cela aidera le MISA à prioriser et à se concentrer sur des campagnes ciblées de surveillance et de gestion des risques – la prochaine étape de son plan d'action. Tout cela montre que nous disposons désormais d'une équipe dans le domaine de la protection de la santé dont l'expertise et l'envergure répondent pleinement aux défis qui se posent au Luxembourg. »

### UNE APPROCHE HOLISTIQUE CONDUITE PAR L'ÉQUIPE DU LNS

Cette chaîne de services est complétée, depuis 2020, par une approche globale holistique. Avec la réorganisation du département, le LNS reprend également la plupart des tâches exécutives qui étaient initialement assurées par le MISA. Alors qu'auparavant les patients ou les médecins interagissaient exclusivement avec la Direction de la santé, où tout était coordonné et organisé, la coordination et l'organisation des prélèvements sur le terrain passent désormais entièrement par le LNS. Afin d'assurer une transparence totale, le LNS et la DISA développent actuellement un outil en ligne qui permettra aux patients, aux médecins et à la DISA de suivre chaque étape de la chaîne de services. Cet outil en ligne sera hébergé au LNS. Les patients et les médecins pourront se connecter en ligne pour voir si et quand la DISA a autorisé les investigations sur place au domicile des patients. Après cela, les infirmiers chargés de l'échantillonnage sur le terrain du LNS contacteront le patient pour planifier une visite. Avec la nouvelle organisation de ce service, la DISA et le LNS visent à optimiser le délai entre le moment où une ordonnance est délivrée et le moment où les patients et les médecins reçoivent les résultats (ce qui inclut des conseils pour la gestion ultérieure des patients et des risques). L'optimisation prévue du rapport permettra d'aller plus loin. À l'avenir, nous souhaitons que le délai entre la prescription initiale et le moment où le rapport final est envoyé aux médecins et aux patients soit réduit à 3 mois maximum.

### COOPÉRATION DIRECTE AVEC LA DISA ET D'AUTRES PARTIES PRENANTES

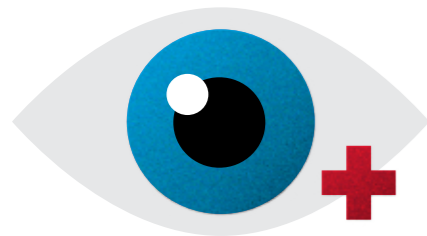
An Van Nieuwenhuysse : « Nous visons à offrir une solution complète depuis la demande initiale jusqu'au rapport. Les compétences de nos infirmiers chargés des prélèvements sur le terrain, l'expertise de notre équipe à Dudelange, ainsi que les infrastructures disponibles sur place forment un ensemble précisément adapté aux besoins actuels et futurs dans le domaine de la pollution intérieure. Tout cela nous permet également de réagir rapidement aux nouvelles situations, avec l'avantage supplémentaire de la coopération directe et simple avec la DISA et d'autres parties prenantes et partenaires qui est caractéristique du Luxembourg. Cela a également permis un processus de restructuration extrêmement rapide dans le département.

### DES DÉFIS PARTICULIERS : LA POLLUTION INTÉRIEURE EN PÉRIODE DE COVID

La pandémie de la COVID-19 a mis les experts en pollution intérieure du LNS face à de nouveaux défis. Cela était dû, d'une part, aux nouvelles exigences en matière d'hygiène comme mesure de prévention contre le virus et, d'autre part, à la situation particulière du confinement. An Van Nieuwenhuysse : « En 2020, les gens restaient très souvent à l'intérieur et travaillaient intensivement dans leurs bureaux à domicile. Cela a considérablement modifié les conditions d'hygiène dans les espaces de vie. En outre, les gens ont essayé de contrer le virus de temps en temps en utilisant des désinfectants particulièrement puissants, ce qui a conduit à une concentration élevée de produits chimiques. »



# KEY FACTS & FIGURES



**8,868**  
MICROBIOLOGICAL ANALYSES

**202**

ANALYSES CONCERNING  
THE PRESENCE OF GMOS

**5,210**

ANALYSES CONCERNING  
THE PRESENCE OF PESTICIDES,  
CONTAMINANTS OR  
OTHER ADDITIVES



## FOOD MONITORING SERVICE

### Main achievements in 2020

- Exponential increase of the scope, in the field of pesticides. The service now carries out almost the entire national pesticides programme for Luxembourg, after a long period of outsourcing these analyses;
- Officially appointed as National Reference Laboratory (NRL) for plant toxins and food-borne viruses. We are now hosting 14 NRLs in line with European legislation;
- Appointed by the European Commission as a validated service provider for reference material certification projects (DNA quantification);
- In line with good governance, all processes started up for the acquisition of the "Blomssystem" software to ensure electronic data transfer between the LNS and the food and feed authority, and this at the request of the authority;
- Impact of COVID-19: number of analyses decreased by 11%, mainly in the field of microbiology (closure of the restaurants).

## ENVIRONMENTAL HYGIENE AND HUMAN BIOLOGICAL MONITORING SERVICE

### Main achievements in 2020

- Indoor pollution: exponential development of organic compounds in air and settled dust; taking over all on-site investigations in patients' houses following medical prescription from MISA (Ministry of Health), at their request;
- Occupational hygiene: carried out worker monitoring during remediation works at the Pulvermühle site;
- Human Biological Monitoring (HBM): implemented the European Chromate Study in Luxembourg.
- Impact of COVID-19: no substantial impact of COVID-19 on results and activities; the number of analyses even increased.

**22,759**

ENVIRONMENTAL  
HEALTH ANALYSES

**12,218**

BIOLOGICAL  
MONITORING ANALYSES

## MEDICAL EXPERTISE AND DATA INTELLIGENCE SERVICE

This service, created in 2020, will host the Department's medical, epidemiological and toxicological expertise. Its ambition is to better guide MISA in the risk assessment and ensure better targeted prevention, risk management and management of the patient's illness.

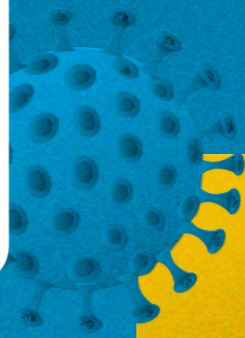
### Main achievements in 2020

- Participation of Luxembourg, with a national population survey, in the aligned studies for the first set of priority compounds, as defined at European level. This was done in collaboration with the Luxembourg Institute of Health (LIH);
- Participation of Luxembourg in a survey of a vulnerable population (mother-child pairs) for the first set of priority compounds, as defined at European level. This was done in collaboration with the Luxembourg Institute for Science and Technology (LIST);
- Developed the protocol, including questionnaires and informed consents, for the implementation of the WHO and UNECE surveys on Persistent Organic Pollutants in breast milk in Luxembourg, at the request of MISA and with the Ministry of the Environment as an interested party;
- Developed the protocol for the European Chromate Study in Luxembourg, including questionnaires and informed consents. Approval by the Comité National d'Éthique (CNER) and the Directorate of Health (DISA);
- Impact of COVID-19: the involvement of the LNS in the set-up of environmental medicine in Luxembourg was to be postponed because of the hospital workload following COVID-19.



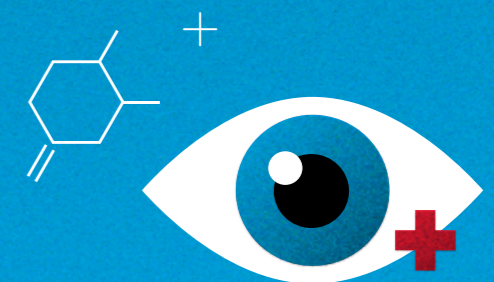
# 2.3

## MEDICAL BIOLOGY



„D’Unerkennung vun eiser  
Expertise an den fortgeschratten  
Methoden gouf mat Spannung  
erwaart. Dëst erlaabt eis elo se op  
all eise Panelen ze benotzen.”

Clément Kebbabi  
Clinical biologist







# NEW DEVELOPMENTS AND ADVANCES IN MEDICAL BIOLOGY

While COVID-19 was naturally the focus of attention in 2020, the Medical Biology Department also saw several other advances during the year. The team was expanded, accreditations were obtained and new tests produced. It was certainly a year full of novelties.

The department had many reasons to be pleased with itself. Regarding the team itself, a new biologist joined the existing team of two. Accreditation under the ISO15189 standard was extended and our first accreditation for separative methods coupled with an array of different detection techniques (spectrophotometric, fluorimetric, electrochemical and tandem mass spectrometry) was a success. "This recognition of our expertise in these advanced methods was eagerly awaited. It will now allow us to deploy them on all our panels," explains Clément Kebbabi, a medical biologist from the Medical Biology Department.

## TOXICO-PHARMACOLOGICAL TESTS AND PREPARATION FOR DIGITISATION

New toxicopharmacological tests were also put into production. The department took part in the DISCOVERY trial for the treatment of SARS-CoV2, which demonstrated the team's responsiveness. It also started performing uracil assays to determine fluoropyrimidine toxicity, which makes it possible to rule out contraindication to chemotherapy treatment. "This test was previously performed abroad. Bringing it in-house it provides modularity and considerable time savings for the patient, among other things," explains Clément Kebbabi, who adds: "The department has also prepared the environment required for the future implementation of exchanges of results in a structured way (lab-to-lab) with our partners, the compilation of LOINC transcoding tables for all of the department's parameters and the adjustment of our LIMS settings, for more efficiency."

## LARGE-SCALE DEPLOYMENT IN 2021

In 2021, the department plans to continue extending the panel of analyses for which the LNS is accredited by the Office Luxembourgeois d'Accréditation et de Surveillance (OLAS) and to expand the analyses available from the department with new panels. It will also accelerate the digitalisation of inter-laboratory exchanges, which has progressed significantly as a result of the COVID-19 health context. "What we have been able to do for COVID-19, in terms of internal and external collaboration and innovation, we will implement more widely."



Preparation of toxicology samples, for drug confirmation.

Evaluation of analytical data after mass spectrometry.



## RÉSUMÉ EN FRANÇAIS

### NOUVEAUTÉS ET AVANCÉES EN BIOLOGIE MÉDICALE

Si la COVID-19 a naturellement été l'objet de toutes les attentions, le département de biologie médicale a également connu plusieurs autres avancées en 2020. Élargissement de l'équipe, accréditations et nouveaux tests, l'année a été riche en nouveautés.

Le département a eu de nombreux motifs de satisfaction. Côté équipe, tout d'abord, l'arrivée d'un nouveau biologiste a permis de compléter l'équipe composée déjà de deux biologistes. L'accréditation à la norme ISO15189 a été étendue et la première démarche d'accréditation concernant les méthodes séparatives couplées à différents principes de détection (spectrophotométrique, fluorimétrique, électrochimique et par spectrométrie de masse en tandem) a été un succès. « La reconnaissance de notre expertise sur ces méthodes de pointe était très attendue. Elles va nous permettre désormais un déploiement sur tous nos panels », explique Clément Kebbabi, biologiste médical du département de biologie médicale.

### TESTS TOXICO-PHARMACOLOGIQUES ET PRÉPARATION À LA DIGITALISATION

De nouveaux tests toxicopharmacologiques ont également été mis en production. Outre la participation à l'essai DISCOVERY pour le traitement du SRAS-CoV2 qui a fait la preuve de la réactivité de l'équipe, le dosage de l'uracilémie pour la recherche de toxicité aux fluoropyrimidines, qui permet d'écartier la contre-indication à un traitement par chimiothérapie, a ainsi été lancé. « Ce dosage était auparavant effectué à l'étranger. L'internaliser offre, entre autres, une modularité et un gain de temps au patient considérable », précise Clément Kebbabi, qui complète : « Le département a également préparé l'environnement requis pour la mise en place future d'échanges de résultats sous forme structurée (lab-to-lab) avec nos partenaires, la compilation de tables de transcodage LOINC pour l'ensemble des paramètres du département et l'ajustement de paramétrage de notre LIMS pour gagner en efficacité. »

### POUR UN VASTE DÉPLOIEMENT EN 2021

En 2021, le département compte poursuivre l'extension du panel des analyses pour lesquelles le LNS est accrédité par l'Office Luxembourgeois d'Accréditation et de Surveillance (OLAS) et élargir le catalogue analytique du département avec de nouveaux panels. Il va également accélérer la numérisation des échanges inter-laboratoires, qui a beaucoup progressé en conséquence dû au contexte sanitaire lié à la COVID-19. « Ce que nous avons su faire pour la COVID-19, en matière de collaboration interne et externe ainsi que d'innovation, nous allons le mettre en place plus largement. »





# MEDICAL BIOLOGY: TACKLING COVID-19 HEAD-ON

**Total adaptation to respond to the health emergency; a host of innovations; and close-knit teams that have discovered new professional and human skills: that is how one could sum what the Medical Biology Department has done its fight against the pandemic in 2020.**



Extraction of samples for toxicological analysis.

## NUMEROUS INNOVATIONS IMPLEMENTED IN RECORD TIME

The year 2020 was a challenging one in terms of the innovations tested in the department. First of all, participation in the international DISCOVERY study was an exciting challenge for the team at the start of the pandemic. "With this study, which aimed to test treatments against the SARS-CoV-2 coronavirus, the team – which does not normally work on infectious diseases – had the opportunity to participate in the national effort to combat the infection. However, the drugs under study proved to be ineffective against COVID-19. The experiment therefore quickly came to an end for the LNS," explains Dr pharm., Dr sc. Patricia Borde, Head of the Medical Biology Department. Similarly, the department immediately offered to work on the Roche COVID-19 antibody-assay kits and provide all the data to the Microbiology Department. The experiment was not continued as it was decided that these assays would be left to front-line laboratories in direct contact with the population, such as private and hospital laboratories, and not to specialised laboratories such as the LNS.

Alongside these interesting but short-lived experiments, one of the important achievements of the department in 2020 was to highlight the importance of Réception Centralisée, or centralised reception. At the beginning of the pandemic, the existing Microbiology team had become accustomed to handling the registration of COVID-19 samples, but this was quickly taken over by Medical Biology. The samples first came from nursing homes and their staff, then from the sampling/consultation centre on the Kirchberg, to which, as the year went on, were added those from the LNS's drive-in test centre, from school testing, from the Ligue Médico-Sociale for very young children, and from a few other occasional missions in the hospitals.

## STRONG AND COMMITTED TEAMS

With the support of the HR Service, Medical Biology recruited additional staff to cope with the influx of samples (+80%). Thanks to the IT Service, the way samples were encoded for this type of mission was improved, although human intervention remains crucial due to errors and incomplete data. "You have to be very reactive and available because you never know what the new requests and directives will be. The Réception Centralisée team has responded and invested a lot of time in these new tasks. Answering the phone and in some cases dealing with the stress and irritation of callers is a challenge in itself," says Patricia Borde.

From the start of the health crisis, the department has done everything it can to manage staffing levels and protect its personnel, with teleworking obviously not being possible for the laboratory technicians. All these measures have been adjusted over time and as understanding of the disease improved. Motivation and team spirit did not waver in the department, which worked as a team every day. "We managed to maintain all our activities during the year 2020, and not a single patient received their results late. It wasn't always easy, however, with split teams, external firms that couldn't come in for maintenance or repairs, or team members who were ill, isolated or in quarantine," says Patricia Borde.

## ADAPTING, IN 2021 AS IN 2020

In 2021, everything that had to be put on hold because of the COVID-19 emergency will gradually be allowed to resume, such as the work of the National Plan for Rare Diseases. New projects will also be able to take shape following the visit of the department's Scientific Council at the end of 2020. Finally, LNS-wide projects should come to fruition. "The LNS has proven its key role in Luxembourg's public health system, both in terms of developing cutting-edge technologies and on the front line with patients. Adaptation will be the key word in 2021 as it was in 2020."



Launch of a series of drug assays.

## RÉSUMÉ EN FRANÇAIS

### LA COVID-19 À BRAS LE CORPS

**Une adaptation totale pour répondre à l'urgence sanitaire, une foule d'innovations et des équipes soudées qui se sont découvert de nouvelles compétences professionnelles et humaines, voilà comment on pourrait résumer l'action du département de biologie médicale dans sa lutte contre la pandémie en 2020.**

### DE NOMBREUSES NOUVEAUTÉS MISES EN PLACE EN UN TEMPS RECORD

L'année 2020 a été stimulante du point de vue des innovations testées au sein du département. La participation à l'étude internationale DISCOVERY, tout d'abord, a très vite été un défi passionnant pour l'équipe au début de la pandémie. « Avec cette étude qui avait pour but de tester des traitements contre le coronavirus SRAS-CoV-2, l'équipe – qui ne travaille pas sur les maladies infectieuses – avait l'occasion de participer à l'effort national de lutte contre l'infection. Néanmoins, les médicaments dosés se sont révélés inefficaces pour lutter contre la COVID-19. L'expérience s'est donc rapidement arrêtée

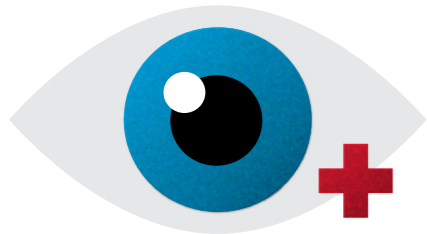
pour le LNS », explique le Dr pharm., Dr sc. Patricia Borde, chef du département de biologie médicale. De même, le service s'est immédiatement proposé pour travailler sur les kits Roche de dosage des anticorps contre la COVID-19 et fournir toutes les données au département de microbiologie. L'expérience n'a ensuite pas été poursuivie comme il a été décidé que ces dosages seraient laissés aux laboratoires de première ligne en contact avec la population tels que les laboratoires privés et hospitaliers, et non aux laboratoires spécialisés tels que le LNS.

A côté de ces expériences intéressantes mais écourtées, l'une des importantes réussites du département en 2020 a été la mise en valeur de l'importance de la Réception centralisée. En début de pandémie, l'équipe en place en microbiologie avait pris l'habitude de s'occuper de l'enregistrement des échantillons COVID-19, mission qui a cependant été reprise rapidement par la biologie médicale. Les échantillons provenaient d'abord des maisons de soins et de leur personnel puis du Centre de Prélèvement/Consultation au Kirchberg, auxquels venaient se rajouter au fil de l'année ceux du Centre de Prélèvement drive-in du LNS, du « school testing », de la Ligue Médico-Sociale pour les très jeunes enfants, et de quelques autres missions ponctuelles dans les hôpitaux.





# KEY FACTS & FIGURES



“The recognition of our expertise in advanced methods was eagerly awaited. It will now allow us to deploy them on all our panels.”

Clément Kebbabi  
Biologiste médical



## Main achievements in 2020

- Despite the context of the pandemic and the resulting lockdown, the department managed to maintain all its activities throughout the year, even increasing them by 4.5% when counting in number of analyses.
- In addition, no patient experienced a delay in receiving their results. A new organisation was put in place, involving splitting teams to avoid crossing paths, taking into account the fact that external firms could not come in to do maintenance/repairs, and allowing for team members falling ill or having to isolate/quarantine.
- A new biologist was recruited to complement the existing team of two.
- The validity period of our ISO15189 accreditation was extended, and the first stage of accreditation for separative methods coupled with several means of detection was successful.
- The department also participated in the international DISCOVERY study on testing anti-COVID-19 drugs.

21,876  
HORMONAL ESSAYS

3,210  
PRENATAL SCREENING

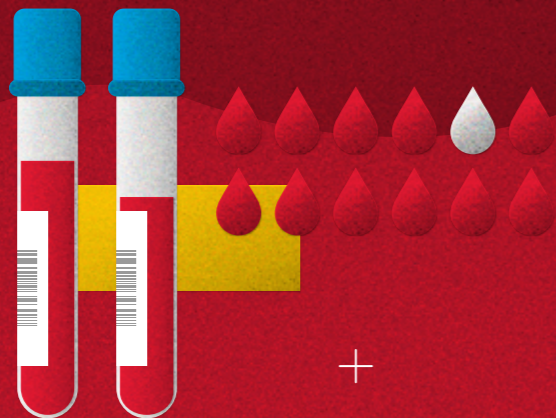
40,479  
NEONATAL & METABOLIC ANALYSES

39,062  
CLINICAL TOXICOLOGY ANALYSES



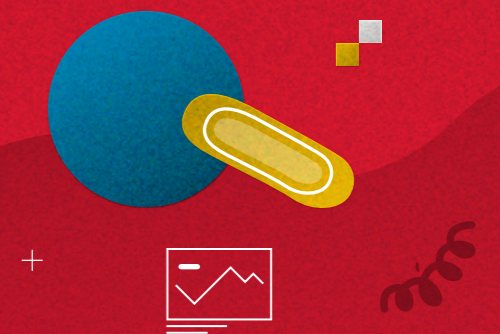
# 2.4

## FORENSIC MEDICINE



“Well eise Laboratoire nach  
ëmmer zimmlech rezent ass,  
si mir technologesch um neiste  
Stand. Dëst huet eis gehollef eis  
Aarbecht sou reiwungslos wéi  
méiglech weiderzemaachen.“

Dr. med. Andreas Schuff  
Head of department





# PROTECTING OUR TEAM AGAINST COVID-19 INFECTION: HOW AUTOPSIES ARE CONDUCTED SAFELY AND WITHOUT WAITING TIMES

Performing an autopsy is clearly a contact activity. COVID-19 has made the conditions for these examinations more difficult, so that in the LNS's Forensic Medicine Service, processes have had to be completely changed to ensure maximum safety for all those involved.

The LNS's Forensic Medicine Service has only been in place since 2014. Its main tasks include autopsies, which are mainly commissioned by the district courts of Luxembourg City and Diekirch. The service's aim is to determine the cause of a death or to clarify the circumstances of a crime. In cooperation with the services of Forensic Toxicology and Forensic Genetics, degrees of intoxication can also be determined, and persons identified.

## THE HIGH TECHNOLOGICAL LEVEL OF THE LABORATORY HELPED SWITCH TO CRISIS MODE QUICKLY

Before forensic medicine moved into the LNS's new headquarters in Dudelange, which had only recently opened, autopsies were performed by experts from the neighbouring countries. The fact that Luxembourg's own forensic medicine services were only set up a few years ago has, however, proved to be a fortunate coincidence in coronavirus times with regard to technological equipment, as the head of service, Dr Andreas Schuff, points out:

"Since our laboratory is still very young, we are technologically at the very cutting edge. This starts with room design, continues with ventilation, and extends to the supply of quality masks and protective clothing of all kinds. All this helped us when it came to switching to crisis mode in March 2020, with the aim of being able to continue our work as smoothly as possible."

## CONTAGION RISK FROM EXPOSURE TO DEAD BODIES NOT INITIALLY CLEAR

Keeping things running smoothly meant contending with several factors: demand for autopsies did not diminish even with the pandemic, and at the same time, there were entirely new measures to be taken to ensure the safety of everyone in the room. What's more, at the beginning of the COVID-19 crisis, there were many questions that were not answered until well into 2020, says Andreas Schuff:

"For example, we were not sure at the beginning whether a possible coronavirus-infected corpse could be a source of infection, and for how long. We got reliable answers to this question from colleagues in Frankfurt, among others, who specifically investigated this issue and came to the conclusion that infection with the virus can also occur via a dead body, for at least 17 days from the time of death."

## SMALLER AUTOPSY TEAMS ALSO REDUCE THE RISK OF INFECTION

Regardless of these findings, the LNS's forensic experts had been playing it safe from the beginning, and treated every corpse to be autopsied as a potential health risk for the living in the room. This was a top priority because there are always several people present at a post-mortem examination. To protect these people from infection, several measures were taken from March onwards.

One of the first essential steps taken with a view to minimising the safety risk was to reduce the number of experts present at autopsies, as Andreas Schuff explains: "As a rule, we always work in teams of three in normal times, consisting of two forensic pathologists and one assistant. Here, we very quickly switched to one forensic pathologist and one assistant."

## REPRESENTATIVES OF THE JUDICIARY MUST BE PRESENT IN THE ROOM, AND PROTECTED

This reduction in team size prevents, not least, a situation where two staff members would need to be on sick leave at once in the event of a COVID-19 infection, which would inevitably lead to immediate delays in procedures in the case of this rather small (seven-staff) service. This in turn would have consequences both internally and externally, as Andreas Schuff explains:

"Our service performed 85 autopsies in 2020. For most of them, there is a lot of time pressure because there are legal questions which we as forensic doctors help answer. In addition, against this background, representatives of the judiciary must also be present with the doctor in the autopsy room, and we have of course included them in our COVID-19 protective measures."

## SWABS BEFORE THE AUTOPSY, VIDEO CONFERENCES AFTERWARDS

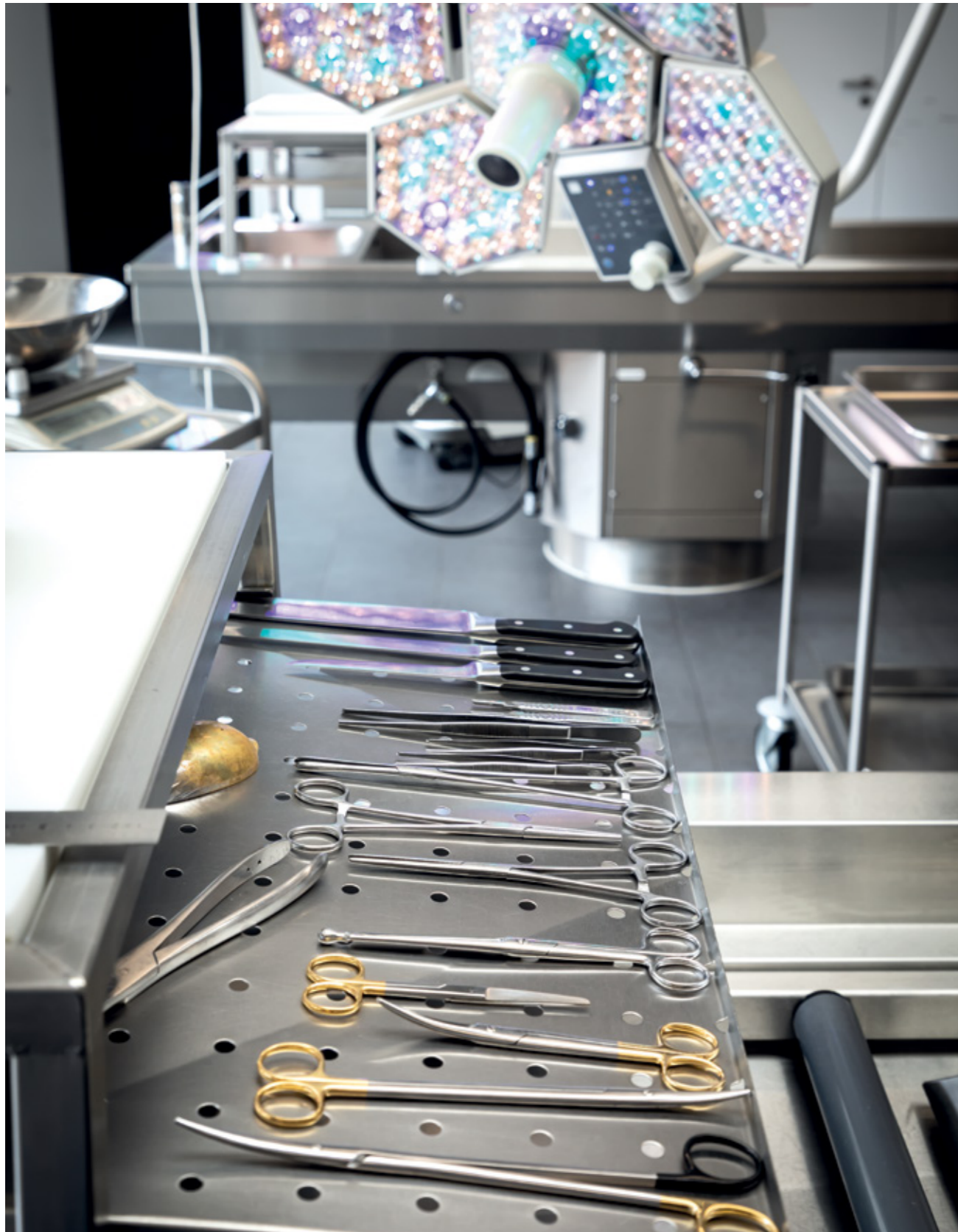
Specifically, these measures mean: FFP-2 masks are mandatory for everyone present in the post-mortem room, as is an expanded range of protective clothing including a second pair of gloves. In addition, the room is permanently ventilated, applying laminar flow ventilation technology. A further, important step is taken even before the autopsy, says Andreas Schuff: "Before we begin, we take a throat swab on the corpse and wait for the virological result (PCR analysis)."

To ensure maximum safety, another swab is taken from the bronchi tubes in the course of the autopsy. When it comes to what happens after the body is examined, things have become less "virus-friendly" since March 2020: "We have digitalised some processes. For example, we exchange information with our clients via video conference, and even identification sometimes takes place in this new, virtual way."



At the cutting edge:  
The LNS's Forensic  
Medicine autopsy room.





## RÉSUMÉ EN FRANÇAIS

### **PROTÉGER NOS ÉQUIPES CONTRE L'INFECTION PAR LA COVID-19 : LES AUTOPSIES SONT RÉALISÉES EN TOUTE SÉCURITÉ ET SANS DÉLAI D'ATTENTE**

**Une autopsie étant clairement une activité de contact, la COVID-19 a rendu les conditions de ces examens plus difficiles. Dans le service de médecine légale du LNS, créé en 2014, les processus ont donc dû être complètement modifiés pour garantir une sécurité maximale à toutes les personnes concernées.**

### **UN PASSAGE RAPIDE EN MODE DE CRISE GRÂCE AU HAUT NIVEAU TECHNOLOGIQUE DU LABORATOIRE**

Le fait que les services de médecine légale luxembourgeois n'aient été créés qu'il y a quelques années s'est avéré être une heureuse coïncidence en matière d'équipement technologique à l'ère des coronavirus, comme le souligne le chef de service, le Dr Andreas Schuff : « Comme notre laboratoire est encore très jeune, nous sommes à la pointe de la technologie. De la conception des locaux, à la ventilation, en passant par la fourniture de masques de qualité et de vêtements de protection de toutes sortes, tout cela nous a aidés lorsqu'il s'est agi de passer en mode de crise en mars 2020. »

### **LE RISQUE DE CONTAGION LIÉ À L'EXPOSITION AUX CADAVRES N'ÉTAIT PAS CLAIR AU DÉPART**

La demande d'autopsies n'a pas diminué, malgré la pandémie, et il a fallu prendre des mesures totalement nouvelles. De plus, de nombreuses questions n'ont trouvé de réponse que durant l'année 2020, explique Andreas Schuff : « Au début, nous ne savions pas si un cadavre potentiellement infecté par le coronavirus pouvait être une source d'infection. Nous avons obtenu des réponses fiables de la part de collègues de Francfort, qui sont arrivés à la conclusion que l'infection par le virus peut également se produire via un cadavre, pendant au moins 17 jours à partir du moment du décès. »

### **DES ÉQUIPES D'AUTOPSIE PLUS PETITES RÉDUISENT ÉGALEMENT LE RISQUE D'INFECTION**

Indépendamment de ces résultats, les experts médico-légaux du LNS ont joué la prudence dès le début, et ont traité chaque cadavre à autopsier comme un risque éventuel pour la santé des personnes se trouvant dans la pièce.

Le nombre d'experts présents lors des autopsies a ainsi été réduit, comme l'explique Andreas Schuff : « En règle générale, nous travaillons toujours avec deux médecins légistes et un assistant. Ici, nous sommes très rapidement passés à un médecin légiste et un assistant. »

### **LES REPRÉSENTANTS DU POUVOIR JUDICIAIRE DOIVENT ÊTRE PRÉSENTS ET PROTÉGÉS**

Cette réduction de la taille de l'équipe permet d'éviter une situation où deux membres du personnel devraient être en congé maladie en même temps en cas d'infection par la COVID-19. Andreas Schuff précise : « Notre service a effectué 85 autopsies en 2020. Pour la plupart d'entre elles, il y a une contrainte de temps. En outre, les représentants de la justice doivent également être présents avec le médecin dans la salle d'autopsie, et nous les avons bien sûr inclus dans nos mesures de protection COVID-19. »

### **PRÉLÈVEMENTS AVANT L'AUTOPSIE, VIDÉOCONFÉRENCES ENSUITE**

Les masques FFP-2 sont obligatoires pour toutes les personnes présentes dans la salle post-mortem, de même qu'une gamme élargie de vêtements de protection. En outre, la salle est ventilée en permanence. Enfin, comme l'explique Andreas Schuff : « Avant de commencer, nous effectuons un prélèvement de gorge et attendons le résultat virologique. »

Depuis mars 2020, d'autres choses sont également devenues moins « conviviales » pour les virus : « Nous échangeons des informations avec nos clients par vidéoconférence, et même l'identification se fait parfois de cette nouvelle manière, virtuellement. »

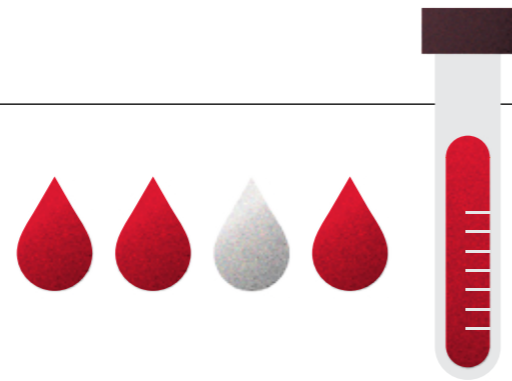


# KEY FACTS & FIGURES

## FORENSIC MEDICINE

### Main achievements in 2020

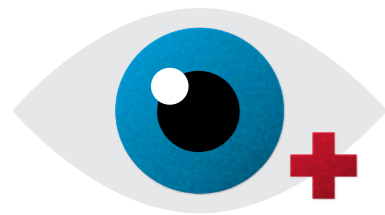
Protecting victims of violence (UMEDO): no increase in the number of examinations was detected during the two lockdowns.



**85**  
AUTOPSIES

**3**  
AUTOPSIES WERE PERFORMED ON CORPSES THAT HAD TESTED POSITIVE FOR COVID-19, BUT WITHOUT THIS BEING THE CAUSE OF DEATH

**45**  
EXPERT OPINIONS



## FORENSIC GENETICS

### Main achievements in 2020

As in all areas, the year 2020 for the service was marked by the sanitary crisis which forced us to rethink the way we work and to reorganise the laboratory. Our goal was to provide and guarantee an unchanged level of service and quality. Despite measures involving reduced attendance, social distancing and shortages of consumables, the service was able to increase its capacity by 25% in comparison to 2019, which confirms the continuous annual increase since the opening for our service. We also ensured a permanent 24-hour availability. The recruitments decided in 2019 were carried out and our Forensic Genetics Service was able to recruit two additional scientific staff members in 2020, in order to continue to improve deadlines while guaranteeing the quality and relevance of its expertise.

**11,859**  
SAMPLES

**2,129**  
EXPERT REPORTS

## FORENSIC TOXICOLOGY

### Main achievements in 2020

- 2020 was marked by the recruitment of a new toxicologist, but also by the COVID-19 crisis which forced the service to reorganize the staff.
- 5% increase of total biological samples, which confirms the continuous annual increase since 2009 for the service. A decrease in the number of analyses requested by the police and the Ministry of "Mobilité" due to the lockdown was compensated by a significant increase in hair tests coming from Belgian Institutes and by a continuous growth of urinary ETG requests.
- Scientific study of the impact of thermic straightening on opiate and methadone content in hair.
- Participation on the revision on the consensus about drugs of abuse in hair from the international Society of Hair Testing (expert group meeting in Sevilla with Dr sc. Michel Yegles).

**774**  
SAMPLES FROM AUTOPSIES

**805**  
SAMPLES FROM LEGAL CASES REQUESTED BY THE POLICE

**169**  
BLOOD ALCOHOL ANALYSES

**1,750**  
HAIR SAMPLES

**682**  
SAMPLES FOR URINARY ETG ANALYSES

## ANALYTICAL TOXICOLOGY AND PHARMACEUTICAL CHEMISTRY TECHNICAL PLATFORM

### Main achievements in 2020

- The "Cannabis analysis laboratory" was set up, in collaboration with the Health Protection Department, SUBI (metals) and ALI (pesticides, mycotoxins) services.
- Analysing drugs seized by customs: our "Customs" project was continued, in collaboration with Luxembourg Customs and MISA (Ministry of Health). This project is scheduled to last three years.
- The "Drugs" project was continued, in collaboration with 4-motion, MISA, Abrigado, the Luxembourg judiciary and JDH. As part of this project, we analyse drugs handed over by consumers during parties or at drug consumption centres.
- Project "APAST" was rolled out, in collaboration with the Grand Ducal Fire and Rescue Service (CGDIS) and MISA, whereby the stability of certain drugs stored in ambulances is analysed.
- Analysis of Hydroxychloroquine, Camostat mesylate and Ribavirin tablets used as Anti-COVID-19 medication in collaboration with the Covid Crisis unit at Ministry of Health.

**11,394**  
ANALYTICAL TOXICOLOGY ANALYSES

**671**  
PHARMACEUTICAL CHEMISTRY ANALYSES





2.5

NATIONAL  
CENTER OF  
PATHOLOGY



“Mir hunn e Wäerte System  
ausgeschafft fir d’Land a  
seng Bierger nach besser ze  
dénge. D’Entscheidung vum  
Gesondheetsministère huet  
den NCP an dësem Bestriewe  
gestärkt.”

Prof. Dr Michel Mittelbronn  
Head of department





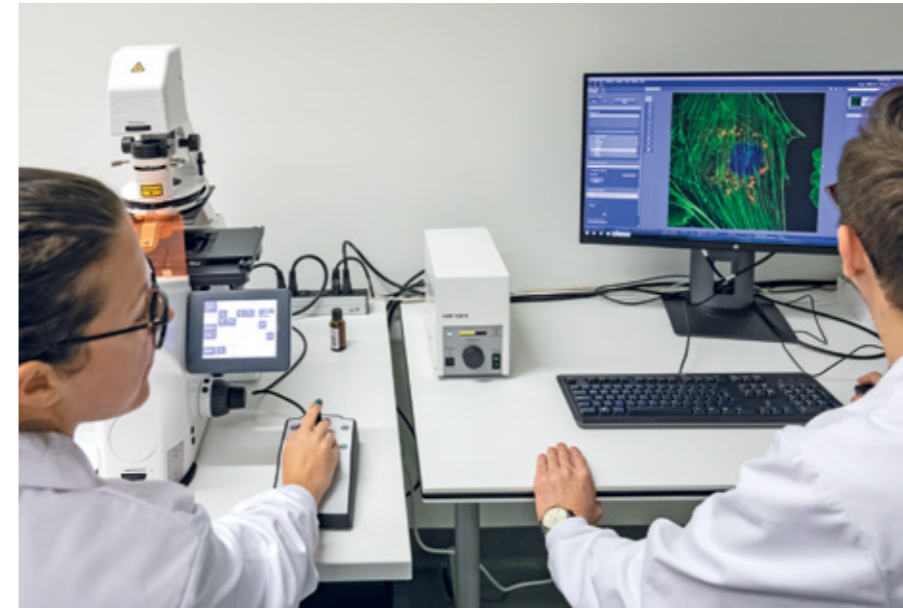


# OFFICIAL RECOGNITION AND TECHNOLOGICAL INNOVATION: THE NCP CONTINUES TO EXPAND ITS EXCELLENCE AND PROCESSES IN 2020

When attempting to turn a crisis into an opportunity, changing quickly is half the battle for an organisation. The other half is to consolidate and further expand processes already in place. The latter was the case at the National Center of Pathology (NCP) in 2020. Firstly, this department – the LNS's largest – received approval for its activities for four more years. At the same time, epigenetic diagnostics, which had been introduced in 2019, were extended to sarcomas – a significant step towards less bias and more precision in diagnostics.



Histological slides loaded on an automated immunohistochemical stainer.



Analysis of an immunofluorescent image.

The four-year authorisation extension was granted to the NCP by the Ministry of Health in June 2020. This followed a recommendation by the Commission Permanente pour le Secteur Hospitalier (CPH), which had already unanimously voted in favour of extending the existing authorisation at the beginning of 2020 – just as for the National Center of Genetics, whose authorisation is now also valid until 2024.

## AUTHORISATION EXTENDED UNTIL 2024

Both authorisations had first come into force in 2018 in the wake of the then newly enacted Hospital Act, and had initially been limited to a period of two years only. In the justification for the extension, the proactive approach with which the LNS strives for the required accredited quality system was positively emphasised. In previous years, the laboratory had consistently taken the necessary steps to obtain accreditations from the Office Luxembourgeois d'Accréditation et de Surveillance (OLAS).

"In the past, we have worked out a value system based on professionalism and excellence in order to be able to serve the country and its people even better," says Prof. Dr Michel Mittelbronn, head of the NCP: "The decision of the Ministry of Health has validated the LNS as a whole and us, the NCP, in this endeavour. Our aim is to offer our stakeholders state-of-the-art expertise in the entire diagnostic spectrum of pathology. This starts with advanced training courses and extends to several research projects that we implement together with national and international partners."

## FURTHER POOLING OF EXPERTISE

"Our team has a lot to offer, both in terms of the training of its members and in terms of experience," Michel Mittelbronn continues: "Bundling this range of competences together is therefore part of a long-term structural process designed for sustainability, which will then have borne further fruit in 2020 and certainly also helped to convince the ministry and CPH."

This specialisation process was initiated at the beginning of 2017, when Michel Mittelbronn, Professor of Neuropathology and National Research Fund Chair, took over as head of the Pathology Department at the LNS, which was renamed the National Center of Pathology a year later. The NCP is divided between two large areas: while the Pathological Anatomy service diagnoses cancerous or precancerous lesions and inflammations, the Gynaecological Cytology service is responsible for the national cervical cancer screening program.





## EPIGENETICS CAPABILITIES FINALLY SET UP AT THE LNS

The two services have not only become more specialised in recent years, they have also continued to grow. This growth has brought with it new tasks and technological innovations. In the case of the Pathological Anatomy Service, the area of epigenetics stood out in this context, which was also finally established at the LNS in 2020, as Michel Mittelbronn explains.

"Epigenetics deal with the question of which factors determine the activity of a gene and thus the development of a cell. For this purpose, changes in gene function that are not based on changes in DNA sequence but also largely passed on to daughter cells are investigated. This makes it possible to determine the origin of cancer much more precisely and objectively."

## HIGH-END TECHNOLOGY MEETS PROFESSIONAL EXCELLENCE

Objectivity is guaranteed mainly thanks to the so-called 850K analysis, Michel Mittelbronn continues: "We have had the necessary technology in-house since 2019, and that has been a quantum leap for our team. Our machine combines diagnostic technology with artificial intelligence. It is always learning – through the process known as "machine learning". This means we can always provide better care for our patients and also systematically expand our services."

For example, the NCP has also been applying epigenetics to sarcomas – malignant tumours in soft tissue – since 2020. In addition, complete epigenetic diagnostics have also been carried out at the LNS since the beginning of 2020. According to Michel Mittelbronn, this demonstrates another claim of the NCP and the LNS: "We want to continue to gradually give our employees the high-end technology they need so that, together, we can make Luxembourg autonomous in providing healthcare."



Slide scanner for telepathological diagnostics.



Loading process of an automated immunohistochemical stainer.

## RÉSUMÉ EN FRANÇAIS

### RECONNAISSANCE OFFICIELLE ET INNOVATION TECHNOLOGIQUE : LE NCP CONTINUE À DÉVELOPPER L'EXCELLENCE ET LES PROCESSUS EN 2020

**Lorsqu'on tente de transformer une crise en opportunité, une organisation qui change rapidement gagne déjà la moitié de la bataille. L'autre moitié consiste à développer davantage les processus déjà en place. C'est ce qui s'est passé au 'National Center of Pathology' (NCP) en 2020. Le plus grand département du LNS a reçu l'approbation de ses activités pour quatre années supplémentaires. Dans le même temps, le diagnostic épigénétique a été étendue aux sarcomes.**

La prolongation de quatre ans de l'autorisation a été accordée au LNS par le ministère de la Santé en juin 2020. Elle fait suite à une recommandation de la Commission Permanente pour le Secteur Hospitalier (CPH), tout comme pour le 'National Center of Genetics' (NCG), dont l'autorisation est désormais également valable jusqu'en 2024.

### UNE AUTORISATION PROLONGÉE JUSQU'EN 2024

Les deux autorisations étaient entrées en vigueur pour la première fois en 2018 dans le sillage de la loi sur les hôpitaux, alors nouvellement promulguée. Dans la justification de la prolongation, l'approche proactive avec laquelle le LNS s'efforce d'obtenir le niveau de qualité requis a été soulignée de manière positive. Les années précédentes, le laboratoire avait systématiquement entrepris les démarches nécessaires pour obtenir les accréditations de l'Office Luxembourgeois d'Accréditation et de Surveillance (OLAS).

« Par le passé, nous avons élaboré un système de valeurs fondé sur le professionnalisme et l'excellence afin de pouvoir servir encore mieux le pays et ses habitants », déclare le Pr. Dr Michel Mittelbronn, chef du NCP : « La décision du ministère de la Santé a validé le LNS dans son ensemble et nous, le NCP en particulier, dans cette entreprise. Notre objectif est d'offrir à nos partenaires une expertise de pointe dans tout le spectre diagnostique de la pathologie. »

### UNE MISE EN COMMUN ACCRUE DE L'EXPERTISE

« Notre équipe a beaucoup à offrir », poursuit Michel Mittelbronn : « Regrouper cet éventail de compétences fait donc partie d'un processus structurel à long terme conçu pour la durabilité, qui aura porté de nouveaux fruits en 2020 et qui a certainement aussi contribué à convaincre le ministère et le CPH. »

Ce processus de spécialisation a été initié début 2017, lorsque Michel Mittelbronn, professeur de neuropathologie et titulaire d'une chaire du Fonds National de la Recherche (FNR), a pris la tête du département de pathologie, qui a été rebaptisé National Center of Pathology un an plus tard. Le NCP se divise en deux domaines : tandis que le service d'anatomie pathologique diagnostique les lésions cancéreuses ou précancéreuses et les inflammations, le service de cytologie gynécologique est avant tout responsable du programme national de dépistage du cancer du col de l'utérus.

### DES CAPACITÉS D'ÉPIGÉNÉTIQUE ENFIN MISES EN PLACE AU LNS

Ces dernières années, les deux services n'ont cessé de se développer. Dans le cas du service d'anatomie pathologique, le domaine de l'épigénétique s'est distingué dans ce contexte, et a finalement été créé au LNS en 2020, comme l'explique Michel Mittelbronn. « L'épigénétique cherche à savoir quels facteurs déterminent l'activité d'un gène et donc le développement d'une cellule. Il est ainsi possible de déterminer l'origine d'un cancer de manière beaucoup plus précise et objective. »

L'objectivité est garantie principalement grâce à l'analyse dite 850K, poursuit Michel Mittelbronn : « Nous disposons de la technologie nécessaire en interne depuis 2019, et cela a constitué un saut quantique pour notre équipe. Notre machine combine la technologie de diagnostic avec l'intelligence artificielle. Grâce au « machine-learning », elle est en permanence en train d'apprendre. Cela signifie que nous pouvons systématiquement étendre nos services. Par exemple, nous appliquons également l'épigénétique aux sarcomes - tumeurs malignes des tissus mous - depuis 2020. En outre, des diagnostics épigénétiques complets sont également réalisés au LNS depuis début 2020. »





# KEY FACTS & FIGURES

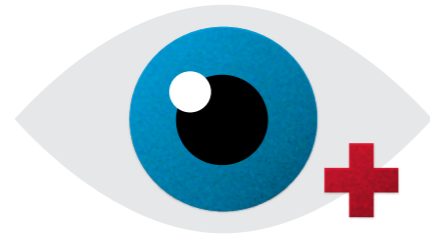
## Main achievements in 2020

- Both in anatomical pathology and gynaecological cytology, analyses reached record figures (see below).
- In June, the NCP received approval for its activities from the Ministry of Health for four more years.
- With electron microscopy and the epigenetics platform, two new activities were introduced and are now fully operational for diagnostic and research purposes.
- The NCP played a key role in establishing the first 3 National Tumour Committees (neuro-oncology, molecular pathology and gynaeco-pathology).
- New pathologists and technicians were recruited. The team was expanded to 102 members.
- The NCP team published more than 35 scientific articles since 2019, recruited the first 2 postdoctoral fellows fully dedicated to research thanks to external scientific grants, and again won the Espoir en tête Research prize.
- Prof. Dr Michel Mittelbronn, head of the NCP, is the lead author of 2 chapters in the new World Health Organization (WHO) Blue Book series and is a founding member and associate editor of the new non-profit, open-access journal freeneuropathology.org.

## GYNAECOLOGICAL CYTOLOGY

# 121,925

**CERVICAL-VAGINAL SMEARS**  
(in liquid-based chromatography and conventional)



# 6,126

**MOLECULAR BIOLOGY ANALYSES: HUMAN PAPILLOMAVIRUS GENOTYPING (HPV-GT)**

# 38,988

**MOLECULAR BIOLOGY ANALYSES: HUMAN PAPILLOMAVIRUS DETECTION (HPV-HR)**

# 8,979

**MOLECULAR BIOLOGY ANALYSES: MYCOPLASMA GENITALIUM (MGEN)**

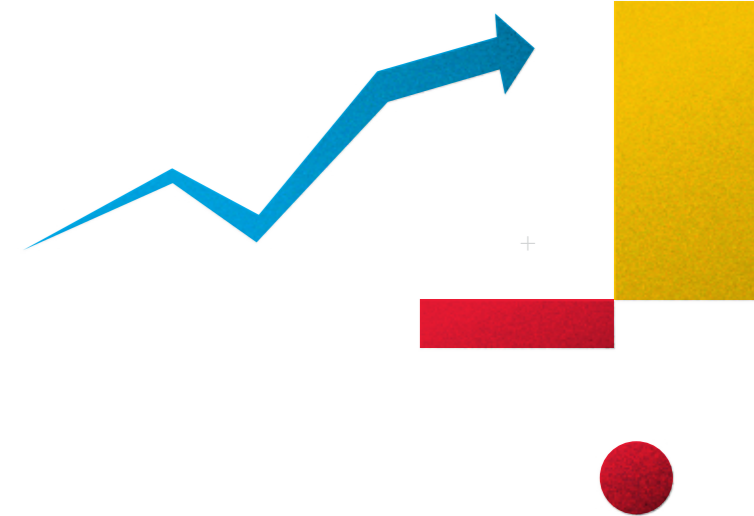
# 16,198

**MOLECULAR BIOLOGY ANALYSES: CHLAMYDIAE TRACHOMATIS AND NEISSERIA GONORRHAEEAE**  
(combined test: COMBO 2)

## PATHOLOGICAL ANATOMY

# 106,604

**BIOPSIES, NON-GYNAECOLOGICAL SMEARS AND OPERATIVE SPECIMENS**



# 117

**HAEMATOLOGICAL CYTOLOGY, HAEMOSTASIS AND COAGULATION ANALYSES**

# 243,744

**HISTOLOGICAL ANALYSIS**

# 23,026

**SPECIAL STAINS**



# 56,224

**IMMUNOHISTOCHEMICAL ANALYSIS**

# 29

**CLINICAL AUTOPSIES**



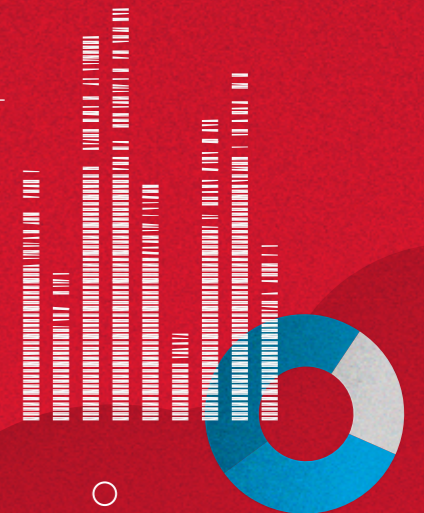
# 2.6

## NATIONAL CENTER OF GENETICS



“D’Telekonsultationen hu gehollef d’Zuel vun de genetische Consultatioune vun 1,360 op 1,947 eropzesetzen am Joer 2020, trotz der Tatsaach datt Consultationen „en présentiel“ während dem initiale Lockdown limitéiert ware wéinst der COVID-19 Situatioun.”

Dr Barbara Klink  
Head of department







# ONLINE COUNSELLING DURING THE COVID: NCG KEEPS UP EXCHANGES WITH PATIENTS WITH THE HELP OF VIDEOCONFERENCES

The Clinical Genetics Unit of the National Center of Genetics (NCG) has become something of a permanent fixture. Genetic counselling is an essential part of the work of the NCG, and the LNS has been able to continue providing this service during the pandemic. One of the things that helped was a switch to videoconferencing.

Since its creation in 2018, the "National Center of Genetics" (NCG) has covered all aspects of human genetics and offered comprehensive genetic testing to the population of Luxembourg. Genetic counselling, whereby patients and their relatives are provided with detailed and individualized information about genetic testing, any genetic disorder that might affect them or was diagnosed in their family, and about the personal risk attached to it, is of central importance in this process, both before and after genetic testing.

## HEREDITARY CANCER AND MANY OTHER DISEASES

This is all the more true since, among other things, genetic analysis in the context of hereditary tumour predisposition (such as hereditary breast and ovarian cancer) as well as the corresponding counselling is offered as part of this service. This is one of the core tasks of the NCG, as its head Dr Barbara Klink explains: "We at the NCG are an important player in the Plan National Cancer. COVID-19 has not changed the importance of this mission. Most cancers require rapid action, and continuing to contribute to this as usual has been our main concern since the outbreak of the crisis."

Genetic counseling is of central importance, both before and after genetic testing.

The same is true for the other genetic diseases that are diagnosed and analysed at the NCG and consequently also discussed in genetics consultations. Dr Barbara Klink: "Our consultations include advice on a wide range of diseases caused by genome defects. Besides hereditary cancer syndromes, these include so-called rare diseases, of which more than 7,000 are known. Other topics covered are prenatal and pre-conceptional genetic counselling, as well as predictive genetic counselling and testing of asymptomatic persons at risk of a genetic disorder known in the family, provided before the first symptoms appear. In addition, we advise family members of patients with regard to the risks they themselves face, and offer genetic tests to make or confirm a diagnosis."



## PATIENTS AND STAFF APPRECIATE VIRTUAL ALTERNATIVE

"The first lockdown meant that the LNS and its department had to postpone all non-urgent appointments indefinitely. As a result, on-site genetic counselling was cancelled, so we tried videoconferences as an alternative. Many patients and their relatives accepted these dialogues in virtual mode, and the NCG staff came to appreciate them as a useful interim solution as well. Over the course of 2020, we were gradually able to offer on-site consultations again, where we can discuss more complex issues with the patients or examine them clinically and genetically."

## VERSATILE OPTIONS ARE HERE TO STAY

"The bottom line," continues Dr Barbara Klink, "is that tele-consultations also contributed to the fact that the number of genetics consultations in 2020 actually increased, from 1,360 to 1,947. What's more, apart from genetic counselling, we also quickly started making extensive use of virtual meetings with our colleagues internally as well as for contacts with hospitals and other partners in Luxembourg and abroad. These multidisciplinary meetings are an important part of our work, and when face-to-face meetings were no longer possible, videoconferencing helped us a lot there as well. It is still used for this sort of meeting with doctors in hospitals."

Against this background, Dr Barbara Klink is sure that online conferences will continue to be an important option in the "new normal": "It is true that virtual exchanges offer somewhat less of a social touch than real-world conversations, but conversely they make distances shorter for all participants, and some processes are more efficient as a result. From this point of view, with the changeover to video meetings we have brought about something new out of necessity, the advantages of which we will continue to use for ourselves and hence for our patients."

## VIDEOCONFERENCING WAS NEW TERRITORY

Typically, a genetic counselling session lasts 1 to 1.5 hours to allow for a thorough and individualized discussion with the patient, couple, or healthy family member. Live exchanges were always preferred, as Dr Barbara Klink explains: "Having an actual conversation allows for direct dialogue, and that's where really profound counselling is best achieved. We were all the more keen to continue offering this service without restrictions despite the coronavirus crisis."

The main challenge the NCG faced in this was, of course, social distancing, which came into effect in March 2020. As a result, on-site consultations at the LNS were no longer possible from one day to the next, so an alternative had to be sought out. This was found in the form of tele-consultations, which also found their way into the LNS for other purposes and became an efficient tool, as Dr Barbara Klink explains. New processes had to be developed to enable remote prescriptions, collecting written consent, and minimal digital clinical examinations while ensuring data security.





## RÉSUMÉ EN FRANÇAIS

**CONSULTATIONS DE GÉNÉTIQUE EN LIGNE PENDANT LA COVID-19 : LE NCG MAINTIEN LES ÉCHANGES AVEC LES PATIENTS À L'AIDE DE VIDÉOCONFÉRENCES**

**La consultation de génétique clinique est une partie essentielle du travail du National Center of Genetics (NCG). Le LNS a pu continuer à fournir ce service pendant la pandémie. Les vidéoconférences ont notamment été très utiles.**

Depuis sa création en 2018, le National Center of Genetics (NCG) couvre tous les aspects de la génétique humaine et propose des bilans génétiques complets à la population luxembourgeoise. La consultation de génétique clinique, au cours de laquelle les patients et leurs proches sont informés sur l'évaluation génétique, sur une maladie génétique qui pourrait les affecter ou qui a été diagnostiquée dans la famille, et sur le risque personnel lié à ces résultats, revêt une importance centrale dans ce processus.

**LE CANCER HÉRÉDITAIRE ET DE NOMBREUSES AUTRES MALADIES**

D'autant plus que l'analyse génétique dans le cadre d'une prédisposition tumorale héréditaire, comme le cancer familial du sein et de l'ovaire, ainsi que les conseils adaptés sont notamment proposés. Il s'agit là de l'une des tâches principales du NCG, comme l'explique sa directrice, le Dr Barbara Klink : « Nous sommes un acteur important du Plan National Cancer. La COVID-19 n'a pas changé l'importance de cette mission. La plupart des cancers nécessitent une action rapide, et continuer à y contribuer comme d'habitude a été notre principale préoccupation. »

Il en va de même pour les autres maladies génétiques, poursuit Barbara Klink : « Nos consultations couvrent un large éventail de maladies d'origine génétique, comme les maladies rares, dont plus de 7 000 sont identifiées à ce jour. Nous nous occupons également du diagnostic prénatal et du conseil génétique préconceptionnel, ainsi que du diagnostic prédictif et présymptomatique, proposé à des personnes asymptomatiques dans le contexte d'un risque familial, avant l'apparition des premiers symptômes. »

**LA VIDÉOCONFÉRENCE ÉTAIT UN NOUVEAU TERRITOIRE**

En général, une consultation de génétique clinique dure entre une heure et une heure et demie pour permettre un examen clinique et une discussion approfondie avec le patient, le couple ou le membre de la famille en bonne santé. Les échanges personnels ont toujours été privilégiés, comme l'explique Barbara Klink : « Un échange personnel est toujours un dialogue direct, et c'est là que les conseils vraiment approfondis sont les meilleurs. Nous étions d'autant plus désireux de continuer à offrir ce service sans restriction malgré la crise du coronavirus. »

Du fait de la distanciation sociale, entrée en vigueur en mars 2020, les consultations sur place au LNS sont devenues impossibles du jour au lendemain. Il a donc fallu chercher une alternative. Celle-ci a été trouvée sous la forme de vidéoconférences, qui se sont révélées être un outil très efficace. De nouveaux processus ont dû être mis au point pour permettre la prescription à distance, le recueil du consentement écrit ou un examen clinique numérique minimal, tout en garantissant la sécurité des données.

**LES OPTIONS FLEXIBLES RESTERONT À L'ORDRE DU JOUR**

« Le premier confinement nous a obligés à reporter tous les rendez-vous non urgents. En conséquence, les consultations sur place ont été annulées, et nous avons donc essayé les vidéoconférences comme solution de rechange. De nombreux patients et leurs proches ont accepté ces dialogues en mode virtuel, et le personnel du NCG aussi en est venu à les apprécier comme une solution provisoire utile. Au cours de l'année 2020, nous avons progressivement été en mesure de proposer à nouveau des consultations sur place. »

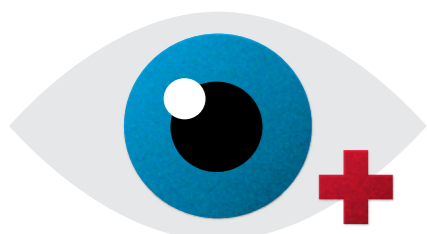
« La vidéoconférence a également contribué à l'augmentation de fait du nombre de consultations de génétique en 2020, passant de 1360 à 1947. Qui plus est, outre les consultations de génétique, nous avons rapidement commencé à faire un usage intensif des réunions virtuelles avec nos collègues en interne, ainsi que pour les contacts avec les hôpitaux et d'autres partenaires au Luxembourg et à l'étranger, et nous les utilisons toujours. »

Dans ce contexte, Barbara Klink est persuadée que les vidéoconférences continueront à jouer un rôle important dans la « nouvelle normalité » : « Il est vrai que les échanges virtuels ont un rôle social moins important que les conversations dans le monde réel, mais à l'inverse, ils permettent de réduire les distances pour tous les participants, et certains processus en deviennent plus efficaces. De ce point de vue, avec le passage aux réunions vidéo, nous avons créé quelque chose de nouveau par nécessité, et nous continuerons à en utiliser les avantages pour nous-mêmes et donc pour nos patients. »





# KEY FACTS & FIGURES

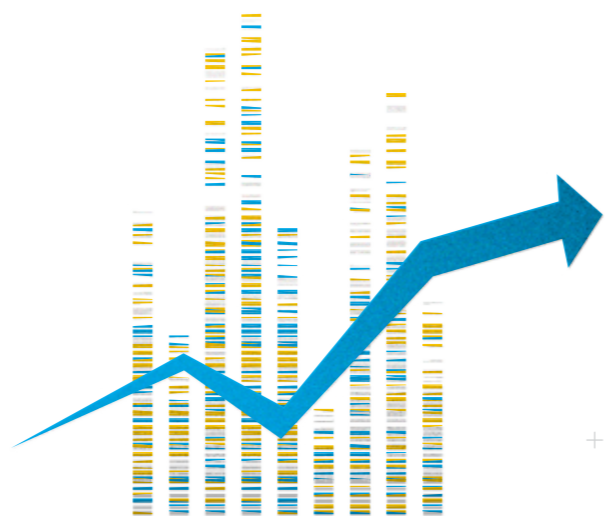


## THE NATIONAL CENTER OF GENETICS

### Main achievements in 2020

- Established in 2018, the NCG continued to develop rapidly in 2020.
- In June, the NCG and the NCP received the extension of authorisation as diagnostic centers for four more years from the Ministry of Health.
- A clinical geneticist, Dr Arthur Sorlin, was recruited to strengthen clinical activities.
- Regarding clinical activities, the number of genetic consultations increased again in 2020, despite COVID-19 2019: 1360 consultations, 2020: 1947 consultations. Consultations were partly conducted via tele-consultations.
- An NCG presentation was delivered at the annual presentation of the 2018-2022 Plan National Maladies Rares (PNMR) in February. Several members of the NCG team are active in various PNMR working groups. Providing clinical diagnosis, diagnostic genetic testing and genetic counselling to patients with rare diseases is one of the key objectives of the NCG. Over the past two years, the NCG has gained visibility, improved its interactions with physicians and hospitals and has become an important partner of the PNMR and the national Hub of the European Reference Networks (ERN) at the CHL.

- As for diagnostic activities, the number of (in-house) tests also increased, and considerably so (2019: 14,230, 2020: 20,831), while outsourcing dropped from 4,213 to 2,204 tests.
- In July 2020, movement of the Cytogenetics and Hemato-Oncogenetics units to a shared lab space in the second floor was finalized, with complete reorganization towards common laboratory spaces dedicated to specific cytogenetic and molecular-cytogenetic techniques, mutualizing rooms and equipment. Furthermore, an automated imaging system for chromosome and FISH analyses (MetaSystems) as well as a fully automated chromosome harvester (HANABI-PI) were implemented. These shared equipment will allow both units to increase productivity and throughput while maintaining consistent and professional quality.
- In October 2020, the Ministry of Health authorized the investment in a production scale sequencer, after approval by the Commission permanente pour le secteur hospitalier (CPH). The Illumina NovaSeq6000 was installed in December 2020 and will allow for the implementation of larger Next Generation Sequencing (NGS) approaches, such as exome sequencing, large multi-gene panels, and even whole genome sequencing in the future. In addition to increasing the portfolio of diagnostic tests, it will advance translation research activity for the LNS and Luxembourg.



## CYTOGENETICS

# 1,601

CYTOGENETIC ANALYSES

# 7,304

NON-INVASIVE PRENATAL TESTS (NIPTS)



## CLINICAL GENETICS

# 1,974

GENETIC CONSULTATIONS FOR 1,473 DIFFERENT PATIENTS

## MOLECULAR GENETICS

# 1,829

SOMATIC GENETIC ANALYSES

## HEMATO-ONCOGENETICS

# 1,107

CYTOGENETICS AND MOLECULAR GENETIC ANALYSES

# 7,332

CONSTITUTIONAL GENETIC ANALYSES

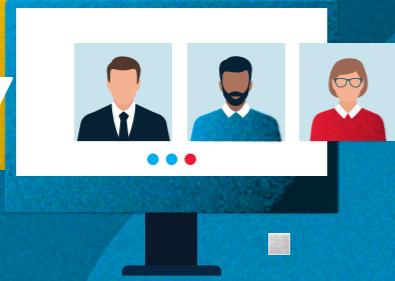
# 1,673

HEMOGLOBINE SEPARATION AND QUANTIFICATION CASES



2.7

## ADMINISTRATION, FINANCE & SUPPORT SERVICES



“Mir krute vill positive Feedback vun eise Stakeholder am Joer 2020. Fir eis all ass dëst eng Bestätegung vun der Qualitéit vun eiser Aarbecht - an och eng Verflichtung.”

Alain Leriche  
Financial Director a.i.







# TRUST MATTERS: HOW TO FINANCE A PUBLIC HEALTH PLAYER IN A SUDDEN CRISIS

In order for a healthcare player like the LNS to fulfil its central role in times of crisis, many competencies are required. At the centre of it all, of course, are the different health experts. However, their contribution to the handling of the COVID-19 crisis would not have been possible without expertise in the fields of Human Resources, Information Technology, Infrastructure & Logistics and, last but certainly not least: Finance.

The four above-mentioned services are the pillars of the Department of Administration, Finance and Support Services, and have formed the backbone of the LNS in the fight against COVID-19 from the very beginning, as Alain Leriche, Financial Director a.i., summarises: "Even in normal times, a modern laboratory like the LNS is a highly diversified organisation with very specific demands in terms of staff, technology and infrastructure. This requires solid and sustainable financing – even more so when you suddenly become one of the most important players in the entire country."

## VERSATILE ACQUISITIONS: A LEAP INTO THE LIMELIGHT ALSO CAUSED A HIKE IN COSTS

This is exactly what happened in March 2020, Alain Leriche continues, when the sudden leap into the limelight took place – numerous imponderables included: "At that time, we did not know what exactly was in store for the LNS, or for the country as whole, for that matter. However, it was clear to all of us from the outset that something serious was happening that we would have to adapt to very quickly. For our Finance service, this meant that we had to prepare for a situation in which significant purchases would have to be made – and the corresponding funds made available."

This situation did indeed occur, and the associated expenditure had to be made in a wide variety of areas, as Alain Leriche explains: "They ranged from the comprehensive purchase of protective clothing to investments in test infrastructure to unforeseen personnel and IT costs. In the case of the latter, the extensive conversion to home office mode turned out to be an unexpected source of costs."

## HAVING FAITH PAYS OFF: STAKEHOLDERS PRAISE LNS'S HANDLING OF FUNDS

Against this backdrop, Alain Leriche continues, reliable processes within the Finance Service were of course also crucial: "Since many of the purchases made were very urgent, the corresponding payments also had to be made quickly. Conversely, the LNS is also a service provider, for instance, to private laboratories. We therefore have to pay attention to efficiency in our own invoicing. This is also important with regards to our stakeholders, who trust in our professionalism."

The LNS has proved worthy of this trust, as Alain Leriche underlines: "We received a lot of positive feedback from our stakeholders during 2020. The basic tenor is that we are responsible and efficient with the resources we have been given. For all of us, this is a confirmation of the quality of our work – and also an obligation. It certainly bears saying that this would not have been possible, for example, if our public partners had not supported us from the outset. And of course, it is the result of the flexibility, the team spirit and the individual commitment of our people."

## RÉSUMÉ EN FRANÇAIS

### COMMENT FINANCER UN ACTEUR DE SANTÉ PUBLIQUE EN CAS DE CRISE SUBITE ?

**Pour qu'un acteur de la santé comme le LNS puisse remplir son rôle central en temps de crise, de nombreuses compétences sont nécessaires. Au centre de tout cela se trouvent les experts de la santé. Mais leur contribution à la gestion de la crise de la COVID-19 n'aurait pas été possible sans une expertise dans les domaines des ressources humaines, des technologies de l'information, de l'infrastructure et de la logistique et, enfin, des finances.**

Les services mentionnés plus haut constituent les piliers du département administratif, finances et services support, et ont formé l'épine dorsale du LNS dans la lutte contre la COVID-19, comme le résume Alain Leriche, directeur financier a.i. : « Même en temps normal, le LNS est une organisation très diversifiée avec des exigences spécifiques en termes de personnel, de technologie et d'infrastructure. Cela nécessite un financement solide - d'autant plus lorsqu'on devient soudainement l'un des acteurs clé de tout le pays. »

### UN BOND EN AVANT QUI A AUSSI ENTRAÎNÉ UNE HAUSSE DES COÛTS

C'est exactement ce qui s'est passé en mars 2020, poursuit Alain Leriche, lorsque le passage –soudain– sous les feux des projecteurs a eu lieu : « À l'époque, nous ne savions pas exactement ce qui attendait le LNS, et le pays tout entier. Cependant, il était clair pour nous que quelque chose de grave se produisait et que nous devions nous y adapter. Pour le service financier, cela signifiait que nous devions nous préparer à une situation dans laquelle des achats importants devaient être effectués - et les fonds correspondants mis à disposition. »

Cette situation s'est effectivement produite, et les dépenses correspondantes ont dû être effectuées dans une grande variété de domaines. Alain Leriche : « Cela allait de l'achat complet de vêtements de protection aux investissements dans l'infrastructure de test, en passant par des frais de personnel et d'informatique imprévus. Dans le cas de ces derniers, le passage généralisé en télétravail s'est avéré être une source de coûts inattendue. »

### TOUS NOS PARTENAIRES SALUENT LA MANIÈRE DONT LE LNS A GÉRÉ SES FONDS

Alain Leriche poursuit : « Comme beaucoup d'achats effectués étaient très urgents, les paiements correspondants devaient également être effectués rapidement. À l'inverse, le LNS est aussi un prestataire de services, par exemple pour des laboratoires privés ou les hôpitaux du pays. Nous avons donc dû veiller à l'efficacité de notre propre facturation. Ce fut également important vis-à-vis de nos partenaires et financeurs, qui avaient confiance en notre professionnalisme. »

Le LNS s'est montré digne de cette confiance, comme le souligne Alain Leriche : « Nous avons reçu beaucoup de retours positifs de nos partenaires. Il en est principalement ressorti que nous fûmes et restons hautement responsables et efficaces avec les ressources qui nous ont été et sont octroyées. Cela n'aurait pas été possible si nos partenaires publics ne nous avaient pas soutenus dès le départ. Et bien sûr, c'est aussi le résultat de la flexibilité, de l'esprit d'équipe et de l'engagement individuel de nos collaborateurs. »



Assembled test kits for the national program to detect COVID-19 in care of the elderly facilities.





# HUMAN RESOURCES FOR HUMAN HEALTH: THE MULTIPLE CHALLENGES OF HR EXPERTS AT THE LNS DURING THE CORONAVIRUS CRISIS.

The LNS is all about people. On the one hand, there are patients, whose well-being depends on a functioning health system. On the other hand, there are the more than 360 experts with 20 different nationalities who work at the LNS to ensure that patients receive the best possible care. While the focus on people is certainly what drives the team, COVID-19 did bring about unforeseen challenges in several areas – and they were handled quickly, creatively, and professionally.



**Alessandra Lanfranconi**  
Head of HR

## HOME OFFICE OR LAB: ORGANISATIONAL AND LEGAL ISSUES

One of the very first tasks at the time was to determine who would work on-site at the LNS in the following weeks and months, and who would work from home. Alessandra Lanfranconi: "What looks simple and logical in retrospect is the outcome of a very well thought analysis process and a constructive team consultation, carried out in the spring of 2020. It was clear from the outset, that our virology team would play a central role in the fight against the virus. The question that arose after that was which other departments would be essential in this fight, and how to ensure service delivery, including the underlying processes that needed to be adjusted while remaining compliant with governance and organizational frameworks."

"The first lockdown in mid-March 2020 was a new situation for everyone," reflects Alessandra Lanfranconi, in charge of Human Resources, on the days that changed the world – and the LNS. "Nevertheless," she continues, "the LNS was prepared for what came next: we had already set up a crisis team before the lockdown, which worked out a concrete plan – in meetings that often went on until late in the evening – on how we could continue to fulfil our mission under the new conditions. HR naturally played a central role in this, since it is our people who fulfil this mission."



Welcoming the new LNS recruits in COVID-19 times.

Whether from a home office or a laboratory, a raft of mammoth organisational and administrative hurdles had to be overcome literally overnight. Quite a challenge for the HR team at the LNS, not least in pushing boundaries and treading new ground in terms of its competences, as Alessandra Lanfranconi explains: "Due to the lockdown, drastic changes were imminent for the whole of society, which also affected us as an employer. The issue of special leave for parents, for example, was a central topic, especially at the beginning. In addition, we also had to face specific challenges in providing tailor made and individualised support to colleagues, for example because working from home and social distancing were completely new and unexpected experiences, to which every person reacted differently."

## LONG-TERM POSITIONING IN THE CRISIS: NEW TEAM MEMBERS, NEW WAYS OF WORKING

In addition to managing existing staff, recruiting and selecting new staff was an even more critical task than usual for the HR team at the LNS in 2020, as there was an urgent need to attract qualified professionals to strengthen the virology team, for example. According to Alessandra Lanfranconi, this actually turned out to be surprisingly simple, especially as the team and candidates adapted fast and turned to new, "pandemic-friendly" methods: "Just as in the day-to-day cooperation within the entire LNS team, we also consistently relied on digital means to communicate with our potential new recruits. The interviews simply took place online via video conference. This was very quickly accepted as "normal", and above all efficient, after an initial adjustment period."

In any case, Alessandra Lanfranconi sees adaptability as one of the distinct strengths of the entire team, which led to the LNS being able to position itself clearly as a pillar of the modern Luxembourg health system during the coronavirus crisis: "March 2020 was a sort of "Fall of the Berlin Wall" moment, where it was important to recognise the signs of the times and respond very fast. We at the LNS succeeded in doing this in a sustainable way. Many of our colleagues have taken up the fight against the virus as a personal mission, with extraordinary and impressive resolve and engagement, against all odds. And as a team, we managed to rally around and translate into practice our vision, namely to serve together proudly to deliver excellence in health care, even under unimaginable circumstances. We are ever mindful of and saddened by the loss and suffering that the pandemic caused in the world and at the same time we appreciate the positive changes and innovation it triggered and that that are clearly here to stay, particularly in the way in which we work together."





## RÉSUMÉ EN FRANÇAIS

### LES MULTIPLES DÉFIS DE L'ÉQUIPE RH DU LNS FACE À LA PANDÉMIE

**Le LNS, c'est avant tout une affaire de personnes. D'un côté, il y a les patients. De l'autre, il y a les plus de 360 experts de 20 nationalités différentes qui travaillent au LNS. Bien que les personnes soient certainement le moteur de l'équipe RH, la COVID-19 a présenté des défis imprévus dans plusieurs domaines.**

« Le premier confinement en mars 2020 était une situation nouvelle pour tout le monde », se souvient Alessandra Lanfranconi, responsable des ressources humaines. Néanmoins, poursuit-elle, le LNS était préparé à ce qui allait suivre : « Nous avons déjà mis en place une équipe de crise avant le confinement, qui a élaboré un plan concret - sur la manière dont le LNS pourrait continuer à remplir sa mission. Les RH ont tout naturellement joué un rôle central dans ce processus, puisque ce sont nos collaborateurs qui assurent cette importante mission. »

### HOME OFFICE OU LABORATOIRE : DES QUESTIONS ORGANISATIONNELLES ET JURIDIQUES

L'une des premières tâches de l'époque a été de déterminer qui travaillerait sur place au LNS dans les semaines et les mois suivants, et qui travaillerait à domicile. Alessandra Lanfranconi : « Il était clair dès le départ que notre équipe de virologie jouerait un rôle central dans la lutte contre le virus. La question qui s'est posée ensuite était de savoir comment assurer la prestation d'autres services essentiels, et notamment les processus de base qui devaient être ajustés tout en restant conformes aux cadres légal et de gouvernance interne. »

Il a fallu surmonter plusieurs obstacles organisationnels et administratifs d'envergure, comme l'explique Alessandra Lanfranconi : « Des changements radicaux étaient imminents pour l'ensemble de la société, ce qui nous a également affectés en tant qu'employeur. Par exemple, la question du congé pour raisons familiales lié à la pandémie était un sujet central pour nos employés. En outre, nous avons dû faire face à des défis spécifiques pour apporter un soutien sur mesure à nos collègues, notamment dans la phase d'adaptation au télétravail et au confinement. »

### NOUVEAUX VENUS ET NOUVELLES MÉTHODES DE TRAVAIL

Le recrutement de nouveaux collaborateurs en 2020 a constitué une tâche encore plus critique que d'habitude car il a fallu renforcer rapidement certaines équipes, surtout en virologie : « Comme pour la coopération quotidienne au sein du LNS, nous nous sommes systématiquement appuyés sur des moyens numériques pour communiquer avec nos nouvelles recrues potentielles. Les entretiens ont tout simplement eu lieu en ligne par visioconférence. Cela a très vite été accepté comme « normal », et surtout efficace, après une première période d'adaptation. »

Alessandra Lanfranconi voit dans l'adaptabilité l'une des grandes forces de toute l'équipe, qui a conduit le LNS, pendant la crise du coronavirus, à se positionner clairement comme un pilier d'un système de santé moderne au Luxembourg : « Mars 2020 a été un peu comme une « chute du mur de Berlin », un moment où il était important de reconnaître les signes du temps et de réagir très vite. Au LNS, nous avons réussi à le faire de manière durable. »





# WHEN BASIC PRODUCTS BECOME SCARCE OVERNIGHT: HOW THE LNS REORGANISED ITS SUPPLY CHAIN MANAGEMENT DURING THE CRISIS

In times of crisis, some consumables become scarce. During the COVID-19 crisis, this was of course especially true for products for the health sector – including so-called personal protective equipment (PPE). For the LNS's logistics experts, this meant a change – sometimes even a complete reorganisation of the supply chain.



**Thomas Wegner**  
Head of infrastructures  
and logistics

## IN THE BEGINNING: MASKS SOLD OUT ACROSS EUROPE

In the beginning, Thomas Wegner remembers, it was mainly protective masks of all kind that were lacking in many places – including at the LNS: “When COVID-19 broke out, established wholesalers for laboratory supplies, with whom we had always worked until then, suddenly could no longer meet the demand for masks. Especially in Europe, the market was almost sold out, the result being that we even had to ‘ration’ the masks we distributed internally.”

The situation finally improved when new, smaller distributors appeared on the scene who bought their masks directly from Asia. However, even this solution was not an automatic success: “We first had to distinguish the serious from the less serious suppliers and then establish new business relationships in the shortest amount of time. With a mixture of reactivity, gut feeling and a well experienced team, we succeeded in the end in always having enough masks available for our employees at all times.”

“The COVID-19 crisis caught us cold with regard to our available stocks,” says Thomas Wegner, Head of Infrastructure & Logistics. “Like other industries, we came to realise almost overnight that the principle of just-in-time stock management does not work in times of shortage.” And shortages, Thomas Wegner continues, sprung up time and again over the course of 2020 – for several articles, and worldwide.

## OTHER SCARCE PRODUCTS IN 2020: FROM GLOVES TO SWABS

That this had its price goes without saying – the keywords here being “supply and demand”. In the meantime, according to Thomas Wegner, prices had “gone through the roof” – for masks as well as for other articles. In any case, PPE products became scarce from time to time as 2020 went on, with the same consequences for the LNS: new suppliers had to be found around the globe – whose products needed to meet requirements for quality, delivery times and price.

Thomas Wegner: “In summer, for example, there was a shortage of gloves, without which no laboratory operation is conceivable. In some cases, special activities require special gloves that have to be tested according to the relevant standards. Here too, we had to find new suppliers in a hurry, just as we had to find new suppliers for swabs and pipette tips in autumn. In both cases we found what we were looking for at the source, i.e. in South Korea and China respectively – and ordered large quantities there.”

## AN INSIGHT FOR THE FUTURE: A WELL-BALANCED SUPPLIER MIX

With this double strategy, consisting of cooperation with various small, local suppliers and direct contact with China and South Korea, the LNS was prepared for its ever-increasing testing activities and got through the winter. In addition, Thomas Wegner says that a general lesson for supply chain management was learned from the “COVID-19 economy”: “Relying on wholesalers may be convenient, but in the end it’s a well-balanced supplier portfolio that makes the difference.”

### RÉSUMÉ EN FRANÇAIS

## QUAND LES PRODUITS DE BASE NE SONT PLUS DISPONIBLES DU JOUR AU LENDEMAIN: COMMENT LE LNS A RÉORGANISÉ LA GESTION DE SA CHAÎNE D'APPROVISIONNEMENT PENDANT LA CRISE

**En temps de crise, certains produits de base deviennent rares. Pendant la crise de la COVID-19, c'était bien sûr particulièrement vrai pour les produits destinés au secteur de la santé - notamment les équipements de protection individuelle (EPI). Pour les logisticiens du LNS, cela signifiait parfois une réorganisation complète de la chaîne d'approvisionnement.**

« La crise de la COVID-19 nous a pris au dépourvu en ce qui concerne nos stocks disponibles », explique Thomas Wegner, responsable de l'infrastructure et de la logistique. « Comme d'autres industries, nous avons réalisé quasiment du jour au lendemain que la gestion des stocks en flux tendu ne fonctionne pas en période de pénurie ».

### AU DÉBUT, DES MASQUES EN RUPTURE DE STOCK DANS TOUTE L'EUROPE

Thomas Wegner se souvient qu'au début, ce sont surtout les masques de protection qui faisaient défaut, y compris au LNS : « Lorsque la COVID-19 a éclaté, nos grossistes attirés pour les fournitures de laboratoire n'ont soudain plus pu répondre à la demande de masques. En Europe surtout, les stocks étaient quasiment épuisés, si bien que nous avons même dû «rationner» les masques que nous distribuions en interne. »

La situation s'est améliorée lorsque sont apparus de petits distributeurs qui achetaient leurs masques directement en Asie : « Nous avons d'abord dû distinguer les fournisseurs sérieux des moins sérieux, puis établir de nouvelles relations commerciales. Avec un mélange de réactivité, d'intuition et d'une équipe bien expérimentée, nous avons réussi pour finir à avoir toujours suffisamment de masques à disposition pour nos employés à tout moment. »

### UN APERÇU DE L'AVENIR : UN ÉVENTAIL DE FOURNISSEURS BIEN ÉQUILIBRÉ

Il a aussi fallu trouver, pour les EPI, de nouveaux fournisseurs dans le monde entier dont les produits devaient répondre aux exigences de qualité, de délais de livraison et de prix. Thomas Wegner : « En été, par exemple, il y avait une pénurie de gants. Là aussi, nous avons dû trouver de nouveaux fournisseurs en urgence, tout comme pour les écouvillons et les pointes de pipettes en automne. Dans les deux cas, nous avons trouvé ce que nous cherchions en Corée du Sud et en Chine. »

Grâce à cette double stratégie - coopérer avec divers petits fournisseurs locaux et établir un contact direct avec la Chine et la Corée du Sud - le LNS a été prêt à faire face à ses activités de test toujours plus nombreuses. Pour Thomas Wegner, une leçon générale pour la gestion de la chaîne d'approvisionnement a été tirée de «l'économie COVID-19» : « S'appuyer sur les grossistes peut être pratique, mais au final, c'est un portefeuille de fournisseurs bien équilibré qui fait la différence. »





# IT AS A BACKBONE IN EMERGENCY SITUATIONS: HOW CUSTOMISED SOLUTIONS ENSURED SMOOTH PROCESSES DURING THE COVID-19 CRISIS

Digitalisation is a magic word in many places, although implementation often falters. At the LNS, digitalisation has already been systematically implemented for years, and the COVID-19 crisis has further strengthened this trend. The focus here is on efficient processes that deliver tangible benefits to patients.



**Yannick Kirschhoffer**  
Head of IT

## A MIX OF PRAGMATISM AND CREATIVITY

According to Yannick Kirschhoffer, these solutions required both pragmatism and a high degree of creativity. This was true, for example, in October 2020, when the LNS was directly involved in the COVID-19 tests: "At that time, the number of infections and thus also demand for tests rose very quickly. Due to the workload of the private laboratories, the LNS was asked for help, virtually overnight, and we had to set up two test centres in a very short time, one at the Kirchberg and another at our site in Dudelange."

In this context, it was also necessary to provide customised IT solutions in order to be able to guarantee smooth processes right from the start. Yannick Kirschhoffer: «Since the LNS is located at a traffic junction, we had to rule out long queues. Another requirement was that we had to be able to deliver test results within 24 hours. In both cases, our contribution as IT experts was needed. By quickly procuring and installing PCR testing machines and setting up a complete online booking system, we were ultimately able to make a significant contribution towards the LNS being able to meet these requirements.»

Healthcare and digitalisation are considered key elements of almost all relevant innovation concepts. Very often, both are mentioned in the same breath, and together they form an essential theoretical basis for tomorrow's society. COVID-19 has pushed plenty of these theoretical considerations into reality and given the digitalisation of healthcare a lasting boost. This is also and especially true for the LNS, as Yannick Kirschhoffer, in charge of IT, explains: "From the very beginning, the coronavirus crisis was a string of different unpredictable situations for which we had to find working solutions very quickly."

## TEAMWORK AND LONG-TERM PERSPECTIVE

It is in the nature of things that the technology did not always run smoothly right from the start. Here too, however, Yannick Kirschhoffer underlines the ability of his team, the LNS as a whole, and also the various external partners to cope with crises: "In our booking system, for example, users were initially unable to make any changes, which then led to a high number of calls. In addition, we first had to find the right partners for the various tasks. However, we were able to get all this over quickly, not least thanks to extremely intensive exchanges between all those involved, and real teamwork at all levels."

Yannick Kirschhoffer also sees this teamwork as a particularly impressive outcome of the coronavirus crisis: "We positioned ourselves at the LNS as COVID-19 fighters, and this is exactly the spirit we lived by: we stood together against the virus. We are therefore also sure that, against the background of this common experience, we will continue to bring long-term benefits to public health in our country. Contacts between the scientific departments and the IT service, which have once again become much more intensive, will help us in this."

## RÉSUMÉ EN FRANÇAIS

### L'INFORMATIQUE EST LA COLONNE VERTÉBRALE EN SITUATION D'URGENCE : DES SOLUTIONS PERSONNALISÉES POUR UN BON DÉROULEMENT DES OPÉRATIONS PENDANT LA CRISE

**La numérisation est un mot magique dans beaucoup de secteurs. Au LNS, la numérisation est réellement mise en œuvre depuis des années, et la crise de la COVID-19 a encore renforcé cette tendance.**

Les soins de santé et la numérisation sont considérés comme des éléments-clés de presque tous les concepts d'innovation pertinents. La COVID-19 a permis de donner un élan durable à la numérisation des soins de santé. C'est aussi vrai pour le LNS, comme l'explique Yannick Kirschhoffer, responsable du service d'informatique : « Dès le début, la crise du coronavirus a été un enchaînement de différentes situations imprévisibles pour lesquelles nous avons dû trouver très rapidement des solutions pratiques. »

### UN MÉLANGE DE PRAGMATISME ET DE CRÉATIVITÉ

Selon Yannick Kirschhoffer, ces solutions ont nécessité à la fois du pragmatisme et un haut degré de créativité : « En octobre 2020, le nombre d'infections et donc aussi la demande de tests ont augmenté très rapidement. En raison de la charge de travail des laboratoires privés, le LNS a été sollicité, et nous avons dû mettre en place deux centres de tests en très peu de temps, un au Kirchberg et un autre sur notre site de Dudelange. »

Dans ce cadre, il était également nécessaire de fournir des solutions informatiques personnalisées afin de pouvoir garantir des processus fluides dès le départ. Yannick Kirschhoffer précise : « Nous devons exclure les longues files d'attente et être en mesure de livrer les résultats des tests dans les 24 heures. En installant rapidement des machines de test PCR et en mettant en place un système complet de réservation en ligne, nous avons ainsi pu contribuer de manière significative à ce que le LNS puisse répondre à ces exigences. »

### TRAVAIL D'ÉQUIPE ET PERSPECTIVE À LONG TERME

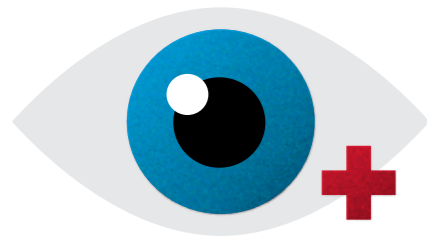
Yannick Kirschhoffer souligne la capacité de son équipe, tout comme du LNS dans son ensemble, mais aussi des différents partenaires externes à faire face aux crises : « Dans notre système de réservation, les utilisateurs n'ont d'abord pu effectuer aucune modification. En outre, nous avons d'abord dû trouver les partenaires adéquats pour les différentes tâches. Mais tout cela a pu être réglé rapidement, notamment grâce à des échanges très intenses entre toutes les personnes impliquées et à un travail d'équipe à tous les niveaux. »

Yannick Kirschhoffer voit dans ce travail d'équipe un résultat impressionnant de la crise du coronavirus : « Nous nous sommes positionnés au LNS comme des combattants de la COVID-19, et c'est exactement l'esprit dans lequel nous avons vécu. Nous sommes certains que nous continuerons à apporter des bénéfices à long terme à la santé publique de notre pays. »





# KEY FACTS & FIGURES



## FINANCE

### Main achievements in 2020

- For the LNS Finance Service, COVID-19 meant a situation in which significant purchases and financing operations had to be made. These operations ranged from setting up brand new missions for the LNS to dealing with more practical issues, from purchasing protective clothing to investing in test infrastructure to covering unforeseen personnel and IT costs.
- Many of the operations carried out were very urgent, and the corresponding financial actions hence had to be executed quickly and as efficiently as possible, in the interest of Luxembourg residents.
- Conversely, as a service provider, for instance to private laboratories and public health authorities and players, the LNS had to pay particular attention to efficiency in its own efficiency.

## IT

### Main achievements in 2020

- Lab2lab interfaces with hospitals: the LNS is now able to receive electronic requests and to send structured HL7 reports to hospital laboratories automatically. This interface was made set up with three hospitals in 2020 and supports private labs for COVID-19 sequencing data exchange.

- Digital Report for Patients: during the COVID-19 outbreak, it was essential to communicate PCR results to patients nearly in real time. The IT Service therefore drove the development of a secure electronic transmission system allowing the patients to download reports immediately they received biological validation.
- Remote Working Support / Crisis Management: on the first COVID-19 lockdown, an urgent need for mobile devices and online collaboration tools arose in all organisations. IT increased its procurement activity to deliver laptops and remote connectivity to all eligible employees. Collaboration tools also had to be adapted to this hybrid environment hence a distribution of headsets and videoconferencing systems licenses.

### Procurements

110

LAPTOPS

30

WEBEX LICENCES

103

HEADSETS (WIRED AND WIRELESS)

## INFRASTRUCTURES & LOGISTICS

### Main achievements in 2020

- In the beginning of the COVID-19 crisis, the LNS came to realise that the principle of just-in-time stock management does not work in times of shortage. Shortages sprung up time and again over the course of 2020 – for several articles, and worldwide.
- At a certain point, we had to “ration” the masks we distributed internally, and in the summer there was a shortage of gloves.
- With a twofold strategy, consisting in cooperation with various small, local suppliers and direct contact with China and South Korea, the LNS was prepared for its ever-increasing activities.

### Procurements

70,000

SURGICAL MASKS

4,310

FFP2 MASKS

636,6L

HAND SANITIZER

150,170

PCR TEST KITS

### Distances covered by LNS drivers

111,270 km

ON 3 DIFFERENT DAILY TOURS

### Outward stock movements

9,790

STOCK MOVEMENTS FROM CENTRAL WAREHOUSE TO LNS DEPARTMENTS

3,899

STOCK MOVEMENTS FROM CENTRAL WAREHOUSE TO EXTERNAL PARTNERS

### Inward stock movements

2,337

STOCK MOVEMENTS FROM VENDORS TO CENTRAL WAREHOUSE





# KEY FACTS & FIGURES

## HR

### Main achievements in 2020

#### COVID-19 tasks

- The lockdown in March led to a need for substantial reorganisation and "flexibility" in all departments. Related challenges for the HR team were, among others: working from home, "chômage technique" (work suspension for technical reasons), family leave.
- HR was also represented in the LNS COVID-19 Task Force.
- Intensive support to the microbiology teams to cope with the consequences of the COVID-19 crisis including 24/7 continuous working hours – a first at the LNS.
- 18 staff recruited to perform sampling and monitoring in the various COVID-19 sampling centres.
- 8 temporary members of staff recruited for testing in schools.
- Implementation of the first cooperation agreement within the LNS in the context of Covid.
- In addition, 20 interns and 22 students were hosted at the LNS.

#### New members of staff

- New recruits included 30 permanent contracts, 42 fixed-term contracts (around 50% related to Virology and Covid crisis management), 5 renewals of existing contracts on a permanent or fixed-term basis and 1 volunteer contract.
- Among the new recruits were a CFO, a Legal Officer, a CIO and a Scientific Advisor / Project Coordinator.

#### Internal processes & developments

- Election of the staff representative to the Board (Jessica Tapp) to replace the predecessor who retired.
- Continuous improvement of the overall performance evaluation system in conjunction with the end-of-year evaluation and target setting for 2021.
- Reorganisation of the central quality process.
- Participation in the review of the new LNS Act.



### The LNS team in 2020

20

COUNTRIES REPRESENTED

363

EMPLOYEES

326.3

FULL TIME EQUIVALENTS

62

NEW RECRUITS + 10 INTERIM WORKERS

36.9%

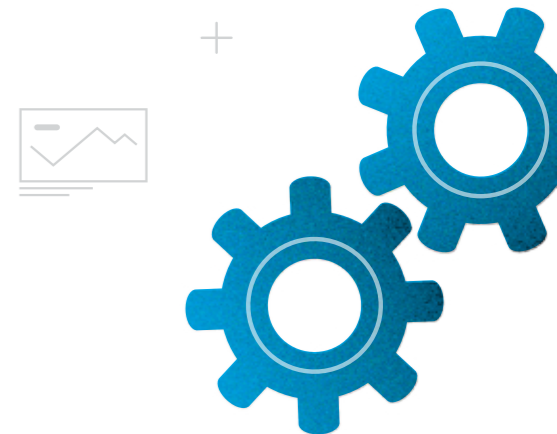
MEN

63.1%

WOMEN

42

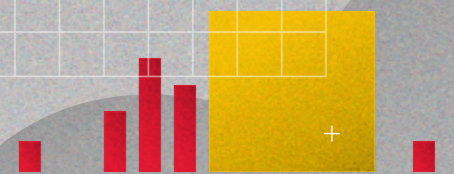
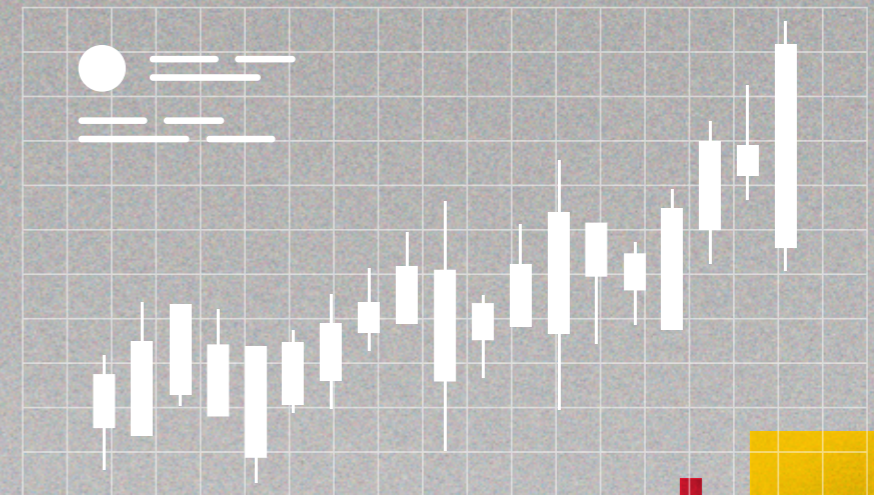
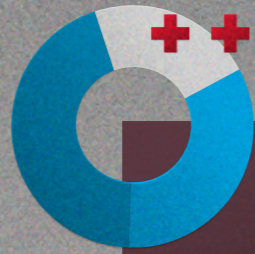
AVERAGE AGE OF STAFF MEMBERS





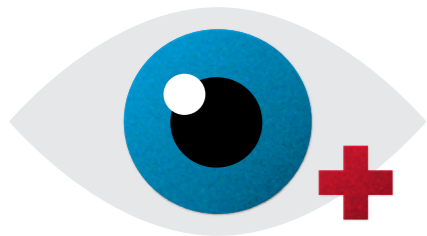
# 3.0

## KEY FIGURES 2020





# KEY FIGURES 2020



## 1. STAFF

326

FULL-TIME / EQUIVALENTS

20

NATIONALITIES

(Austria, Belgium, Bosnia and Herzegovina, Brazil, Canada, China, Great Britain, France, Georgia, Germany, Hungary, Italy, Luxembourg, Netherlands, Peru, Portugal, Romania, Spain, Sweden, Switzerland)

42

AVERAGE AGE OF STAFF

24

NEW POSITIONS  
(EXCLUDING REPLACEMENTS)

72

NEW RECRUITS  
(FIXED-TERM AND PERMANENT  
CONTRACTS)

63.1%

WOMEN

36.9%

MEN

## 2. TOTAL INCOME

€ 62,417,912.38

## 3. ACTIVITIES DEPARTMENT BY DEPARTMENT

Medical Biology

104,627

BIOCHEMICAL ANALYSES

Health Protection

34,977

ENVIRONMENTAL HEALTH AND  
BIOLOGICAL MONITORING ANALYSES



14,280

FOOD MONITORING ANALYSES



Forensic Medicine

11,859

GENETIC IDENTIFICATIONS

Microbiology

112,733

PCR ANALYSES IN VIROLOGY

National Center of Pathology

323,220

PATHOLOGY ANALYSES

National Center of Genetics

20,846

GENETIC ANALYSES

12,065

ANALYSES (TECHNICAL PLATFORM FOR ANALYTICAL TOXICOLOGY AND PHARMACEUTICAL CHEMISTRY)

35,069

BACTERIOLOGY, MYCOLOGY AND ANTIBIOTIC RESISTANCE ANALYSE

192,216

GYNAECOLOGICAL CYTOLOGY ANALYSES

4,180

EXPERTISE REQUESTS IN FORENSIC TOXICOLOGY

22,913

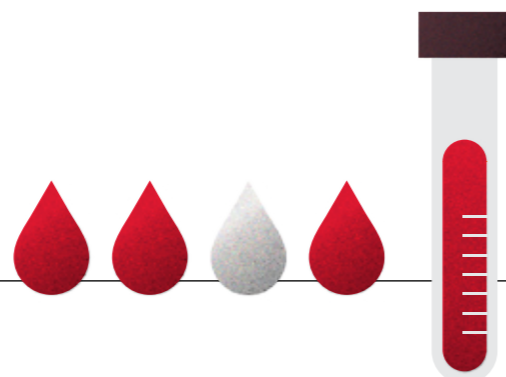
SEROLOGY ANALYSES

130

FORENSIC MEDICAL, AUTOPSIES AND EXPERT WITNESS REPORTS

5,120

WHOLE GENOME ANALYSES





# FINANCIAL REPORT 2020

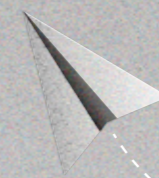
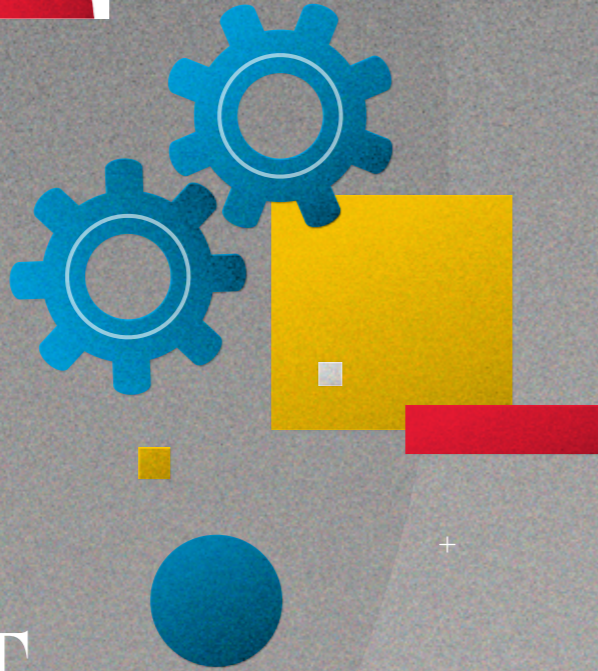
ASSETS	2020	2019
<b>Fixed assets</b>		
Intangible fixed assets		
Concessions, patents, licenses, trademarks and similar rights	281,860.90	366,425.71
Advances paid and intangible assets in progress	-	73,021.00
	281,860.90	439,446.71
Tangible fixed assets		
Land and buildings	73,054,675.91	76,266,160.51
Technical installations and machines	6,026,210.98	3,976,219.58
Other installations, tools and furniture	832,450.41	827,447.87
Advances paid and tangible fixed assets in progress	55,644.44	140,902.16
	79,968,981.74	81,210,730.12
<b>Total fixed assets</b>	<b>80,250,842.64</b>	<b>81,650,176.83</b>
<b>Current assets</b>		
Stocks		
Raw materials and consumables	569,834.63	260,476.59
Debtors		
Trade debtors		
- Becoming due and payable within one year	19,172,368.95	12,192,407.71
Other debtors		
- Becoming due and payable within one year	13,394,022.53	13,528,603.42
- Becoming due and payable after more than one year	534,744.86	384,643.52
Cash at bank and in cash	2,464,730.72	5,746,542.50
<b>Total current assets</b>	<b>36,135,701.69</b>	<b>32,112,673.74</b>
<b>Deferred cost</b>	<b>602,010.58</b>	<b>501,826.29</b>
<b>Total assets</b>	<b>116,988,554.91</b>	<b>114,264,676.86</b>
<b>LIABILITIES</b>	<b>2020</b>	<b>2019</b>
<b>Equity</b>		
Retained earnings	12,073,436.33	8,421,973.60
Profit or loss of the year	4,693,155.13	3,651,462.73
Capital investment subsidies	76,498,285.06	79,578,231.16
<b>Total equity</b>	<b>93,264,876.52</b>	<b>91,651,667.49</b>

LIABILITIES	2020	2019
<b>Provisions</b>		
<b>Other provisions</b>	<b>4,870,877.26</b>	<b>4,671,037.92</b>
<b>Debts</b>		
Trade debts		
- Becoming due and payable within one year	2,817,320.46	2,811,930.56
Other debts		
Tax debts	441,153.72	95,075.11
Social security debts	926,423.74	647,252.93
Other debts		
- Becoming due and payable within one year	13,927,108.22	13,528,687.03
- Becoming due and payable after more than one year	230,926.19	-
<b>Total debts</b>	<b>18,342,932.33</b>	<b>17,082,945.63</b>
<b>Deferred income</b>	<b>509,868.80</b>	<b>859,025.82</b>
<b>Total liabilities and equity</b>	<b>116,988,554.91</b>	<b>114,264,676.86</b>
<b>PROFIT AND LOSS ACCOUNT</b>	<b>2020</b>	<b>2019</b>
<b>Net turnover</b>	<b>36,308,541.73</b>	<b>30,812,495.51</b>
<b>Other operating income</b>	<b>26,109,370.65</b>	<b>24,486,682.54</b>
<b>Use of merchandise, raw materials and consumable materials</b>		
Raw materials and consumable materials	(10,376,447.16)	(8,111,939.24)
Other external expenses	(20,065,287.41)	(21,996,450.00)
<b>Staff costs</b>		
Wages and salaries	(16,961,926.17)	(13,307,721.66)
Social security contributions covering pensions	(1,163,104.13)	(943,537.40)
Other social expenses	(859,200.48)	(767,277.17)
<b>Value adjustment</b>		
On intangible and tangible fixed assets	(5,244,160.79)	(4,905,949.06)
<b>Other operating expenses</b>	<b>(3,054,096.02)</b>	<b>(1,614,529.28)</b>
<b>Other interests and other financial income</b>		
Other interests and other financial income	1,202.57	451.43
<b>Interests and other financial expenses</b>		
Other interests and financial expenses	(1,737.66)	(762.94)
<b>Net result for the year</b>	<b>4,693,155.13</b>	<b>3,651,462.73</b>



# 4.0

LNS  
IN SHORT







## GOVERNANCE BODIES

The LNS is a public institution managed by the board of directors. The management of the Laboratory is entrusted to a director assisted by the executive committee and a scientific advisory board.

### Board of Directors

The board of directors is the managing body of the LNS. It defines the general policy, organization and functioning of the laboratory in compliance with applicable laws, regulations and conventions.

#### President

- Prof. Dr Evelin Schröck

#### Delegates from the Ministry of Health

- Dr Jean-Claude Schmit, vice-president
- Dr Thérèse Staub
- Mr Xavier Poos
- Dr Marc Schlessler
- Mrs Lucienne Thommes

#### Delegates from the Ministry of Justice

- Mr Luc Reding
- Mr Georges Oswald, expert with an advisory voice

#### Delegate of the Ministry of Higher Education and Research

- Mr Pierre Misteri

#### Delegate of the Ministry of Economy

- Dr Françoise Liners

#### Delegate of the Ministry of Finance

- Mr Serge Hoffmann

#### LNS staff representative

- Mrs Jessica Tapp

#### Delegate of the Ministry of Consumer Protection

- Mr Ian Tewes, observer

### Scientific Advisory Board

The scientific advisory board, composed of five members chosen among national and foreign experts, is responsible for contributing to the scientific agenda of the institution, expresses its opinion on the strategic plan and comments on the general guidelines for the activities of the laboratory. The scientific advisory board gives its opinion on all matters falling within the area of competence of the institution.

### Executive Committee

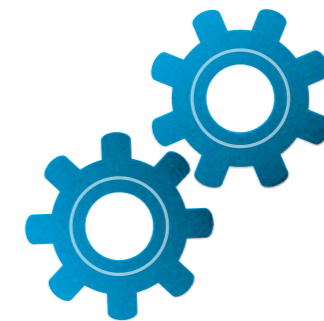
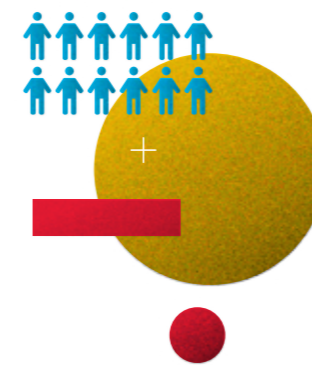
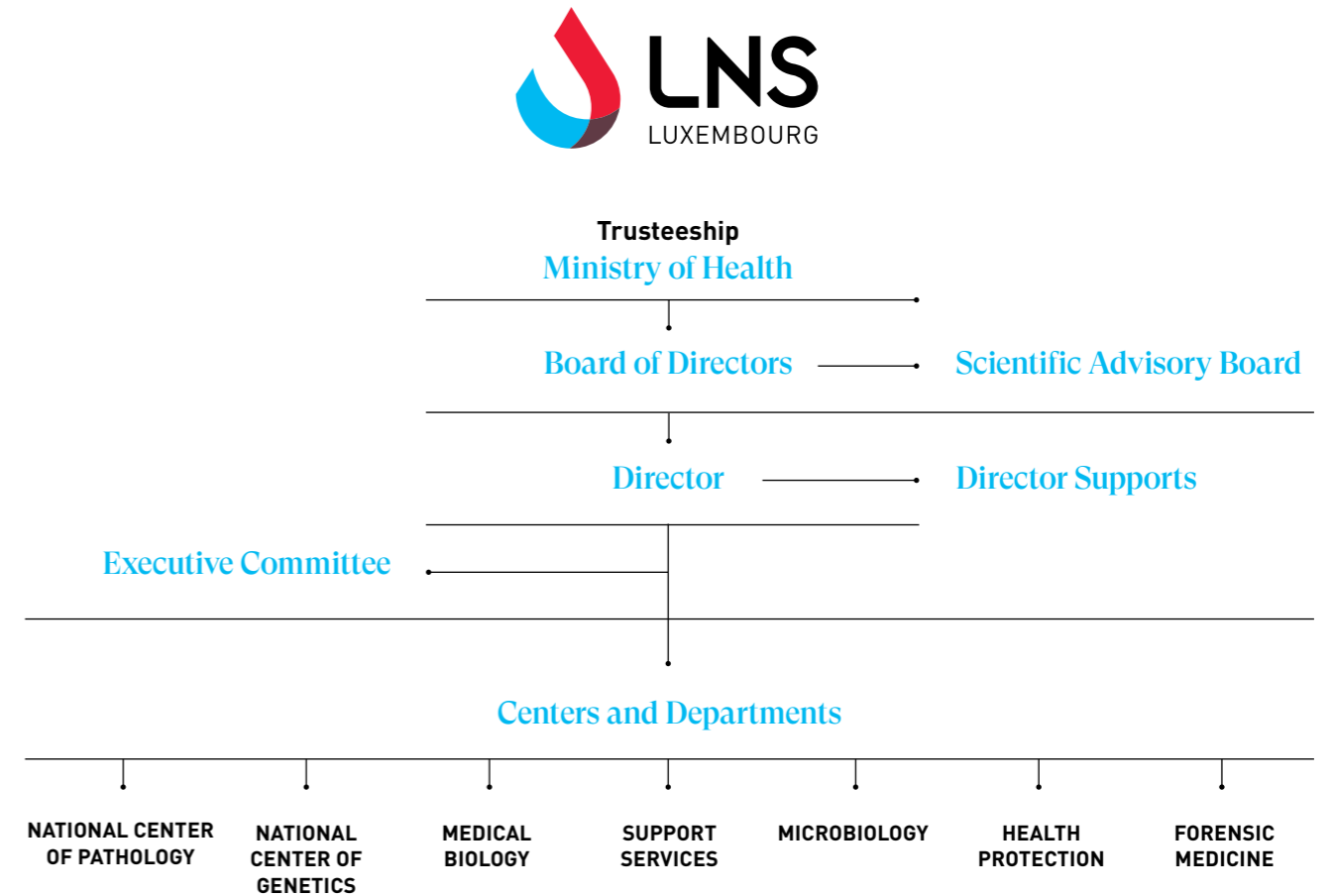
The executive committee, composed of the heads of the departments, the heads of the diagnostic centers and the director, meets at regular intervals to coordinate the activity of the institution.

Members [as at 31 December 2020]





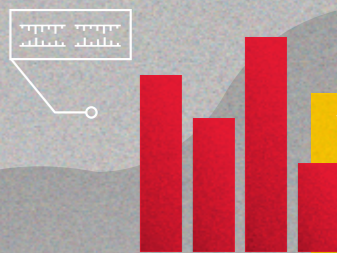
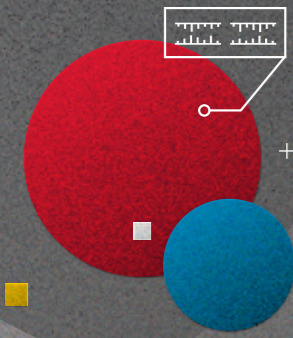
# ORGANISATION CHART





5.0

PUBLICATIONS





# PUBLICATIONS

## NATIONAL CENTER OF PATHOLOGY

Baldini F, Hertel J, Sandt E, Thinnies CC, Neuberger-Castillo L, Pavelka L, Betsou F, Krüger R, Thiele I, on behalf of the **NCER-PD Consortium** (2020). Parkinson’s disease-associated alterations of the gut microbiome predict disease-relevant changes in metabolic functions. *BMC Biology*, 18(1), 62. <https://doi.org/10.1186/s12915-020-00775-7>

Baumann C, Tichy J, Schaefer JH, Steinbach JP, **Mittelbronn M**, Wagner M, Foerch C (2020).

Delay in diagnosing patients with right-sided glioblastoma induced by hemispheric-specific clinical presentation. *Journal of Neuro-Oncology*, 146(1), 63–69. <https://doi.org/10.1007/s11060-019-03335-4>

Bohmann FO, Seiler A., Gelhard S, Stolz L, Brill B, Brunkhorst R, Steinmetz H, Harter P, **Mittelbronn M**, Foerch C (2020). Blood Pressure Lowering Decreases Intracerebral Hemorrhage Volume and Improves Behavioral Outcomes in Experimental Animals. *Journal of Stroke*, 22(3), 416–418. <https://doi.org/10.5853/jos.2020.02390>

Braczynski AK, Capper D, Jones DTW, Schittenhelm J, Stichel D, von Deimling A, Harter PN, **Mittelbronn M** (2020). High density DNA methylation array is a reliable alternative for PCR-based analysis of the MGMT promoter methylation status in glioblastoma. *Pathology, Research and Practice*, 216(1), 152728. <https://doi.org/10.1016/j.prp.2019.152728>

Braczynski AK, Gfroerer S, Beschorner R, Harter PN, Baumgarten P, Rolle U, **Mittelbronn M**. (2020). Cholinergic innervation and ganglion cell distribution in Hirschsprung’s disease. *BMC Pediatrics*, 20(1), 399. <https://doi.org/10.1186/s12887-020-02299-z>

Braun Y, Filipiński K, Bernatz S, Baumgarten P, Roller B, Zinke J, Zeiner PS, Ilina E, Senft C, Ronellenfitsch MW, Plate KH, Bähr O, Hattungen E, Steinbach P, **Mittelbronn M**, Harter, P. N. (2021). Linking epigenetic signature and metabolic phenotype in IDH mutant and IDH wildtype diffuse glioma. *Neuropathology and Applied Neurobiology*, 47(3), 379–393. <https://doi.org/10.1111/nan.12669>

Devraj G, Guérit S, Seele J, Spitzer D, Macas J, Khel MI, Heidemann R, Braczynski AK, Ballhorn W Günther, Ogunshola OO, **Mittelbronn M**, Ködel U, Monoranu CM, Plate KH, Hammerschmidt S, Nau R, Devraj K, Kempf VA J (2020). HIF-1α is involved in blood-brain barrier dysfunction and paracellular migration of bacteria in pneumococcal meningitis. *Acta Neuropathologica*, 140(2), 183–208. <https://doi.org/10.1007/s00401-020-02174-2>

Dreger S, Wollschläger D, Schafft T, **Hammer GP**, Blettner M, Zeeb H. (2020). Cohort study of occupational cosmic radiation dose and cancer mortality in German aircrew, 1960-2014. *Occupational and Environmental Medicine*, 77(5), 285–291. <https://doi.org/10.1136/oemed-2019-106165>

Golebiewska A, Hau AC, Oudin A, Stieber D, Yabo YA, Baus V, Barthelemy V, Klein E, Bougnaud S, Keunen O, Wantz M, Michelucci A, Neirinckx V, Muller A, Kaoma T, Nazarov PV, Azuaje F, De Falco A, Flies B, Richart L, Poovathingal S, Arns T, Grzyb K, Mock A, Herold-Mende C, Steino A, Brown D, May P, Miletic H, Malta TM, Noushmehr H, Kwon YJ, Jahn W, Klink B, Tanner G, Stead LF, **Mittelbronn M**, Skupin A, Hertel F, Bjerkvig R, Niclou SP (2020). Patient-derived organoids and orthotopic xenografts of primary and recurrent gliomas represent relevant patient avatars for precision oncology. *Acta Neuropathologica*, 140(6), 919–949. <https://doi.org/10.1007/s00401-020-02226-7>

Gui Y, Thomas MH, Garcia P, Karout M, Halder R, Michelucci A, Kollmus H, Zhou C, Melmed S, Klaus Schughart K, Balling R, **Mittelbronn M**, Nadeau JH, Williams RW, Sauter T, Buttini M, Sinkkonen L (2020). Pituitary Tumor Transforming Gene 1 Orchestrates Gene Regulatory Variation in Mouse Ventral Midbrain During Aging. *Frontiers in Genetics*, 11, 566734. <https://doi.org/10.3389/fgene.2020.566734>

Latszubaia A, Wienecke-Baldacchino A, Tapp J, Arbyn M, Karabegović I, Chen Z, **Fischer M**, Mühlischlegel F, Weyers S, Pesch P, Mossong J (2020). Characterization and Diversity of 243 Complete Human Papillomavirus Genomes in Cervical Swabs Using Next Generation Sequencing. *Viruses*, 12(12). <https://doi.org/10.3390/v12121437>

Qureshi-Baig K, Kuhn D, Viry E, Pozdeev VI, Schmitz M, Rodriguez F, Ullmann P, Koncina E, Nurmik M, Frasilho S, Nazarov PV, Zuegel N, Boulmont M, Karapetyan Y, **Antunes L**, **Val D**, **Mittelbronn M**, Janji B, Haan S, Letellier E (2020). Hypoxia-induced autophagy drives colorectal cancer initiation and progression by activating the PRKC/PKC-EZR (ezrin) pathway. *Autophagy*, 16(8), 1436–1452. <https://doi.org/10.1080/15548627.2019.1687213>

Ronellenfitsch W, Harter PN, Kirchner M, Heining C, Hutter B, Geldon L, Schittenhelm J, Schuhmann MU, Tatagiba, Marquardt G, Wagner M, Endris V, Brandts CH, Mautner VF, Schröck E, Weichert W, Brors B, von Deimling A, **Mittelbronn M**, Steinbach JP, E. Reuss DE, Glimm H, Stenzinger A, Fröhling S (2020). Targetable ERBB2 mutations identified in neurofibroma/schwannoma hybrid nerve sheath tumors. *The Journal of Clinical Investigation*, 130(5), 2488–2495. <https://doi.org/10.1172/JCI130787>

Unger K, Fleischmann DF, Ruf V, Felsberg J, Piehlmaier D, Samaga D, Julia Hess J, Suresh MP, **Mittelbronn M**, Lauber K, Budach W, Sabel M, Rödel C, Reifenberger G, Herms J, Tonn JC, Zitzelsberger, Belka C, Niyazi M (2020). Improved risk stratification in younger IDH wild-type glioblastoma patients by combining a 4-miRNA signature with MGMT promoter methylation status. *Neuro-Oncology Advances*, 2(1), vdaa137. <https://doi.org/10.1093/oaajnl/vdaa137>

Urban H, Maurer GD, Luger AL, Lorenz NI, Sauer B, Stroch C, Trojan J, **Mittelbronn M**, Steinbach JP, Harter PN, Ronellenfitsch MW (2020). Cetuximab-Mediated Protection from Hypoxia- Induced Cell Death: Implications for Therapy Sequence in Colorectal Cancer. *Cancers*, 12(10). <https://doi.org/10.3390/cancers12103050>

Wefers AK, Stichel D, Schimpf D, Coras R, Pages M, Tauziède-Espariat A, Varlet P, Daniel Schwarz D, Söylemezoglu F, Pohl U, Pimentel J, Meyer J, Hewer, Japp A, Joshi A, Reuss DE, Reinhardt A, Sievers P, Belén Casalini MB, Ebrahimi A, Huang K, Koelsche C, Low HL, Rebelo O, Marnoto D, Becker, Staszewski O, **Mittelbronn M**, Hasselblatt M 27 , Schittenhelm J, Cheesman E, Santos de Oliveira R, Gomes P Queiroz, Valera ET, Hans VH, Korshunov A, Olar A, Ligon KL, Pfister SM, Jaunmuktane Z, Brandner S, Tatevossian RG, Ellison DW, Jacques TS, Honavar M, Aronica, Thom T, Sahm F, von Deimling A, Jones DTW, Blumcke I, Capper D (2020). Isomorphic diffuse glioma is a morphologically and molecularly distinct tumour entity with recurrent gene fusions of MYBL1 or MYB and a benign disease course. *Acta Neuropathologica*, 139(1), 193–209. <https://doi.org/10.1007/s00401-019-02078-w>

## NATIONAL CENTER OF GENETICS

Golebiewska A, Hau AC, Oudin A, **Stieber D**, Yabo Y., Baus V, Barthelemy V, Klein E, Bougnaud S, Keunen O, Wantz M, Michelucci M, Neirinckx V, Muller A, Kaoma K, Nazarov PV, Azuaje F, Alfonso De Falco A, Flies B, Richart L, Poovathingal S, Arns T Grzyb K, Mock A, Herold-Mende C, Steino A, Brown D, May P, Miletic H, Malta TM, Noushmehr HN, Yong-Jun Kwon YJ, Jahn W, **Klink B**, Tanner G, Stead LF, Mittelbronn M, Skupin A, Hertel F, Bjerkvig R, Niclou, SP (2020). Patient-derived organoids and orthotopic xenografts of primary and recurrent gliomas represent relevant patient avatars for precision oncology. *Acta Neuropathologica*, 140(6), 919–949. <https://doi.org/10.1007/s00401-020-02226-7>

Schuster A, Klein E, Neirinckx V, Knudsen AM, Fabian C, Hau AC, Dieterle M, Oudin A, Nazarov PV, Golebiewska A, Muller A, Perez-Hernandez D, Rodius S, Dittmar G, Bjerkvig R, Herold-Mende C, **Klink B**, Kristensen BW, Niclou SP. (2020). AN1-type zinc finger protein 3 (ZFAND3) is a transcriptional regulator that drives Glioblastoma invasion. *Nature Communications*, 11(1), 6366. <https://doi.org/10.1038/s41467-020-20029-y>

Seifert M, Schackert G, Temme A, Schröck E, Deutsch A, **Klink B** (2020). Molecular Characterization of Astrocytoma Progression Towards Secondary Glioblastomas Utilizing Patient-Matched Tumor Pairs. *Cancers*, 12(6). <https://doi.org/10.3390/cancers12061696>

Spodenkiewicz MS, Spodenkiewicz M, Cleary M, Massier M, Fitsialos G, Cottin V, **Jouret G**, Poirsier C, Doco-Fenzy M, Lèbre AS. Clinical Genetics of Prolidase Deficiency: An Updated Review. *Biology (Basel)*. 2020;9(5):E108. Published 2020 May 21. <https://doi.org/10.3390/biology9050108>

Szczurek E, Krüger T, **Klink B**, Beerenwinkel N (2020). A mathematical model of the metastatic bottleneck predicts patient outcome and response to cancer treatment. *PLoS Computational Biology*, 16(10), e1008056. <https://doi.org/10.1371/journal.pcbi.1008056>

Voronina N, Wong JKL, Hübschmann D, Hlevnjak M, Uhrig S, Heilig CE, Horak P, Kreutzfeldt S, Mock A, Stenzinger A, Hutter B, Fröhlich M, Brors B, Jahn A, **Klink B**, Geldon L, Sieverling L, Feuerbach L, Priya Chudasama, Beck K, Kroiss M, Heining C, Möhrmann L, Fischer A, Evelin Schröck, Glimm H, Zapotka M, Lichter P, Fröhling S, Ernst A (2020). The landscape of chromothripsis across adult cancer types. *Nature Communications*, 11(1), 2320. <https://doi.org/10.1038/s41467-020-16134-7>

Wallace PW, Conrad C, Brückmann S, Pang Y, Caleiras E, Murakami M, Korpershoek E, Zhuang Z, Rapizzi E, Kroiss M, Gudziol V, Timmers H, Mannelli M, Pietzsch J, Beuschlein F, Pacak K, Robledo M, **Klink B**, Peitzsch M, J Gill AJ, Tischler AS, de Krijger RR, Paphthomas T, Aust D, Eisenhofer G, Richter S. (2020). Metabolomics, machine learning and immunohistochemistry to predict succinate dehydrogenase mutational status in pheochromocytomas and paragangliomas. *The Journal of Pathology*, 251(4), 378–387. <https://doi.org/10.1002/path.5472>

## MICROBIOLOGY

Adlthoch C, Mook P, Lamb F, Ferland L, Melidou A, Amato-Gauci AJ, Pebody R, **European Influenza Surveillance Network** (2021). Very little influenza in the WHO European Region during the 2020/21 season, weeks 40 2020 to 8 2021. *Euro Surveillance* : Bulletin Européen Sur Les Maladies Transmissibles = European Communicable Disease Bulletin, 26(11). <https://doi.org/10.2807/1560-7917.ES.2021.26.11.2100221>

Alba P, Leekitcharoenphon P, Carfora V, Amoroso R, Cordaro G, Di Matteo P, Ianzano A, Iurescia M, Diaconu EL, **ENGAGE-EURL-AR Network Study Group**, Pedersen SK, Guerra B, Hendriksen RS, Franco A, Battisti A (2020). Molecular epidemiology of Salmonella Infantis in Europe: insights into the success of the bacterial host and its parasitic pESI-like megaplasmid. *Microbial Genomics Vol. 6*(5) <https://doi.org/10.1099/mgen.0.000365>

Alm E, Broberg EK, Connor T, Hodcroft EB, Komissarov AB, Maurer-Stroh S, Melidou A, Neher RA, O’Toole A, Pereyaslov D, **WHO European Region sequencing laboratories and GISAIID EpiCoV group** (2020). Geographical and temporal distribution of SARS-CoV-2 clades in the WHO European Region, January to June 2020. *Euro Surveillance* : Bulletin Européen Sur Les Maladies Transmissibles = European Communicable Disease Bulletin, 25(32). <https://doi.org/10.2807/1560-7917.ES.2020.25.32.2001410>

Baldini F, Hertel J, Sandt E, Thinnies CC, Neuberger-Castillo L, Pavelka L, Betsou F, Krüger Thiele R, on behalf of the **NCER-PD Consortium** (2020). Parkinson’s disease-associated alterations of the gut microbiome predict disease-relevant changes in metabolic functions. *BMC Biology*, 18(1), 62. <https://doi.org/10.1186/s12915-020-00775-7>

Berger FK, Mellmann A, von Müller L, Bischoff M, Gärtner BC, German speaking **C. difficile laboratory study group** (2020). Quality assurance for genotyping and resistance testing of Clostridium (Clostridioides) difficile isolates - Experiences from the first inter-laboratory ring trial in four German speaking countries. *Anaerobe*, 61, 102093. <https://doi.org/10.1016/j.anaerobe.2019.102093>

Bortolaia V, Kaas RS, Ruppe E, Roberts MC, Schwarz S, Cattoir V, Philippon A, Allesoe RL, Rebelo AR, Florensa AF, Fagelhauer L, Chakraborty T, Neumann B, Werner G, Bender JK, Stingl K, Nguyen M, Coppens J, Xavier BB, Malhotra-Kumar S, Westh H, Pinholt M, Anjum MF, Duggett NA, Kempf I, Nykäsena S, Otkkola S, Wieczorek K, Amaro A, Clemente L, **Mossong J**, Losch S, **Ragimbeau C**, Lund O, Aarestrup FM (2020). ResFinder 4.0 for predictions of phenotypes from genotypes. *The Journal of Antimicrobial Chemotherapy*. <https://doi.org/10.1093/jac/dkaa345>



Fagherazzi G, Fischer A, Betsou F, Vaillant M, Ernens I, Masi S, **Mossong J**, Staub T, Brault D, Bahlawane C, Rashid MA, Ollert M, Manon Gantenbein M, Huiart ML [2020]. Protocol for a prospective, longitudinal cohort of people with COVID-19 and their household members to study factors associated with disease severity: the Predi-COVID study. *BMJ Open*, 10(11), e041834. <https://doi.org/10.1136/bmjopen-2020-041834>

Höper D, Grützke J, Brinkmann A, **Mossong J**, Matamoros S, Ellis RJ, Deneke C, Tausch SH, Cuestal I, Monzón S, Juliá M, Petersen TN, Hendriksen RS, Pamp SJ, Leijon M, Hakhverdyan M, Walsh AM, Cotter PD, Chandrasekaran L, Tay MYF, Schlundt J, Sala C, De Cesare A, Nitsche A, Beer M, Wylezich C [2020]. Proficiency Testing of Metagenomics-Based Detection of Food-Borne Pathogens Using a Complex Artificial Sequencing Dataset. *Frontiers in Microbiology*, 11, 575377. <https://doi.org/10.3389/fmicb.2020.575377>

**Latsuzbaia A**, **Herold M**, Bertemes JP, **Mossong J** [2020]. Evolving social contact patterns during the COVID-19 crisis in Luxembourg. *PLoS One*, 15(8), e0237128. <https://doi.org/10.1371/journal.pone.0237128>

**Latsuzbaia A**, **Wienecke-Baldacchino A**, **Tapp J**, Arbyn M, Karabegović I, Chen Z, Fischer M, **Mühlschlegel F**, Weyers S, Pesch P, **Mossong, J.** [2020]. Characterization and Diversity of 243 Complete Human Papillomavirus Genomes in Cervical Swabs Using Next Generation Sequencing. *Viruses*, 12(12). <https://doi.org/10.3390/v12121437>

Leitmeyer KC, Espinosa , Broberg EK, Struelens MJ, **ECDC National Focal Points laboratory e-reporting survey group members** [2020]. Automated digital reporting of clinical laboratory information to national public health surveillance systems, results of a EU/EEA survey, 2018. *Euro Surveillance* : Bulletin European Sur Les Maladies Transmissibles = European Communicable Disease Bulletin, 25(39). <https://doi.org/10.2807/1560-7917.ES.2020.25.39.1900591>

Lötsch F, Albiger B, Monnet DL, Struelens MJ, Seifert H, Kohlenberg A, **European Antimicrobial Resistance Genes Surveillance Network (EURGen-Net) carbapenem-resistant Acinetobacter baumannii capacity survey group** [2020]. Epidemiological situation, laboratory capacity and preparedness for carbapenem-resistant *Acinetobacter baumannii* in Europe, 2019. *Euro Surveillance* : Bulletin European Sur Les Maladies Transmissibles = European Communicable Disease Bulletin, 25(45). <https://doi.org/10.2807/1560-7917.ES.2020.25.45.2001735>

Melidou A, Hungnes O, Pereyaslov D, Adlhoch C, Segaloff H, Robesyn E, Pasi Penttinen P, Olsen SJ, **European Region influenza surveillance network** [2020]. Predominance of influenza virus A(H3N2) 3C.2a1b and A(H1N1)pdm09 6B.1A5A genetic subclades in the WHO European Region, 2018–2019. *Vaccine*, 38(35), 5707–5717. <https://doi.org/10.1016/j.vaccine.2020.06.031>

Melidou A, Pereyaslov D, Hungnes O, Prosenk K, Alm E, Adlhoch C, Pebody R, **WHO European Region influenza surveillance network** [2020]. Virological surveillance of influenza viruses in the WHO European Region in 2019/20 - impact of the COVID-19 pandemic. *Euro Surveillance* : Bulletin European Sur Les Maladies Transmissibles = European Communicable Disease Bulletin, 25(46). <https://doi.org/10.2807/1560-7917.ES.2020.25.46.2001822>

Mook P, Meerhoff T, Olsen SJ, Snacken R, Adlhoch C, Pereyaslov D, Broberg EK, Melidou A, Brown C, Penttinen P, Collective of the WHO European Region, **European Influenza Surveillance Network** [2020]. Alternating patterns of seasonal influenza activity in the WHO European Region following the 2009 pandemic, 2010–2018. *Influenza and Other Respiratory Viruses*, 14(2), 150–161. <https://doi.org/10.1111/irv.12703>

Oberweis ML, Codreanu A, Boehm W, Olivier D, Pierron C, Tsoho C, Kohnen M, **Abdelrahman TT**, **Nguyen NT**, Wagner K, de la Fuente Garcia, I [2020]. Pediatric Life-Threatening Coronavirus Disease 2019 With Myocarditis. *The Pediatric Infectious Disease Journal*, 39(7), e147–e149. <https://doi.org/10.1097/INF.0000000000002744>

Pentland DR, Stevens S, Williams L, Baker M, McCall C, Makarovaite V, Balfour A, **Mühlschlegel FA**, Gourlay CW [2020]. Precision Antifungal Treatment Significantly Extends Voice Prosthesis Lifespan in Patients Following Total Laryngectomy. *Frontiers in Microbiology*, 11, 975. <https://doi.org/10.3389/fmicb.2020.00975>

Plachouras D, Lötsch F, Kohlenberg A, Monnet DL, **Candida auris survey collaborative group** [2020]. *Candida auris*: epidemiological situation, laboratory capacity and preparedness in the European Union and European Economic Area\*, January 2018 to May 2019. *Euro Surveillance* : Bulletin European Sur Les Maladies Transmissibles = European Communicable Disease Bulletin, 25(12). <https://doi.org/10.2807/1560-7917.ES.2020.25.12.2000240>

Sala C, Mordhorst H, Grützke J, Brinkmann A, Petersen TN, Poulsen C, Cotter PD, Crispie F, Ellis RJ, Castellani G, Amid C, Hakhverdyan M, Le Guyader S, Manfreda G, **Mossong J**, Nitsche A, **Ragimbeau C**, Schaeffer J, Schlundt J, Tay MYF, Aarestrup FM, Hendriksen RS, Pamp SJ, De Cesare A [2020]. Metagenomics-Based Proficiency Test of Smoked Salmon Spiked with a Mock Community. *Microorganisms*, 8(12). <https://doi.org/10.3390/microorganisms8121861>

Soudeyns C, Speybroeck N, Brisson M, **Mossong J**, **Latsuzbaia A** [2020]. HPV vaccination and sexual behaviour in healthcare seeking young women in Luxembourg. *PeerJ*, 8, e8516. <https://doi.org/10.7717/peerj.8516>

Vargas KG, Tajsic M, **Latsuzbaia A**, Bastian S, Andric T, Kassem M, Jäger B, Huber K [2020]. Gender-based differences of copeptin alone or combined with troponin for early rule-out of non-ST-elevation myocardial infarction. *The American Journal of Emergency Medicine*. <https://doi.org/10.1016/j.ajem.2020.08.053>

## FORENSIC MEDICINE

Barrio P, Gual A, Lligoña A, Teixidor L, Weinmann W, **Yegles M**, Wurst FM [2020]. Phosphatidylethanol for Monitoring Alcohol Use in Liver Transplant Candidates: An Observational Study. *Journal of Clinical Medicine*, 9(9). <https://doi.org/10.3390/jcm9093060>

**Oliverio S**, Varlet V [2020]. “New strategy for carbon monoxide poisoning diagnosis: Carboxyhemoglobin (COHb) vs Total Blood Carbon Monoxide (TBCO).” *Forensic science international* 306: 110063. <https://doi.org/10.1016/j.forsciint.2019.110063>

**Schuff A** [2020]. „Atemalkoholmessung” in: Burhoff/Grün (Hrsg.), *Messungen im Straßenverkehr*; ZAP-Verlag, Deutschland, 5th Edition, pp. 683–693

Webb B, Manninger M, Leoni M, Widek T, Dobrovnik M, Scherr D, Stollberger R, Schwark T [2020]. T2 and T2\* mapping in ex situ porcine myocardium: myocardial intravariability, temporal stability and the effects of complete coronary occlusion. *International Journal of Legal Medicine*, 134(2), 679–690. <https://doi.org/10.1007/s00414-019-02211-0>

Widek T, Genet P, Ehammer T, **Schwark T**, Urschler M, Scheurer E [2021]. Bone age estimation with the Greulich-Pyle atlas using 3T MR images of hand and wrist. *Forensic Science International*, 319, 110654. <https://doi.org/10.1016/j.forsciint.2020.110654>

## HEALTH PROTECTION

Aerts R, Dujardin S, Nemery B, **Van Nieuwenhuyse A**, Van Orshoven J, Aerts JM, Somers B, Hendrickx M, BruffaertsN, Bauwelinck M, Casas L, Demoury C, Plusquin M, Nawrot TS [2020] Residential green space and medication sales for childhood asthma: A longitudinal ecological study in Belgium. *Environ Res*. 189:109914. <https://doi.org/10.1016/j.envres.2020.109914>. Epub 2020 Jul 17. PMID: 32980008.

Aerts R, Nemery B, Bauwelinck M, Trabelsi S, Deboosere P, **Van Nieuwenhuyse A**, Nawrot TS, Casas L [2020] Residential green space, air pollution, socioeconomic deprivation and cardiovascular medication sales in Belgium: A nationwide ecological study. *Sci Total Environ*. 712:136426. <https://doi.org/10.1016/j.scitotenv.2019.136426>. Epub 2020 Jan 7. PMID: 31945528.

Aerts R, Stas M, Vanlessen N, Hendrickx M, Bruffaerts N, Hoebeke L, Dendoncker N, Dujardin S, Saenen ND, **Van Nieuwenhuyse A**, Aerts JM, Van Orshoven J, Nawrot TS, Somers B. [2020] Residential green space and seasonal distress in a cohort of tree pollen allergy patients. *Int J Hyg Environ Health*. 223(1):71–79. <https://doi.org/10.1016/j.ijheh.2019.10.004>. Epub 2019 Oct 15. PMID: 31628039.

Demoury C, De Schutter H, Faes C, Carbonnelle S, Fierens S, Molenberghs G, Van Damme N, Van Bladel L, **Van Nieuwenhuyse A**, Vleminckx C [2020]. Thyroid cancer incidence near nuclear sites in Belgium: An ecological study at small geographical level. *International Journal of Cancer*, 146(11), 3034–3043. <https://doi.org/10.1002/ijc.32796>

De Troeyer K, Bauwelinck M, Aerts R, Profer D, Berckmans J, Delcloo A, Hamdi R., Van Schaebroeck, B, Hooyberghs H, Lauwaet D, Demoury C, **Van Nieuwenhuyse A.** [2020]. Heat related mortality in the two largest Belgian urban areas: A time series analysis. *Environ Res*. 188:109848. <https://doi.org/10.1016/j.envres.2020.109848>. Epub 2020 Jun 25. PMID: 32846640.

Fréry N, Santonen T, Porras S P, Fucic A, Leso V, Bousoumah R, **Duca RC**, El Yamani, Kolossa-Gehring M, Ndaw S, Viegas S, Iavicoli I [2020]. Biomonitoring of occupational exposure to phthalates: A systematic review. *International Journal of Hygiene and Environmental Health*, 229, 113548. <https://doi.org/10.1016/j.ijheh.2020.113548>

Lauwers L, Trabelsi S, Pelgrims I, Bastiaens H, De Clercq E, Guilbert A, Guyot M, Leone M, Nawrot T, **Van Nieuwenhuyse A**, Remmen R, Saenen N, Thomas I, Urban KH [2020]. Environment and mental health: the NAMED project, protocol for a mixed-method study. *BMJ Open*. 10(2):e031963. doi: 10.1136/bmjopen-2019-031963. PMID: 32086354; PMCID: PMC7045166.

Moldovan HR, Wittlich M, John SM, Brans R, Tiplica GS, Salavastru C, Voidazana ST, **Duca RC**, Fugulyan E, Horvath G, Alexa A, Butacu AI [2020]. Exposure to solar UV radiation in outdoor construction workers using personal dosimetry. *Environmental Research*, 181, 108967. <https://doi.org/10.1016/j.envres.2019.108967>

Nagy K, **Duca RC**, Lovas S, Creta M, Scheepers, PTJ, Godderis L, Ádám B [2020]. Systematic review of comparative studies assessing the toxicity of pesticide active ingredients and their product formulations. *Environmental Research*, 181, 108926. <https://doi.org/10.1016/j.envres.2019.108926>

Scheers H, Nawrot TS, Nemery B, De Troeyer K, Callens M, De Smet F, **Van Nieuwenhuyse A**, Casas L [2020]. Antithrombotic medication and endovascular interventions associated with short-term exposure to particulate air pollution: A nationwide case-crossover study. *Environmental Pollution* (Barking, Essex: 1987), 266(Pt 1), 115130.

Scholten B, Kenny L, **Duca RC**, Pronk A, Santonen T, Galea KS, Loh M, Huuonen K, Sleeuwenhoek A, Creta M, Godderis L, Jones K [2020]. Biomonitoring for Occupational Exposure to Diisocyanates: A Systematic Review. *Annals of work exposures and health*, wxaa038. <https://doi.org/10.1093/annweh/wxaa038>

**Schummer C**, Zandonella I, **Van Nieuwenhuyse A**, **Moris G** [2020]. Epimerization of ergot alkaloids in feed. *Heliyon*, 6(6), e04336. <https://doi.org/10.1016/j.heliyon.2020.e04336>

Putzeys E, Vercruyssen C, **Duca RC**, Saha PS, Godderis L, Vanoirbeek J, Peumans M, Van Meerbeek B, Van Landuyt KL [2020]. Monomer release from direct and indirect adhesive restorations: A comparative in vitro study. *Dental Materials: Official Publication of the Academy of Dental Materials*, 36(10), 1275–1281. <https://doi.org/10.1016/j.dental.2020.06.001>

Viegas S, Zare Jeddi M, B Hopf N, Bessems J, Palmen N, S Galea K, Jones K, Kujath P, **Duca RC**, Verhagen H, Santonen T, Pasanen-Kase R [2020] Biomonitoring as an Underused Exposure Assessment Tool in Occupational Safety and Health Context- Challenges and Way Forward. *Int J Environ Res Public Health*. 13; 17(16):5884. doi: 10.3390/ijerph17165884.

Verscheure E, Creta M, Vanoirbeek J, Meziane LZ, Taleb A, Lebegge R, Poels K, **Duca RC\***, Godderis L\* [2020] Environmental contamination and occupational exposure of Algerian hospital workers, *Front. Public Health*, doi: 10.3389/fpubh.2020.00374 [\*shared last authorship]

Vervliet P, De Nys S **Duca RC**, Boonen I, Godderis L, Elskens M, Kirsten L. van Landuyt, Covaci, A. [2020]. Human phase I in vitro liver metabolism of two bisphenolic diglycidyl ethers BADGE and BFDGE. *Toxicology Letters*, 332, 7–13. <https://doi.org/10.1016/j.toxtlet.2020.06.022>

## MEDICAL BIOLOGY

Franková V, Driscoll RO, Jansen ME, Loeber JG, Kožich V, Bonham J, **Borde P**, Brincat I, Cheillan D, Dekkers E, Fingerhut R, Bilandžija Kuš I, Girginoudis P, Groselj U, Hougaard D, Knapková M, La Marca G, Malniece I, Nanu MI, Nennstiel U, Olkhovych N, Oltarzewski M, Pettersen RD, Racz G, Reinson K, Salimbayeva D, Songailiene J, Vilarinho L, Vogazianos M, Zetterström RH, Zeyda M, Members of the European Society of Human Genetics (ESHG)-EuroGentest Quality Sub-Committee [2020]. Regulatory landscape of providing information on newborn screening to parents across Europe. *European Journal of Human Genetics*: EJHG, 29(1), 67–78. <https://doi.org/10.1038/s41431-020-00716-6>



Laboratoire national de santé  
1, rue Louis Rech  
L-3555 Dudelange

T : (+352) 28 100 - 1  
F : (+352) 28 100 - 202  
info@lns.etat.lu

[www.lns.lu](http://www.lns.lu)



Follow us on

