

LODZ CREATES INNOVATION

NEWS MAGAZINE OF THE CITY OF LODZ

NO. 4 (25)/2019

FOSTERING INNOVATION

●
**DRUG DELIVERY TO THE BRAIN.
IS THIS POSSIBLE?**

●
**LIFE SCIENCE
— MEETING AT THE SUMMIT**

●
**ILLUSTRATIONS, BOOKS, APPS
— ŁADNE HALO IS NICE WHICHEVER
WAY YOU LOOK AT IT!**

●
NOT ONLY TO MEDICINAL WATERS

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ANNA KRAWCZYK
EDITOR-IN-CHIEF

New technologies are the driving force behind the development of life science and healthcare industries. The use of micro-robots and micro-devices has become a daily occurrence in medicine. Although the gap between us and Western European countries, the United States or Israel is still large, several years ago a noticeable change in the approach to financing such projects in Poland has been introduced. Two Venture Capital funds have already been established in the Lodz area and their total capitalization is over PLN 100 million.

The EU-MED Summit conference, dedicated to the development of the life science industry, has several years of tradition in Israel, but this year its organizers decided to move this event to Lodz. The city of Lodz is a strategic partner of the conference, which will take place on 24–25 September and involve the participation of investors, representatives of global companies and start-ups from the life science industry.

Hanna Zdanowska, President of Lodz, discusses why investing in Lodz is a good idea in the interview opening this issue. Her statement is complemented by Marek Cieślak, President of Bionanopark in Lodz, an institution that was founded just seven years ago and is currently thriving. Thanks to the qualified scientific personnel and modern equipment, it is able to conduct scientific research on its own. Furthermore, its functions include an entrepreneurship incubator for the fields of medicine, biotechnology, IT, and even design. At the moment, the new challenge ahead of Bionanopark is to acquire investors.

And while we're talking about healthcare, we should pay attention to the research projects under way at Lodz universities. One of them is "NanoTENDO: The transfer of nanoparticles through the endothelial barrier." The method developed by the team of scientists from the University of Lodz will enable us to administer medicine directly into the brain, which might turn out to be a breakthrough in the treatment of e.g. Alzheimer's or Parkinson's disease.

In addition, a team of scientists from the Laboratory of Laser Molecular Spectroscopy (LLSM) of the Lodz University of Technology has been working on innovative methods of cancer diagnostics and guidance during oncological operations. The project will lead to detecting cancer and determining the degree of its malignancy in as little as two minutes.

But that's not everything Lodz universities succeeded at. The Department of Knitting at the Faculty of Material Technologies and Textile Design of the Lodz University of Technology with Tricomed S.A., a manufacturer of medical products, created Optomesh® ULTRALIGHT, a non-resorbable, ultra-light surgical mesh. It is manufactured by knitting transparent and blue monofilament polypropylene yarns, and has been successfully used in the treatment of various kinds of hernias.

We can't possibly list all of the topics we discuss in this issue, which is why we encourage you to read the magazine and, of course, participate in the EU-MED Summit conference. Registration is open until 20 September! ●

Photo: Paweł Lawreszduk



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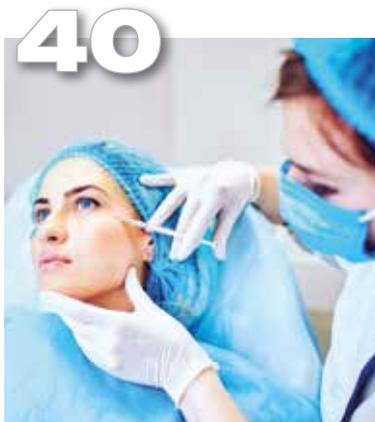
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Ładne Halo (Nice Halo) is a creative studio specialising in illustrations for books, press and advertising, as well as designing applications, publications and visual identification

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PUBLISHER

Business Development and International Relations Bureau
Mayor's Department
City of Lodz
al. Politechniki 32, 93-590 Lodz
tel.: +42 638 59 39
fax: +42 638 59 40
e-mail: boi@uml.lodz.pl



REALISATION

INFRAMEDIA Anna Krawczyk



ul. Konstruktorska 10c/25, 02-673 Warsaw
tel.: +48 22 821 0 777
e-mail: biuro@inframedia.pl
www.inframedia.pl

EDITOR-IN-CHIEF

Anna Krawczyk
a.krawczyk@inframedia.pl

JOURNALISTS

Malwina Wadas
redakcja@inframedia.pl
Katarzyna Józwick
k.jozwick@inframedia.pl
Marzena Zbierska
m.zbierska@inframedia.pl

EDITING AND PROOF-READING

Katarzyna Olędzka
sekretarz@inframedia.pl

TRANSLATION

ATET Euro-Tłumacze Sp. z o.o.

PHOTOGRAPHER

Paweł Ławreszuk

LAYOUT & DESIGN

Joanna Bialecka-Rybacka – Green Flow

COVER

Inoculation of microbiological samples in an anaerobic chamber at the Industrial Biotechnology Laboratory in Bionanapark
Photo: Bionanopark

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Fostering innovation

Lodz creates innovation not only in promotional slogans, but most of all in reality. This is demonstrated by the prestigious EU-MED Summit biotechnology conference, of which Lodz is a strategic partner.

The conference will serve as a meeting place for leaders of the international life science sector: investors, corporations, start-ups, universities and government representatives. We decided that preparations for it would be a good moment to talk to **HANNA ZDANOWSKA**, President of Lodz, and **MAREK CIEŚLAK**, President of Bionanopark.

The development of any enterprise hinges on introducing innovations, while in the case of SMEs this can be a condition of their survival. Looking at how Lodz is developing, it also seems that it's the cornerstone for building and reinforcing its potential. Could you please tell us about this?

Hanna Zdanowska: Innovations come about when they encounter a favourable environment.

○ **Hanna Zdanowska: In addition to our proud traditions, we're also eyeing new industries**

As the city's president, I feel it's my job to create an ecosystem that facilitates their development.

What actions is the city taking to achieve this and what are still planned?

HZ: Younger and younger citizens of Lodz are showing their entrepreneurial spirit, as the ever-growing interest in the "Youth in Lodz - I've Got a Start-Up Idea" competition clearly shows. The jury, made up of representatives of the business community and of the leading universities in Lodz, is constantly surprised by innovative projects. Meanwhile, during the competition the participants can take advantage of a number of training sessions, networking classes and, which they highly praise, mentoring.



We launched the Art_Inkubator, an institution supporting the development of creative entrepreneurs in the Art Factory. More residents are being recruited at this very moment. It's worth underlining that this is where the world-famous Lodz Design Festival or the completely new MODOPOLIS initiative, addressed to fashion designers, are held. This is wonderful, because it emphasises the city's roots in the textile industry.

However, in addition to our proud traditions, we're also eyeing new industries. That's why Bionanopark was created. The combination of science and business is a tremendous success of this place.

○ Marek Cieślak: We've become a point on the map of Lodz, the entire country even, one where people, companies and projects related to biotechnology appear

What makes these sectors – business and science – particularly important to you?

HZ: We want universities to closely monitor the market's educational needs, as this allows them to meet them head on. I believe that this is happening

– close co-operation with the business community is leading to new university courses. At the same time, universities are becoming increasingly better as partners in commercial projects or even their initiators.

Bionanopark is one of the places you mentioned. Where does its potential lie?

HZ: Undoubtedly, this is a space we can all be proud of. Bionanopark serves as the foundation of an industry cluster with global potential. It's both an incubator for domestic biotechnology companies and a magnet for investments by large companies operating in this field. Innovative industries, such as those that draw on the potential of combining business with science, occupy a key place in the city's development plans. Bionanopark is proof of those plans becoming a reality.

Marek Cieślak: We work with universities in Lodz, mostly with the Lodz University of Technology, due to the park's nature, but also with the University of Lodz and the Medical University. We're a good proving ground for joint research projects efforts, ideas related to the implementation of various types of projects, as well as other activities that combine business and science. This potential stems from the fact that we not only have a business base and modern spaces, but also well-educated,

committed academic staff – several professors, 25 doctors, over 20 PhD students.

Bionanopark was opened in 2012. How is it different today compared to seven years ago?

MC: Things have changed quite a bit in Bionanopark since then. Our extensive offer comprises three areas. The first is the incubator and the over 140 companies that have passed through it. Currently, it houses nearly 50 start-ups from the IT industry, biotechnology, as well as from related and other fields. The second consists of laboratories with specialised scientists and cutting-edge equipment. The third, which I hope will become more visible soon, are investment areas. We've reached an advanced stage of talks with companies that have decided to locate with us, leading to the creation of a biotechnology hub. We've become a point on the map of Lodz, the entire country even, one where people, companies and projects related to biotechnology appear. A lot has changed, but the most important thing remains – Bionanopark combines the potential of business with that of science.

In retrospect, do you see these changes as evolutionary or revolutionary in nature? Or perhaps there are some landmark events you can distinguish?

MC: For years Bionanopark's development has been evolutionary. However, the moment the investment was completed was our biggest breakthrough. It was then that we took a completely different perspective of what's happening on the market. We decided that our key task is to reconcile commercial operations with activities related to collaboration with universities or research projects. It all started with an incubator, then there was an incubator and two laboratories, and today there are seven such laboratories, and we're still developing.

We're talking on the eve of the EU-MED Summit biotechnology conference, of which Lodz is a partner. Is it really noticeable on the map of the country that Lodz is an important hub for this industry, also through the operations of Bionanopark?

MC: Lodz, but also the entire voivodeship, has for some time been really specialising in broadly understood medical-related activities in biomedicine and the bioeconomy. The number of companies in the pharmaceutical and cosmetic industries, the products and innovations from these industries, they all show that this is the right direction. It's in Lodz and its surroundings where leaders on the Polish and European scale operate.

Additionally, universities with a strong presence in this area, mostly the Medical University and the Lodz University of Technology, serve as a natural base for these companies. It seems that a platform connecting science and business, one in line with what has been happening in Lodz and the voivodeship for years, reflects the right trends for development.

Madam President, the fact that this conference is being organised serves as a confirmation of how much Lodz is involved in the development of new technologies...

HZ: Until now, the EU-MED Summit conference had been organised in Israel, while today the largest investors, corporations and start-ups in the healthcare, pharmacy and biotechnology industries are focusing on Lodz. For the first time – and hopefully not the last – the city will be a meeting place for leaders of the international life science sector, with representatives of local governments and government administration at the forefront. The start-up ecosystem in Lodz is booming, with the healthcare and biotechnology industries constantly growing. There's a need to organise a space, where members of these industries can share their stories and experiences, so we meet them half-way.

What other goals are behind the organisation of this event?

HZ: The EU-MED Summit conference aims to present the latest innovations and trends shaping the future of healthcare and life science (including medical devices, digital health, pharma), promote start-ups to attract foreign investment, as well as create opportunities for networking between different categories of participants. Such networks of technology start-ups and representatives of science and business are very important – they result not only in individual, innovative projects, but also in the development of the economy as a whole.

It's impossible not to notice the promotional potential of this event for the city.

HZ: This prestigious event is obviously not an end in and of itself, but part of a consistent pursuit of an image of Lodz as a city strong through innovations and new technologies. Organising the EU-MED Summit is very important to me – it's a great opportunity to promote Lodz as an open place that supports the life science industry and innovations.

Thank you for your time. ●

BY AGATA DOMAŃSKA

A healthy person in a healthy body

We want to be healthy. We know that our well-being is largely in our hands. That's good and bad. Good, because there's a lot that we can do ourselves that actually has an impact on our own health and well-being. Bad, because when we fall ill, we feel a certain kind of odium: "He didn't take care of himself and here's the result."

In one of his sketches, Michał Kempa, a satirist and stand-up comedy master, introduces himself as a man born in 1648, so very old. When asked how he managed to live so long, he replies: "I run a lot and eat kale. Oh, and I toe strike while running, not heel strike – and that's the key." This seems like a joke at first sight, but not entirely, because this "recipe" for longevity boils down to what we already know – when it comes to health and associated longevity, environmental factors get you three-quarters of the way there. Scientists believe that our longevity, health and good physical condition, without which a satisfying existence is impossible, is 60 percent down to diet. Our lifestyle (e.g. amount and quality of movement) accounts for the next 20 percent, while only 20 percent is due to genes. What's more, some genetic predispositions to certain diseases can be overcome... through diet and lifestyle.

Even 10 years ago, if someone asked for soymilk for their coffee in a café, they were accused of decadence, snobbery, or eccentricity in the best-case scenario. Now, vegetable drinks are everywhere and servers in cafés ask what kind of milk the customer wants with their coffee. The soy latte has become a symbol of a hipster lifestyle, but it's really something more. It's a trend where people say: "I don't eat and don't drink what isn't good for me, and I choose what benefits me", which is based on a desire to put health first. It includes numerous "sub-trends", such as giving up dishes with gluten, removing dairy products from one's diet, regular drinking of green tea or introducing products lauded by nutritionists into one's diet (e.g. kale). Another important trend is to give up meat. The WHO refreshes its recommended food pyramid from time to time and keeps

moving meat higher – to products that should be eaten less often. Young, well-being-oriented people are increasingly often complying with these recommendations. Even though Polish statistics are lacking in this respect, Australian or German studies, for example, show a clear, year-on-year increase of several percent in the number of people switching to vegetarianism. According to current scientific knowledge, such a diet is associated with a lower risk of diseases, such as: colorectal cancer, heart and vascular disease, type 2 diabetes, hypertension and even depression (although in the last case the relationship is not so clear). And since giving up meat is not exactly easy for people brought up in a meat-eating culture, a new approach to diets was born, the so-called flexitarianism. Flexitarians are people who eat vegetarian dishes a few days a week, but they devour steak or fish when they feel like it. And that's great, because every day without meat is like walking up a flight of stairs – every step up and every day without meat extend one's life by a few seconds.

However, it's worth noting that every fashion should be tailored to a person's needs. For example, going gluten-free is fashionable, but gluten, even though it does real harm to some people, is completely harmless to others. Despite the fact that foregoing grain-based dishes might be good for the figure, a gluten-free diet also forces one to discard whole grain products and that's not so good. The healthiest diet is based on a large amount of vegetables, a slightly smaller amount of fruit, some whole grain products, a few eggs and occasionally fish. The key here is not to find one recipe, but to maintain a healthy variety. ●



Zeta potential of nanogold particles studied by Zetasizer NanoS90, Malvern

BY MARZENA ZBIERSKA

Drug delivery to the brain. Is this possible?

A team of scientists from the University of Lodz is working on a method of delivering drugs directly to the brain. The “NanoTENDO: Transfer of nanoparticles through the endothelial barrier” research project will be implemented together with partners from Latvia and Spain. If successful, this may lead to a breakthrough in treating various diseases, including Alzheimer's and Parkinson's.

The project received funding under the M-ERA.NET network's competition, which provides financial support for research in the field of material sciences and material engineering. A total of 166 projects competed and 27 of them were selected for implementation (the total funding amounts to EUR 18.2 million), including four projects with Poles as participants. One of them is the NanoTENDO project coordinated by Professor Maria Bryszewska, head of the Department of General Biophysics at the University of Lodz. The researchers from

Lodz received EUR 151 thousand in co-financing, with over EUR 600 thousand allocated to the entire project. It should be underlined that this is the first project to be led entirely by a Polish research team since the National Science Centre started participating in competitions under the M-ERA.NET network.

BREACHING THE BLOOD-BRAIN BARRIER

“Controlled drug delivery to the brain still remains a challenge in the effective treatment of neurodegenerative diseases and this is due

to the presence of the endothelial barrier”, explains Prof. Maria Bryszewska, coordinator of the NanoTENDO project. “The endothelial barrier is an important part of the body, as it surrounds our vessels and protects the body's tissues from unwanted guests, such as micro-organisms and toxic substances. However, the fact that it recognises all substances as undesirable causes difficulties in the treatment of many serious brain diseases, including Alzheimer's and Parkinson's.”

Alzheimer's disease is one of the most common causes of dementia and the incidence of dementia increases as society ages. It is a neurodegenerative disease that leads to many disorders, especially in terms of memory and behaviour. Parkinson's disease is also a common problem for people over 50. Despite numerous studies on the underlying causes for neurodegenerative diseases, there is no effective treatment, while diagnosis and treatment are still difficult.

The project aims to develop nano-systems based on dendrimers, dendrons or gold nanoparticles, which are able to overcome the endothelial barrier, i.e. the blood-brain barrier, which should result in the delivery of therapeutic substances to the brain. Dendrimers are polymers that have a structure similar to a tree crown, to which drugs, or short nucleic acids that are increasingly used in therapy, can be attached. Dendrons are fragments of dendrimers that attach to their core molecule during synthesis. Meanwhile, gold nanoparticles themselves demonstrate antibacterial action.

Teams from Poland, Latvia and Spain will be cooperating on the project, with each group of researchers responsible for another stage. What will the Polish scientists' task be?

“Our research will focus on the nanoparticles that we receive from the Spanish team. Our task will be to prepare a biophysical specification of these particles, as well as to investigate whether they are toxic, whether they can bind with drugs, e.g. short nucleic acids used more and more often in therapies, whether they form relatively stable compounds with them and whether they are capable of penetrating cells. To test this, we will perform studies on the transport of various nanoparticles through a model endothelial barrier,” explains Prof. Maria Bryszewska. “We will also prepare compounds of nanoparticles with drugs and nucleic acids to study their penetration through this barrier and to identify factors facilitating this process. In addition, we will examine the transport of nanoparticle-drug compounds through the endothelial barrier in Alzheimer's disease,



From the left: D.Sc. Katarzyna Milowska, associate professor UL; Dr. Elzbieta Pedziwiatr-Werbicka; D.Sc. Maksim Ionov, associate professor UL; Prof. Maria Bryszewska, Head of the Department of General Biophysics UL

using a model barrier characteristic of pathological conditions for this purpose.”

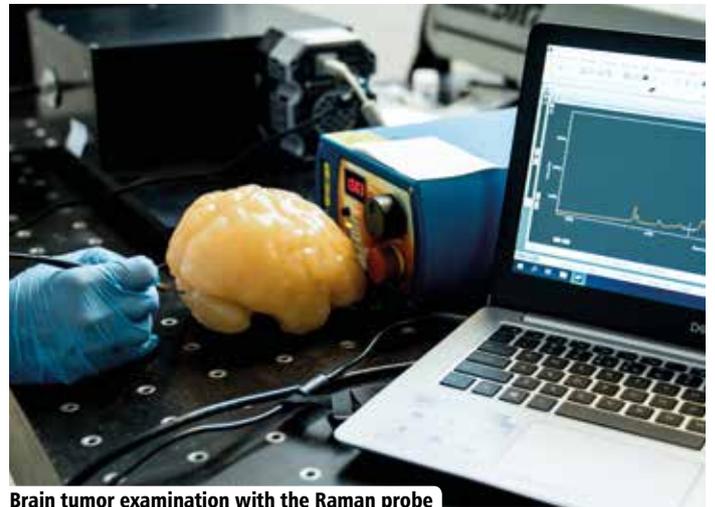
IN VIVO TESTING WITH MICE

Spanish researchers from the University of Alcalá de Henares specialising in the synthesis of carboxylic dendrimers, among other substances and particles, are tasked with providing nanoparticles for testing. Meanwhile, scientists from the Polish laboratory will check whether the nanostructures are non-toxic and able to form a compound with the drugs, and then deliver it to the brain by passing through the endothelial barrier. At this stage of the project in vitro tests, i.e. tests performed outside a body, will be conducted. Subsequently, in vivo studies, i.e. ones on live animals, are planned, but this next phase of the project will be carried out by Latvian scientists from Rīga Stradiņš University and from the Latvian Biomedical Research and Study Centre. For this purpose, they will use mice with laboratory-induced diseases, e.g. Alzheimer's or Parkinson's. This will allow them to check whether the effects in a living organism will be similar to those obtained by the Polish research team. The project's success will lead to more possibilities of treating neurodegenerative diseases. The developed solutions could then be used in a wider scope, not only in relation to one specific disease, but in all those where damage to the endothelium barrier occurs, i.e. in ischemic strokes.

Research under the NanoTENDO project is to be concluded in 2022. ●

BY MARZENA ZBIERSKA

Detecting cancer in a few minutes?



Brain tumor examination with the Raman probe

A team of scientists from the Laboratory of Laser Molecular Spectroscopy (LLSM) of the Lodz University of Technology has developed innovative methods of cancer diagnostics and guidance during oncological operations. The possibilities of the new techniques include detecting cancer and determining the degree of its malignancy in as little as two minutes.

The scientists from LLSM have developed techniques that enable oncologists to obtain objective and accurate examination results in real time and to conduct operations in a way that eliminates the risk of relapse while saving the healthy organ, as far as this is possible. Three methods are the subject of the innovation: virtual histopathological Raman imaging, optical biopsy by Raman scattering and intraoperative Raman guidance. All these innovations are based on Raman light scattering.

INSTANT DIAGNOSIS

“Virtual histopathology is a tissue examination that allows for determining the presence of pathological lesions without the need to stain tissues with hematoxylin and eosin or to dissect them, as is the case during a traditional histopathological examination,” explains Professor Halina Abramczyk, the Head of LLSM. “Traditional histopathology is a procedure that takes quite a long time. In practice, the waiting time for the result is about two weeks. The method we have developed is based on the measurement of Raman scattered light and the creation of an image that allows us to identify pathological lesions in tissues. It takes about two minutes to create the image. The result obtained is much more precise and fully objective,

because it does not depend on the interpretation of a more or less experienced histopathologist.”

This method can be used for the histopathological analysis of tissues collected e.g. during surgery. The virtual Raman image is reliable and very quick to perform, which is why it can be used during surgical procedures.

“Tissue can be collected and examined during surgery. Once the image is created, it is possible to provide the doctor with information about the nature of the lesion in a very short time,” adds Professor Halina Abramczyk.

Another innovation is an optical biopsy, which involves illuminating tissue with suspected neoplastic lesions with laser light using a fiber-optic probe and analysing the Raman spectrum produced in a matter of seconds as a tissue response. During a traditional biopsy the material is collected with a needle, while during the optical biopsy the needle is used only for puncturing the pathological lesion, but the material is not collected. This means that more punctures can be made and, as a result, the risk of removing tissue from the wrong place – which may lead to a false result – can be eliminated.

GUIDED SURGERY

Intraoperative Raman guidance is another tool based on the Raman radiation effect that can be used during surgeries.

“Within seconds and without the need to collect tissue samples, this method provides the doctor with information on where the safety margin is, i.e. how much tissue to remove in order to avoid the risk of cancer relapse but at the same time preserve the healthy tissue. This is important e.g. in breast cancer, where the aesthetic aspect matters. Breast-conserving surgery is a priority all over the world. Similarly, in the case of brain tumours, the safety margin is also of great significance because of the risk of potential damage to other tissues,” says Professor Halina Abramczyk.

IN VIVO BIOPSY ON HUMANS

The LLSM researchers have studied four types of cancer: located in the breast, head and neck, brain and gastrointestinal tract. The research was performed on human tissues collected during surgeries, so the cooperation with hospitals was crucial.

“We are the first scientific entity in Europe to perform an optical biopsy and Raman guidance on a rat's brain in vivo, i.e. in physiological conditions on a living animal. In the next stage we plan to perform an in vivo biopsy on humans, and in this respect we have a chance to become pioneers in Europe,” concludes the Head of LLSM.

Intraoperative Raman guidance was used during a recent procedure performed in Canada. It was the first such case. The scientists from Lodz are planning to perform an operation using Raman guidance on humans in the near future. If everything goes according to plan, it will happen within a year. And the Polish researchers may be the first in Poland and Europe to have accomplished this. What else has been achieved?

“We have calibration curves showing the degree of malignancy for two pathologies: breast cancer and brain cancer, mainly gliomas,” says Professor Halina Abramczyk.

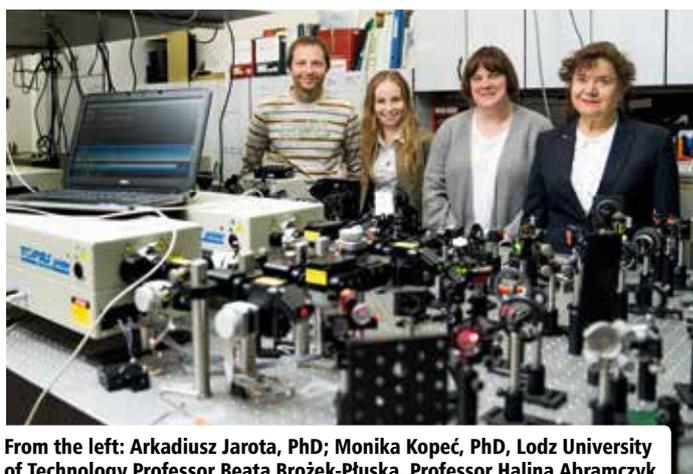
“Thanks to the developed tools we are not only able to distinguish between healthy and affected tissue within seconds, but we can also determine the degree of cancer malignancy on the basis of Raman biomarkers. A complete picture of pathological lesions is obtained within a few minutes.”

This is a revolution in oncology that will allow for faster diagnostics and more precise surgeries, which is particularly important in the case of brain tumours. Another benefit of using innovative methods

developed by the laboratory is the follow-up of responses to treatment.

“During cancer therapy it is possible to check whether the drug is working properly and where it accumulates,” explains the head of the team. Raman optical biopsy can also be used in cancer prevention.

“Optical biopsy on the skin can be performed non-invasively in preventive medical examinations. This technique can also be used in screening tests as part of breast cancer prevention,” says Professor Halina Abramczyk. “After a lesion is detected in an ultrasound or mammography, optical biopsy makes it possible to determine the type of cancer without having to collect any material.”



From the left: Arkadiusz Jarota, PhD; Monika Kopeć, PhD, Lodz University of Technology Professor Beata Brożek-Pluska, Professor Halina Abramczyk

Cancer prevention also involves blood analysis for cancer markers.

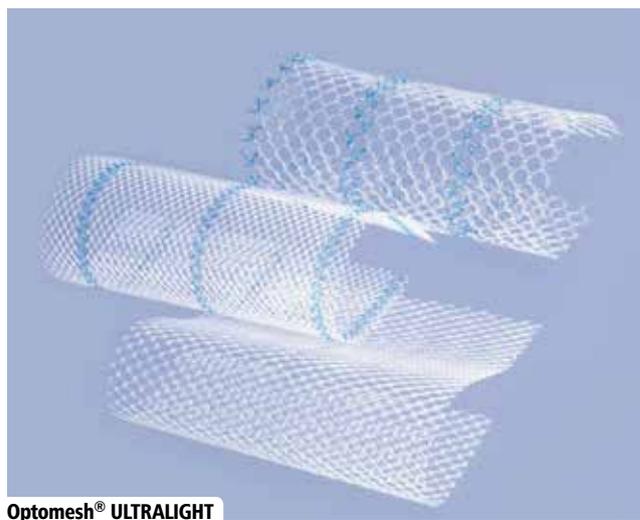
“We are conducting very intense research on blood to be able to use the Raman light scattering method in our laboratory tests. This is possible and we have already carried out the first experiments, but we still don't have a sufficient number of samples. If the research is successful, it will be possible to determine very important cancer markers during blood tests,” explains Professor Halina Abramczyk.

She points out that the newly-developed technologies are not expensive, which means they will be widely available to hospitals and diagnostic centres. In addition, they are completely safe for patients.

The popularisation of methods of fast cancer diagnostics in Poland is a matter of several years, but there is a growing interest in the commercialisation of the developed techniques already today. The main goal of the scientists from Lodz is to introduce a new quality in cancer diagnostics that will benefit both patients and doctors. ●

BY KATARZYNA JÓZWIK

Thread back to health



Optomesh® ULTRALIGHT

People usually associate knit materials with clothing. Hardly anyone realises that this technique can be used to manufacture high quality medical products. Optomesh® ULTRALIGHT is a perfect example of this – a non-resorbable, ultra-light surgical mesh, manufactured by knitting transparent and blue monofilament polypropylene yarns. For several years now, it has been successfully used in the treatment of various kinds of hernias.

It was created through co-operation between the Department of Knitting at the Faculty of Material Technologies and Textile Design of the Lodz University of Technology with Tricomed S.A., a manufacturer of medical products.

CO-OPERATION OF KNITTING EXPERTS

The co-operation between Tricomed S.A. and the Lodz University of Technology in developing ultra-modern surgical nets is by no means coincidental. The company is deeply rooted in the knitting tradition and has been combining the textile and medical industries for 60 years. Meanwhile, the Textile Faculty of the Lodz University of Technology was the only faculty providing education in this field at the time of the company's establishment – Tricomed S.A.'s founders are also its graduates. The interconnectedness of both of these entities resulted not only in transfers of knowledge within the discipline, but also continued research co-operation. Tricomed S.A. commissioned the University to develop several variants of knit materials for the production of advanced, ultra-light mesh implants used in herniology.

“The Knitting Department of the Technical University of Lodz undertook to develop weaves and create variants of knitted fabrics from supplied medical grade yarn in accordance with a given specification,” explains Witold Sujka, PhD, Eng., President of Tricomed S.A.'s management board. “The University's task was also to scale up the manufacturing technology for knitted fabrics to an industrial

scale. The project lasted approx. 5 years and has enabled us to develop a third-generation product that stands out in terms of physical-mechanical, as well as functional parameters.”

SURGICAL PRECISION

Since the offered meshes are used in hernia surgery, they must meet stringent safety standards, especially since Optomesh® ULTRALIGHT is used in reconstructive procedures to strengthen the physical and mechanical parameters of soft tissues.

“The meshes developed by our team are made from new, original weaves of thin, medical-grade polypropylene yarn,” explains Professor Zbigniew Mikołajczyk, head of the Knitting Department at the Lodz University of Technology. “This makes it possible to fashion the mesh into a small roll and implant it during a laparoscopic procedure without invasive surgery.”

As further emphasised by the manufacturer of these ultralight surgical meshes, the major advantage of the product is its high strength regardless of the passage of time and the influence of surrounding tissues.

“Synthetic, knitted, porous mesh implants overgrow with connective tissue during healing. The non-resorbable polymers used in Optomesh® ULTRALIGHT show a high resistance to the biologically active environment, so their properties remain unchanged,” Witold Sujka, PhD, Eng. explains.

For these reasons, the material used to manufacture Optomesh® ULTRALIGHT meshes was not chosen by accident – it was a conscious decision made based on experience and a series of tests. Among their other characteristics, non-resorbable synthetic polymers assure the stability of their material parameters, adequate physical-mechanical and chemical quality of the biomaterial, easy sterilisation and no propensity to cause allergic, irritant and cytotoxic reactions or effects.

“One of the arguments in favour of using polypropylene meshes is the fact that the implant



Professor Zbigniew Mikołajczyk, head of the Knitting Department at the Lodz University of Technology

does not become contaminated and procedures using meshes are considered the gold standard in hernia surgery,” adds Tricomed S.A.'s president.

PUT IN THE LACE WORK

The secret behind the success of the surgical meshes manufactured by the company from Lodz is the technology used in their manufacturing. Carefully chosen raw materials, meticulously selected weave and knitting parameters, as well as stabilisation and further treatments have resulted in a knitted fabric with the sought after properties.

“The use of knitting has allowed for the creation of openwork structures demonstrating robust stability,” explains Professor Zbigniew Mikołajczyk. “At the same time, this type of structure is not only light, but first and foremost flexible and durable, which allows it to support tissues in surgical hernia procedures.”

Optomesh® ULTRALIGHT mesh is manufactured using monofilament polypropylene yarns in two colours – transparent and blue. The use of coloured yarns makes it possible to create orienting lines, which results in the product's greater visibility in the surgical area.

“Thanks to our meshes' optimal physical-mechanical properties they are suitable for various types of hernias, from small to large, with the use of various surgical techniques,” Witold Sujka, PhD, Eng. underlines. “The extremely thin yarns and the type of weave ensure that the implants have atraumatic edges. All meshes can be cut easily during surgery, without the need for specialised tools.”

The manufacturer offers three variants of the product, which not only feature different physical-mechanical parameters, but also mesh eye sizes and yarn diameters.



Witold Sujka, PhD, Eng., President of Tricomed S.A.

OPEN ROAD TO INNOVATION

The R&D teams from the Lodz University of Technology and Tricomed S.A. agree that the Optomesh® ULTRALIGHT surgical meshes are only the start and research on further innovative knitting products for medical use will follow.

“We currently have knowledge that allows us to develop mesh variants that would revolutionise the medical market. Unfortunately, the inadequate technical level of our laboratories is the barrier here,” Professor Zbigniew Mikołajczyk regrettably observes.

As he underlines, Polish researchers are able to develop a product that could be fully tailored to an individual patient's needs. He also admits that the commercial implementation of the third generation of surgical meshes is a significant success for science, especially as the product is distributed both domestically and abroad.

“Optomesh® and Optomesh® ULTRALIGHT meshes are currently sold in: Germany, Romania, Russia, Greece, Bosnia and Herzegovina, the Czech Republic, Hungary, Lithuania, Latvia and Ukraine. Efforts are ongoing to register these medical products in other markets,” Witold Sujka, PhD, Eng. reveals. ●

BY MARZENA ZBIERSKA

Life science – meeting at the summit

On 24–25 September, the 2019 EU-MED Summit conference will attract investors, representatives of global life science companies and start-ups to Lodz. It will be a perfect opportunity to discuss current trends, challenges of modern medicine, and to establish contacts between scientists, investors and representatives of local governments. Thanks to the support of companies that implement innovation and develop biotechnology, Lodz became the Polish capital of life science.

The life science industry is based on the fields of science that directly impact living organisms, in particular humans; novel solutions are designed to extend human life and make it more comfortable. They primarily include innovations used in medicine and pharmacy, e.g. new drugs, modern equipment and diagnostic methods.

TECHNOLOGY SHAPES TRENDS

The most important trends of life science are those that are based on the use of robotics, IT technology and biotechnology. Global tendencies in modern medicine have another dimension as well: new technologies allow us to diagnose and treat diseases more efficiently, and to move some of these activities to the patient's home, without the need for hospitalization. Not only does such an attempt reduce the costs of operation of often overfilled hospitals, but also – in the case of several illnesses – improve the effectiveness of therapy and the comfort of living of people who can spend more time at home without worrying about a lack of control over their health.

“It has been proven multiple times that people convalesce better when at home,” says Marek Gajewski, member of the management board of Poland Biomed Ventures, CEO Summit Technology. “Nowadays, technology supports caring for sick people who return home after hospitalization, and older people who can be monitored remotely in their daily lives.”

Using remote devices, it's possible to measure a patient's vitals non-invasively, and to continuously submit data in real time to their guardian or physician.

“This is a great breakthrough and an opportunity for a new quality in healthcare,” emphasizes Adam Broncel, managing partner at the Biomed Innovations fund.

“To achieve this, we use various small sensors that do not encumber the patient while providing a continuous stream of information about their health, beginning with basic vitals such as: body temperature, blood pressure, heart rate, physical activity, and ending with more complex ones, like a ECG, continuous glucose level monitoring, and sleep apnoea.

Monitoring methods for certain vitals (e.g. heart rate) during training have been known in sports for a long time. Today, similar solutions have been introduced to medicine and enable us to e.g. measure the blood glucose level and thus automatically dose appropriate medicine.

“I know a technology that can detect an exacerbation of disease in patients suffering from depression, based on the analysis of their voice and speed of performing certain actions,” adds Adam Broncel.

Sensors that monitor specific parameters can be placed in objects of everyday use, including: clothes, mattresses, chairs, or even mirrors, that can identify the patient's state based on e.g. the motion of



From the left: Adam Broncel, Marek Gajewski

retinas. The use of micro-robots and micro-devices for diagnostic purposes and treatment is the next step with respect to medical devices.

“The use of new technologies in diagnostics and treatment is related to the possibility of device miniaturization. This is another pronounced trend,” says Marek Gajewski. “There are companies that specialize in making nanobots injected into the bloodstream or cerebrospinal fluid. These are fully autonomous devices that can perform complicated tasks inside a human body. They are remotely controlled and more precise than traditional methods, less invasive and safe for the patient. These solutions are already being applied in e.g. cardiac surgery and neurosurgery.

On the other hand, IT technologies enable further innovations. We now have an electronic medical records system on the market, which replaces paper-based archives. With it, physicians can quickly gain access to necessary information and tests, and thus make a more accurate diagnosis and begin treatment. These new directions also involve mobile apps for physicians that facilitate finding the latest treatment algorithm for a specific disease entity and determining the action plan.

TO CATCH GLOBAL LEADERS

Specialists emphasize that the market of modern medical technologies has been substantially underfinanced over the years in Poland, and if innovations did appear, they were not sufficiently developed.

“Significant changes have occurred in Poland concerning the approach to financing life science innovations for the past several years,” states Marek Gajewski. “The gap between us and Israel, the United States or Western European countries is still large, but we have been attempting to close this distance. Poland does not yet have as many significant implementations as other European countries, but we have been observing a very rapid growth in this field.”

Two Venture Capital funds with a total capitalization of over PLN 100 million have been established in the Lodz area. They support the business of Polish as well as international start-ups. Proper financing is the key factor of development. Nonetheless, experts jointly agree that the provision of a proper research & development infrastructure to start-ups, access to offices and media, and promotional support, especially with respect to establishing contacts in order to facilitate the flow of knowledge and technology, are equally as important. Therefore, one of the methods to achieve this goal is to organise

a global conference. The 2019 EU-MED Summit will be the first event of its type in Poland. Similar meetings have been taking place for a dozen or so years in Israel, attracting several thousand participants.

The conference in Poland is intended to become just as prestigious and turn Lodz into the Silicon Valley of the life science industry.

The fact that the 2019 EU-MED Summit conference is a consequence of the prior cooperation between Polish and Israeli life science entities, the effect of which are joint research projects, is also of significance. Now is the time to create a forum for exchanging experiences, information, discuss development directions and challenges for companies. Lodz is meant to become a place where the most important people in venture capital and experienced industry researchers meet. The city stands out due to many factors: the high level of development of biotechnology companies, research and scientific infrastructure, as well as location.

“The authorities of Lodz have approached this idea with great kindness and offered us comprehensive support,” says Adam Broncel. “This helped us jointly prepare the first edition of the conference, engage many people and create a world-class event.”

THE FIRST EDITION OF THE 2019 EU-MED SUMMIT

The programme of the 2019 EU-MED Summit primarily involves speeches and panel discussions; however, the conference will also constitute an opportunity to establish direct business contacts.

“We will present the latest global trends in the life science industry and encourage the audience to actively participate in the discussion,” says Adam Broncel.

● THEMATIC SCOPE OF THE 2019 EU-MED SUMMIT:

- Tomorrow's Healthcare – Where are We Headed in the Next Decade?
- What Do Investors Look For? Challenges and Opportunities in HealthCare and Digital Medicine
- Digital Health as a National Strategy How to Protect Sensitive Data
- The Hospitals' Role in Healthcare Innovation
- Effective Ways of Funding Your Startup
- The Future of Pharma – An Overview of Innovative Biotech Companies
- Robots in the Service of Healthcare
- The Green is Here: Medical Cannabis – A New Player on the Market
- Government Offers for Innovation Support



Mateusz Sipa, Deputy Director of the Economic Development and International Cooperation Bureau at the City of Lodz Office.

“The city of Lodz has been supporting the economic development of the region, including the life science industry, by using multiple tools and projects aimed at various recipient groups. We execute a range of programmes and promotional actions, including with respect to employer branding, promoting local companies as reliable employers, and building their brand on the local labour market. We also execute the programme ‘Youth in Lodz – I’ve Got a Start-Up Idea,’ which supports the professional development of innovators and encourages them to associate their future with the city. Biotechnology companies are very important to us. One of the region’s smart specializations is ‘Medicine, pharmacy, cosmetics,’ and biotechnology is one of key technologies for the development of the province. This part of the market has a great potential for development and provides high-quality jobs, thus guaranteeing stable employment under good conditions.

“We want to show the entire community of Polish biotechnology start-ups what investors look for, and how to present a specific idea in order to have a chance at finding funding in the future. On the other hand, we want to present young domestic companies to investors, along with their ideas and knowledge, and Lodz’s research & development potential, of which we should be proud.

Adam Broncel emphasizes that there are excellent R&D teams in Lodz, as well as high-class laboratories that can successfully be used in breakthrough international projects. Therefore, the conference will also constitute an opportunity to present support programmes for biotechnology projects, at both local and regional levels, financed by local governments, and at the domestic level.

“Public funds significantly assist the development of the life science industry,” admits Adam Broncel. “We express a great gratitude for this support, although we also implore the administrators of

The biotechnology industry in Lodz is very strong and local companies can successfully compete with the West even now, while in the future they will have a chance to conquer the global market. This is why we want biotechnology companies to also take advantage of their intended tools and support. I am referring here to the flagship R&D infrastructure project – the Bionanopark. On the one hand, it’s a laboratory park where research teams work; on the other hand, it’s also an incubator for young companies that can reach the stage of mature organisations therein.

This year, a Eurofins Scientific project was launched in the Bionanopark. They are a global leader in laboratory tests who will build microbiology and chemistry laboratories with logistics and infrastructural support. We want to create a biotechnology hub in its place together with this investor and other similar companies.

An important part of this ecosystem of Lodz are universities, including the Medical University of Lodz and the Lodz University of Technology. We can be proud of the universities that are among the best in the country with respect to this sector, while constituting a driving force behind the entire life science industry, both concerning the education of personnel and the creation of conditions for the development of start-ups and the commercialization of prepared technologies. This is largely thanks to university authorities and the personnel responsible for the cooperation between scientists and businesses.

The city of Lodz is a strategic partner of the 2019 EU-MED Summit conference, which is intended as an event promoting local biotechnology companies. We hope that entrusting the organisation of the event to the Kenes Group, i.e. a global leader in the event industry, will make the 2019 EU-MED Summit a high-class conference. Perhaps it will become a regular event and establish the recognisability of Lodz around the world.”

these funds to be open to changes and consider their rate of change, which is very high in this industry. We also hope that the Lodz city authorities will enable the development of the EU-MED Summit and support the subsequent editions of the conference. We would like to create a multi-year international event, like in Israel, that will attract numerous participants from around the world to Lodz.

But that’s not all with respect to the local government. Adam Broncel sees many more tasks for city authorities here, which have already been successfully executed in Lodz.

“The local government is, in my opinion, a catalyst for change that will connect two environments of the life science industry: the academic world and existing private companies, while working as an incubator for biotechnology start-ups,” adds Adam Broncel. “This role of the city is priceless.” ●



BY MARZENA ZBIERSKA

Technologies change the world of medicine

Exal Bone, from the left: Kamil Chrzan, Mateusz Siwak, Łukasz Piotrowski

Start-ups from the life science industry require significant funds and time to get running, develop and win over the market. However, this doesn't discourage researchers or investors, and new ideas are still being hatched in the quiet of laboratories and doctors' offices. Is the world going to hear about them?

Ideas for innovative medical solutions usually come from life itself – medical practice combined with patients' needs and experiences. When competences in cutting-edge technologies are added to the mix, only one result is possible: a start-up. Launching such a micro-company is just the beginning though. Obtaining financing and creating an effective business model are the real challenges. There's no shortage of start-ups from the life science industry in Lodz that have already taken the first steps on the road to an international career.

BROKEN BONE? DRESSING INSTEAD OF PLASTER

Exal Bone from Lodz developed a new generation of orthopaedic immobilising dressing, which just might bring about a true revolution for patients with fractures and injuries.

“Thanks to its properties, the Exal Bone dressing can be used on a fresh injury (instead of an uncomfortable plaster) and up to the last stage of treatment, when expensive orthoses are often used,” explains Doctor Mateusz Siwak, CEO. “The lightness, water resistance, ergonomics and the fact that the dressings don't cause itching during use are the biggest advantages for patients. Their openwork structure assures ventilation of the skin's surface, which reduces the risk of skin irritation that would be burdensome for the patient.”

For therapeutic reasons, it's important that skin can be observed directly in the area of the injury, the dressing can be re-plasticised and refitted in line with the clinical indications.

“We're currently working on a quality management infrastructure and the base for a certification process,” informs Doctor Siwak. “At the same time, following input from



Neuromedical, Adam Broncel



Arazim Polska, Agnieszka Jarecka

doctors and orthopaedic technicians, we're improving the use ergonomics to provide patients and medical staff with the best possible solutions to the everyday problems.”

Once development work on Exal Bone finishes, the clinical trial necessary for certification in line with the latest regulations will begin. When the dressing receives a CE certificate, it will be made available on the largest European Union markets. Next, Exal Bone's creators plan to develop another version of the product that would shorten the recovery period and speed up the treatment process for patients.

CURING ALZHEIMER'S DURING SLEEP

Another advanced and multidisciplinary research project is being conducted by Lodz-based company Neuromedical, which was founded in 2014 by an international team of experts in neurology, neurophysiology, psychiatry and medical engineering, including: Adam Broncel, MD, PhD, Tamir Ben David, PhD, Prof. Jan Konopacki, Prof. Piotr Gałeczki, Agnieszka Jarecka, MA and Prof. Elinor Ben-Menachem.

Since 2017, the company has been carrying out research and development work on VGuard, a medical device for non-invasive brain stimulation to help patients with Alzheimer's disease and cognitive disorders.

“We're currently preparing for the start of clinical trials,” says Adam Broncel, MD, PhD. “We obtained very promising results in animal studies and preliminary human studies carried out using functional magnetic resonance, and that

convinced investors to start the next research stage. At the same time, we're securing financing to introduce the product on the American market in the future.

VGuard is a device for stimulating the vagus nerve in patients with mild cognitive impairment symptoms, including memory disorders occurring in the course of Alzheimer's disease. It consists of a stimulating mechanism developed by the Neuromedical company, which uses low-level electrical impulses that reach structures of the brain responsible for memory consolidation.

“Mild electro-stimulation of the vagus nerve aids the consolidation process for recent memory, which is disrupted in the case of patients in the initial stage of Alzheimer's disease,” explains Adam Broncel, MD, PhD. “Work on designing the VGuard device started with the promising results obtained during pilot clinical trials on a group of dementia patients carried out by Prof. Elinor Ben-Menachem and experience in the use of tVNS, a vagus nerve stimulation method used in the treatment of drug-resistant epilepsy and depression.”

There is currently no effective method of treating cognitive disorders in the course of Alzheimer's disease and VGuard could change this. It's non-invasive, which means there is no need for surgical intervention to place the stimulator unit in the patient's chest (the current method for treating drug-resistant epilepsy requires surgery). This allows for the remote monitoring of stimulation parameters, e.g. using mobile devices, and is small, simple and convenient in use.



3Clicks, Sławomir Chomik

FEELING THE PICTURE. AN ALTERNATIVE TO BRAILLE

The scientists who established Arazim Polska have taken up the challenge to facilitate communication for the blind. Their goal is to develop an innovative technology – a touch tablet that would allow the sense of touch to be used not only to read, but also to feel graphics. This is a good example of how science seeks to find solutions to market needs.

“In our modern world, most communication channels are supported by digital technologies,” notes Agnieszka Jarecka, CFO of Arazim Polska. “However, due to limitations of the ones we use currently, much of the information that reaches healthy people remains unavailable or difficult to access for the blind. And we're talking about approximately 300 million people worldwide.”

As Agnieszka Jarecka underlines, the most popular solutions for transposing digital text into Braille (Braille displays) have many limitations: they're expensive (the cost is USD 2.5-8 thousand), they're not mobile devices, like a tablet, as they need to be connected to a desktop or laptop computer. In addition to this, they “display” only one line of text each time, which is a significant difficulty for users, and sometimes makes it impossible to “read ahead”. Braille displays have no facility for conveying graphical information, such as: charts, graphs, diagrams, plans, icons or buttons.

“We plan to create a tactile tablet, which would use a dense grid of taxels (mobile pins named for ‘tactile pixels’) to display more lines of text and graphics. It will be possible to create

a “bas-relief” that can be felt with the fingers and understood,” explains Agnieszka Jarecka.

APPLICATION AS A DOCTOR'S ASSISTANT

3Clicks employs IT technologies in the development of innovative solutions for doctors. The company was founded in 2016 and has since then introduced 18 applications targeted at doctors, nurses and patients. The 3Clicks digital platform is a universal wizard for a new generation of mobile applications and is a response to the challenges faced by Poland's healthcare system. These are, in particular, growing health care costs, an ageing population, increasing expectations of beneficiaries and needs regarding the quality of medical services.

“The 3Clicks digital platform can be used to create mobile applications for iOS, Android, as well as a version adapted to Microsoft's system. They're addressed to the main health market stakeholders, i.e. doctors, nurses and, to a limited extent, patients,” explains Sławomir Chomik, MD, PhD, President of the 3Clicks Management Board. “Each mobile application is created for an individual therapeutic discipline, e.g. cardiology (hypertension), oncology (cancer of the kidney or large intestine) or antibiotic therapy in infectious diseases, and contains key information supporting (but not replacing) the diagnostic and treatment process. This information includes simple algorithms, diagnostic scales, short information on drug doses or guidelines of scientific societies.”

Thanks to their simple and practical nature, 3Clicks' applications facilitate the medical assessment process in a situation where access to the necessary knowledge is difficult to reach, e.g. at the patient's bedside or during a home visit. The information can even be viewed offline, in the event the local Wi-Fi network is out of reach.

3Clicks' applications allow the doctor not only to speed up the diagnostic process, but also to implement appropriate treatment for the patient, based on current knowledge of reimbursed drugs, in a quicker manner. The business model assumes free and unlimited access for users, with the project being financed through sponsors. They're limited to advertising space in designated areas of the application and have no influence on the content. According to the collected data, over 10 thousand doctors in Poland were using 3Clicks' applications at the end of June 2019. Therefore, the creators plan to adapt and implement them in other European countries. ●

BY MARZENA ZBIERSKA

Universities activate start-ups

Innovative solutions in the life science industry are created in places where specialists from various fields and many different countries cooperate together and experience comprehensive business support. Such a combination enables us to build and develop the start-up ecosystem. In Lodz, young technology companies are being supported by universities that have their trusted methods.

The most active universities in the city that operate to the benefit of young life science companies are the Medical University and the Lodz University of Technology. Both of these universities stand out because they conduct ground-breaking research, offer high-quality education, and support the entrepreneurship of researchers, graduate and postgraduate students. Lodz universities have been developing a range of initiatives so that everyone can receive support in the execution of their enterprise.

BROKERS OF INNOVATION

“We believe that innovation is born in interdisciplinary teams that are in close contact with the economic environment and participate in international cooperation. This strategy has been adopted by the Lodz University of Technology, which has been applying it continuously,” states Grzegorz Kierner, director of the Centre for Cooperation with Innovation Economy and Technology Transfer of the Lodz University of Technology.

There are innovation brokers at all departments of the university, supporting scientists with interesting business ideas.

“They are intermediaries responsible for establishing cooperation between the scientific community and the economic environment,” explains Grzegorz Kierner. “On the other hand, the Entrepreneurship Incubator organises regular workshops and meetings with entrepreneurs. The Lodz University of Technology intends to acquire the status of a research facility and plans to create a fund supporting the international protection of inventions and spin-off and spin-out companies in the first stage of operation. The university has many industry-leading partners in Poland and abroad, with whom it has

been developing and implementing new solutions and technologies. Our scientists are also participating in ground-breaking scientific projects which involve centres around the world. We are talking here, among others, about cooperation with the European Organization for Nuclear Research (CERN) and the Large Hadron Collider, or the participation in the experimental thermonuclear reactor project (ITER), i.e. the construction of an artificial sun.”

As the first university in Poland, the Lodz University of Technology has founded a special purpose vehicle to establish spin-offs and perform direct commercialisation of inventions.

“We are present on the forum of the Polish Association of Centres for Technology Transfer, thanks to which our scientists have access



Grzegorz Kierner, Lodz University of Technology



Honorata Boczkowska, Medical University of Lodz

to the academy of clinical research, meetings with fund representatives, interesting training courses, exhibitions and fairs, and the invention selection system for the needs of international companies,” lists Grzegorz Kierner.

According to the director of the CCIETT, there has been a rapid growth of the start-up system in Poland recently. A range of EU funds has appeared, supporting inventors in their pursuit of success in their own business.

“The University has been co-organising the ‘Youth in Lodz – I’ve Got a Start-Up Idea’ competition with the City of Lodz Office since its inception,” adds Grzegorz Kierner. “This is the second year we’ve been responsible for its mentor programme and connecting project groups with professional mentors. I believe this is the best competition of its kind in Poland. This system has made it easier to complete a team to found a company, obtain funding for business development, and earn the proverbial first million.”

EXCHANGE OF EXPERIENCE AND KNOWLEDGE

The Medical University has been supporting young innovation leaders primarily as part of building the economic ecosystem, including the start-up space at the Knowledge and Innovation Zone of the Business Incubator. Young companies have the opportunity to lease office

spaces, virtual spaces and laboratories, access to specialists and infrastructure of three teaching hospitals.

“We’re also offering the support of acceleration programmes of the European Institute of Innovation & Technology (EIT Health) for teams at various levels of development. From teams with an idea to teams with a prototype, participation in ‘InnoStars Award’ and ‘European Health Catapult’ competitions where start-ups can acquire funds for development. As well as in boot camps during which young entrepreneurs obtain knowledge about product validation and the opportunity to enter European markets,” says Honorata Boczkowska, entrepreneurship specialist at the special purpose vehicle of the Medical University of Lodz; she also emphasizes that the development of innovation in medicine is a difficult and often complex process. “In order to successfully implement new solutions, we need numerous specialists from different innovation clusters. The development of the start-up ecosystem enables us to exchange both experience and knowledge. This facilitates a continuous evaluation of solutions in order to make them respond to market needs as well as possible, because the bigger the ecosystem, the greater the chances for implementation and profit for young innovators, and for start-ups this means

broad access to specialists and an opportunity to exchange services, materials and experiences.

STEM CELLS FROM A BIOREACTOR

Akrimtech is a biotechnology start-up which began its operation in early 2019, originating at the Lodz University of Technology. The company manufactures high-performance Steemore bioreactors for culturing stem cells. What is their role in medicine?

“Mesenchymal stem cells (MSCs) have the properties of multipotent progenitor cells. Their primary advantage is the ability to differentiate into bone, cartilage, fat and connective tissue of organs, as well as into the bone marrow stroma for hematopoietic cells,” explains Robert Adamski, President of Akrimtech. “MSCs also have the ability to modulate functions of the immune system. They can be obtained from foetal tissue (umbilical cord, cord blood, placenta) and a wide range of locations in the adult body, of which the most practical are bone marrow and fat tissue.”

Mesenchymal stem cells are currently commonly used in regenerative medicine. MSC preparation can be used in diseases for which there is no other contemporary treatment or it's ineffective, especially in autoimmune diseases, e.g. in multiple sclerosis, non-specific inflammatory

bowel disease, leukaemia, lymphoma. However, a positive effect can be achieved only if we have a large number of these cells.

“Our goal is to streamline the process of culturing stem cells by using the Steemore bioreactor,” adds Robert Adamski. “Its use will result in increased culture performance and bacteriological safety; it will decrease labour intensity and material intensity of the culturing process and thus reduce costs in comparison to the current technology. By using the bioreactor as a closed circuit, it will be possible to reduce the risk of contaminating the stem cell preparation that is present during production.”

Akrimtech already has a prototype which will be subject to a series of verification tests next year at three independent bodies in Poland. Furthermore, the team will launch a process of acquiring a certificate in accordance with the requirements of the Tissue and Cell Bank, and obtain the permit of the Chief Pharmaceutical Inspector for the use of the Steemore bioreactor, which will enable the team to move to the development phase and implement the new solution in production.

TREATMENT WITHOUT SIDE EFFECTS

Receptor Pharma Poland is an example of the efficient operation of the Medical University under one of the EIT Health financing programmes. The company was founded as a result of cooperation between a team from Sweden and the Medical University of Lodz. Its founders, Dr Stefan Broselid and Zacharia Ressaissi founded the company with specialists from Lodz: Dr Marcin Mitał and Przemysław Nowakowski.

As a result, the Receptor Pharma Poland team decided to create a drug based on original molecules intended to treat Alzheimer's disease, which significantly reduces the quality of life of the patient and their environment. The data indicates that nearly half of the population aged 80+ can suffer from various types of dementia.

“This is a serious issue from the point of view of public health, especially in the light of the problem of the ageing population of Europe, the United States and other highly developed regions of the world,” mentions Dr Marcin Mitał. “Of note is the fact that there hasn't been any new effective method of treating Alzheimer's for 20 years.”



Robert Adamski, Akrimtech



Marcin Mitał, Receptor Pharma Poland

The primary task of Receptor Pharma Poland is to test the drug in preclinical trials (in vitro and animal studies), as well as to commence clinical trials, i.e. test the studied molecule on first patients.

“The solution itself is an innovative approach to halting the disease’s emergence process at the molecular level of the cell, and it’s the result of the Swedish team’s research. Our approach will lead to the creation of a new class of low-molecular-weight γ -secretase modulators. Thanks to the discovery of a new signalling pathway, we hope to develop a molecule that will not cause serious side effects that have been so far the obstacle in previous works on similar molecules,” explains Dr Marcin Mitał.

The start-up is operating in the pharmaceutical industry and thus requires significant funding and is searching for sponsors. The current research works are being performed thanks to small grants.

SYSTEM ESTIMATES THE RISK OF DISEASE

Is it possible to identify patients at risk of heart diseases who are hospitalised due to a different reason, e.g. broken arm or stomach pain? Typically, they don’t know their circulatory system should be tested. Can programmers solve this problem? As it turns out, yes. **HD Platform**, founded at the Medical University of Lodz, has been working on innovative hospital software.



Andrzej Sobecki, HD Platform

“We are focusing on creating specialised software using machine learning techniques to support the process of making medical decisions,” explains Andrzej Sobecki of HD Platform. “We created a platform supporting the analysis of medical data concerning patients with or at risk of heart disease. It can make predictions and estimate the risk of atrial fibrillation or myocardial infarction. The classification is made on various detail levels using text descriptions concerning patients, metadata, and results of a physical examination.

An additional advantage of the platform is the ability to quickly search for patients that meet various criteria, including synonyms of medical concepts used with respect to patients at risk of heart disease. The software is currently in the prototype stage, i.e. algorithms, classifiers and data processing services are being developed.

“We have a user interface for the available functions but we lack system implementation automation tools and the option to define alarms for given patient filtering rules. Those are our targets for the coming months,” plans Andrzej Sobecki.

This isn’t the end of the challenges, and these aren’t the only novel ideas. The list of start-ups originating in Lodz academic communities is longer. All of them are highly innovative, think globally and have an original business model. •



BY MARZENA ZBIERSKA

The medicine of tomorrow: new technologies or a return to nature?

New protein sources for the food industry, modern biosimilars and therapies using natural methods, e.g. medicinal leeches or bacteriophages, are just some directions of development in the life science industry. Lodz companies have been running projects in these areas.

Regardless of whether research projects and innovative businesses are being run by market leaders or SMEs, their goal is common: to improve human quality of life and protect the environment. They are the answer to the challenges of the modern world such as diseases of civilization, climate warming and loss of agricultural land.



BIOSIMILARS: CHEAPER AND EFFECTIVE

Mabion is the first Polish biotechnology company whose primary goal is to develop, produce and market oncological biosimilars. What does this category mean? Biosimilars are preparations that are very similar to the existing original biotechnological medicine (the so-called reference medicine). They are less expensive but just as effective and safe, which has to be proven by the manufacturer before obtaining a marketing authorization.

The company's current priority project is the global release of MabionCD20, a biosimilar containing rituximab, which is an active substance with oncological and autoimmune use.



The company's flagship product is MabionCD20 - the drug is currently at the final stage of the registration in the European Union

This product is in the final stage of registration in the European Union. The company has been also running other projects, e.g. research on MabionMS and MabionEGFR. The former medicine contains rituximab, but it's intended for the treatment of multiple sclerosis. It's an innovative therapy because no such indication has been identified for rituximab yet. On the other hand, MabionEGFR is an oncological drug containing cetuximab, which is intended for the treatment of patients with metastasized colon cancer.

The company's strategy also stipulates new projects involving autoimmune, metabolic disorders and oncological medicine.

"We have a strong and experienced team with all the required competences to develop new products. After analysing the key factors, we arrived at the conclusion that we're ready operationally, financially and with respect to HR to launch new projects this year," says Sławomir Jaros, PhD (Eng.), member of the Mabion Management Board.

Biosimilars is a rapidly growing field of the global pharmaceutical industry with huge potential. According to the market research published in March 2018 by Infoholic Research, the global market of biosimilars will reach a compound annual growth rate of 57 percent in 2018–2024 and a total value of USD 99.3 billion in 2024. On the other hand, the Research and Markets' report published in January 2019 states that this market will reach a compound annual growth rate of 45.6 percent in 2017–2024.



FEED HUMANKIND, SAVE ENVIRONMENT

Developing a globally innovative technology of manufacturing protein isolates using oilseed and pea family seeds – primarily rapeseed – is the task of **NapiFeryn BioTech**, a company that has been executing this plan since October 2016. The total value of the project is PLN 16.1 million, and EU financing amounts to PLN 11 million.

The technology developed by the company enables us to obtain valuable and functional proteins from rapeseed oil pressing residues.

"Our technology is better than the current methods of manufacturing soy proteins because this is based on solutions that are newer, safer, and resulting in a higher-quality product



From the left: Piotr Wnukowski and Magdalena Kozłowska, NapiFeryn BioTech

than those commonly used to manufacture soy proteins," says Magdalena Kozłowska, co-founder and President of NapiFeryn BioTech. "This process does not require harmful hexane, and conditions in which rapeseed proteins are isolated do not damage (denature) it, which makes it functional."

This discovery is ground-breaking because it answers one of the largest civilizational challenges, i.e. feeding more people without intensifying processes that are detrimental to the environment, such as climate warming, deforestation and desertification of soil, which are currently priority issues for the Food and Agriculture Organization of the United Nations.

"Soon there will be no soil suitable for grazing and feed production on Earth. We are currently using 60 percent of agricultural land for these purposes," notes Piotr Wnukowski, co-founder and Vice President of NapiFeryn BioTech. "Furthermore, meat production is a large waste of calories. We need over 4 kg of feed to obtain 1 kg of pork and over 7 kg of feed to obtain 1 kg of beef."

Another important issue is the fact that animal husbandry has a negative impact on the environment, increasing – among others – emissions of greenhouse gases to a greater degree than transport; it leads to water pollution (sewage from pigsties and cowsheds) and soil degradation (desertification of pastures and fields due to overgrazing and overexploitation). It also requires the constant use of antibiotics, which are being used several times more often than antibiotics used to protect the human population.

According to specialists from NapiFeryn BioTech, rapeseed is a Polish speciality, and local food production is an important condition for sustainable and environmentally friendly agriculture.

“Rapeseed is widely cultivated in Poland, which eliminates the need for transporting it over thousands of kilometres and negative effects of using resources from other countries, such as deforestation or soil degradation,” adds Piotr Wnukowski.

NapiFeryn BioTech is a developer of protein production technology, i.e. know-how. The company does not plan to produce protein isolates or finished food but intends to create a licensable technology. Protein isolates will be used by oil processing plants and food manufacturers as food ingredients, which will constitute a great opportunity for them to expand their product offer. During its first stage of development, the company will focus on the Polish market, but its plans also involve expanding to other countries where large-scale cultivation of rapeseed is common. In Europe, this will mainly include: France, Germany, the United Kingdom, and globally – China, India, the US, Canada and Australia.

The construction of NapiFeryn BioTech’s pilot processing line is almost nearing its end. If everything goes according to plan, rapeseed proteins will be available on the market in late 2021 or early 2022. Until this time, the process will be adapted to industrial conditions, i.e. it will enable us to build the first industrial installation in Poland for the commercial manufacture of rapeseed proteins.



PILOT PRODUCTION AT THE PILOT PLANT

One of the largest pharmaceutical companies operating on the Polish market with 100 percent Polish capital owns a manufacturing plant near Lodz. We are talking about **Adamed**, which was founded on the basis of Polish scientific thought and owns over 190 registered patents. The company employs 2.2 thousand people and manufactures 580 products, which are being exported to 70 countries worldwide. It also has 9 international offices, including in: Spain, Russia, Vietnam, Kazakhstan, Uzbekistan, the Czech Republic, Ukraine, Slovakia, as well as the newly established branch in Italy.

Adamed has also two production plants in Poland and one in Vietnam, as well as R&D infrastructure that enables it to conduct a nearly complete preclinical evaluation of a potential new medicine candidate. Its portfolio of medicines under development includes several dozens of molecules.

What sets Adamed apart? The company works on original medicine in two therapeutic fields: oncology and CNS disorders. They are completely innovative drugs. Furthermore, the majority of medicine produced by Adamed are those with added value, having their own patented forms or routes of administration and innovative formulation and technologies that enable the company to e.g. manufacture tablets containing several active ingredients. These are also innovative products. According to the definition of the Organisation for Economic Co-operation and Development (OECD), innovative drugs cover both new molecules and products that are substantially improved compared to the original medicine. Improvement can mean e.g. a new route of administration or elimination of preservatives from formulation.

In April 2018, Adamed launched its Pilot Plant in Pabianice near Lodz, which constitutes a pilot production area. It enables the company to conduct efficient R&D works on medicinal products. The Pilot Plant was created in order to respond quicker and more accurately to the patient’s needs and challenges of modern medicine, thus improving medicine safety in Poland.



Adamed, Pilot Plant station in Pabianice

For many years Adamed has been growing not just in relation to the domestic market, but also foreign expansion. The company has been consistently reinforcing its position worldwide, in particular in EU and Asian countries.

Moreover, in 2018 the Company was listed in the prestigious report “1000 Companies to Inspire Europe,” prepared by the London Stock Exchange. The report focuses on growing and top dynamic SMEs in Europe with great significance for future economic growth, innovation and job creation. This year, the company also received an award at the Emerging Europe Awards in the category “Global Market Champion of the Year 2019,” where prizes are awarded each year by the London think tank Emerging Europe. They are given to enterprises that contribute to the further development of Central and South-Eastern Europe as a region with the highest socio-economic potential.



DISEASES OF CIVILIZATION ARE A CHALLENGE

The development of products based on the analysis of patient needs and an offer that answers the health challenges of the modern world are **Aflofarm's** strengths. For many years, the company has been implementing new therapeutic solutions adapted to patient needs and intensively expanding its offer on foreign markets. At present, the company's products are available in 30 countries around the world. The list of the company's flagship products includes innovative products that arrived first on the market, such as: Neosine, featuring the highest dosage on the market, and the paediatric form of the Diohespan Max syrup, which is the first product on the market containing 1000 mg of diosmin, and Desmoxan, the first cystine-containing capsules. According to Aflofarm, the availability of OTC Desmoxan and a broad advertisement campaign contributed to the cessation of smoking by 0.5 million people in 2013–2014. Research indicates that since 2005, cytisine has helped treat 2.6 million people, i.e. approx. 30 percent of smokers. Other well-known brands from the company's portfolio include: Opokan, Inventum and Herbapect. As far as prescription medicine goes, Cetix is particularly worthy of



Aflofarm products can be purchased in 30 countries around the world

attention, as it is the only oral third-generation cephalosporin on the Polish market; Sulovas is the first biological medicine in the company's offer, and Neosine Duo and Kidofen Duo are innovative combinations of active ingredients in a single product.

Aflofarm is a Polish family company that has been operating in the health protection sector for 30 years. It produces medicine, medical devices, dietary supplements and cosmetics. It's one of the leading pharmaceutical companies on the Polish market.

The key direction of its R&D works is toward medicinal products available by prescription and without a prescription (OTC).

The main assumption in the development of prescription products is treatment of the most common diseases of civilization and working on introducing products that contain substances that have not yet been available in Poland (e.g. new biological medicine). Aflofarm has been very successful in the field of paediatrics and dermatology, and its next venture is cardiology.

As far as OTC products go, the company has been manufacturing novel combinations of safe substances that assist in treating symptoms of disease entities in the most important therapeutic groups.

One of the company's strategic goals is foreign expansion. So far, Aflofarm's role involved acquiring foreign distributors for its products on offer. Thanks to this strategy, the company's products are already available in 30 countries worldwide, including in: Europe, Asia, the US and the Middle East.

At present, the company has been individually establishing organizational structures abroad and supporting the recognisability and position of its brands on foreign markets.

Aflofarm has recently been investing in the increase of manufacturing capabilities, among others, with respect to the production of medicine and cosmetics. As part of the project, it plans to expand the plants in Ksawerów and Pabianice near Lodz, as well as to build a central warehouse. The modernisation of these sites will primarily involve expanding the factory area in order to house new production and laboratory facilities. The total value of outlays is approx. PLN 120 million.

This project is the answer to the company's ambitious development plans for the Polish and foreign markets. At the moment Aflofarm owns four production plants: in Pabianice, Ksawerów, Rzgów and Kraków. The latter joined the company in early 2019 as a result of a merger with Kraków's Scan Anida, a manufacturer of medicinal products and natural cosmetics.



BACTERIOPHAGES INSTEAD OF ANTIBIOTICS

Is it possible to prevent bacterial diseases in breeding animals and limit the amount of used antibiotics? Limiting antibiotic therapy

in the farming of poultry, cattle and fish is an important step toward healthy nutrition for people whose daily diet includes meat, milk and eggs. It turns out that bacteriophages can be helpful, i.e. viruses that selectively eliminate specific bacteria.

The **Proteon Pharmaceuticals** biotechnology company is one of the top global companies that use bacteriophages on an industrial scale. It developed and has been producing a new generation of natural antibacterial products constituting an alternative to antibiotic therapies intended for livestock healthcare. The company has globally unique solutions: from the development of bacteriophage products, through commencement and running scientific research as part of its own R&D centre, commercial testing and production of solutions, to marketing, sales and distribution.

The company's flagship products include BAFASAL[®], a feed additive used in poultry farming that prevents Salmonella infections, and BAFADOR[®], used in fish farming to eliminate two most common pathogens contributing to the fish mortality rate. The company has been also working on new products for the poultry and fish industry, as well as on solutions intended for pigs and cattle.

One of the company's current R&D projects involves poultry farming safety. The team at Proteon Pharmaceuticals developed a new preparation based on bacteriophages in order to comprehensively protect chickens against E. coli infections (Avian Pathogenic Escherichia coli). The role of bacteriophages in this preparation is to fight existing APEC E. coli bacteria, and the additional presence of bacteria reducing emissions of ammonia improves the conditions of the environment in which the animals live. The reduction of ammonia is primarily intended to protect the birds' respiratory system from potential infection and improve the parameters of air emitted during the rearing process. The project involves the development of a diagnostic method enabling a quick differentiation between APEC (Avian Pathogenic Escherichia coli) poultry pathogens and commensal bacteria, along with specifying the level of pathogenicity. Both endeavours are supposed to constitute an integrated system of diagnostics and prevention of pathogenic E. coli infections in poultry flocks.



Bafador and Bafasal – flagship products of Proteon Pharmaceuticals

The purpose of another project conducted for poultry farmers is to develop a range of products for the comprehensive protection of animals from *Camphylobacter* infections in all stages of development, beginning with rearing, through slaughter, cutting and ending with packaging the meat.

Proteon Pharmaceuticals is also working on a product that will solve a problem that cow farmers must face. Scientists have been developing a bacteriophage preparation that is active against pathogens causing mastitis. A successful fight with this disease using antibiotics is often prevented by infections of antibiotic-resistant bacteria. However, this is not an obstacle for bacteriophages, which remain effective even in such conditions.



THEY BREED A MILLION LEECHES PER YEAR

Bio-Gen has been operating the only medicinal leech biofarm in Poland, and one of the largest in Europe. It has been breeding three species: *Hirudo medicinalis*, *Hirudo verbana* and *Hirudo orientalis*. The farm operates under laboratory conditions, which guarantees that there is no risk of complications. Leeches bred at Bio-Gen are being sold to hirudotherapy centres and hospitals.

“The list of hirudotherapy indications is very long,” says Artur Kanicki, Managing Director of Bio-Gen's medical biofarm. “Leeches are underappreciated in cases of post-surgery convalescence involving limb replantation and thrombosis, where difficulties in blood flow prevent e.g. transporting intravenously administered medicine. Moreover, the list includes a wide range of circulatory system diseases, e.g. lowering cholesterol level, stabilization of blood pressure and reduction of migraine headaches. We can also list locomotor system diseases such as joint inflammation, osteoarthritis, rheumatism and traumatic haematoma. With respect to neurology, great effects are noted in the treatment of e.g. hypertensive encephalopathy, Alzheimer's and Parkinson's diseases, facial nerve and trigeminal neuralgia, or paresis and compression syndromes of peripheral nerves. There is also a range of gynaecological, ophthalmological, gastrointestinal and respiratory system diseases.



The only Polish medicinal leeches biofarm and one of the largest such farms in Europe is owned by Bio-Gen

Hirudotherapy is a rapidly growing field and I'm certain that the list of indications will expand every year.

Medicinal leech therapy is a medical procedure listed in the ICD-9 International Classification of Medical Procedures under No. 99.991, other nonoperative procedures, which means it requires a professional approach. People working in hirudotherapy must have appropriate qualifications and obtain the title of hirudotherapist. In 2004, medicinal leeches (*Hirudo medicinalis*) were authorised for medical sales and deemed a medicinal product.

Artur Kanicki admits that the growing interest in this method of therapy has been noticeable for a while now.

“Patients who are not satisfied with conventional treatment and still suffer from their condition often ask us to direct them to a hirudotherapy office,” adds Artur Kanicki. “Despite there being a lot of hirudotherapists now, this list has been growing continuously. Physicians, nurses, physical therapists and rehabilitation specialists have been taking advantage of this method increasingly often. They know that the proper use of leeches in therapy is a powerful weapon against many diseases, significantly speeding up treatment and convalescence.”

Bio-Gen has been delivering leeches to almost all countries around the world, including the US, Canada, China, India and the RSA. The company sells approx. 1 million medicinal leeches annually. ●



Anna Zając (Fashionable.com.pl) talks to Anna Lewandowska about healthy motivation

BY MALWINA WADAS

See Bloggers Łódź 2019 – a great Internet celebration

From 7 to 9 June Lodz was the capital of the Polish blogosphere. Popular bloggers, YouTubers, Instagrammers and other internet influencers came to See Bloggers Łódź held at EC1 Lodz – City of Culture.

The organisers prepared a series of lectures, discussion panels and workshops for participants and event partners. It was a real treat for followers and those they follow to meet without smartphones and other mobile devices in between. The co-organiser and main partner of the event was the city of Lodz, while the “Lodz Creates Innovation” editorial office acted as one of the media patrons.

HOW LODZ BECAME THE CAPITAL OF THE INTERNET

This year's seventh edition of See Bloggers Łódź saw 2.5 thousand creators and over 100 speakers. Activities took place simultaneously on three stages, in several workshop rooms and a spacious partner brand zone. Today, this event is the largest of its kind in the country, but it hasn't always been this way.

● WINNERS OF THE #HASHTAGI ROKU 2019 AWARDS

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- Maffashion** – Influencer of the Decade
 - Magda Bereda** – Influencer of the Year
 - Littlemoonster96** – Influencer Top of the Year
 - Anna Lewandowska** – winner in the Public Figure Active Online 2019 category
 - Busem Przez Świat** – winner in the Blogger of the Year 2019 category
 - Damian Kordas** – winner in the Instagrammer of the Year 2019 category
 - Szparagi** – winner in the YouTuber of the Year 2019 category
 - Lili Antoniak** – winner in the Discovery See Bloggers Łódź 2019 category
 - Podziarany Tata** – winner of the Socially Active Influencer Award
-

“The first edition of See Bloggers took place in August 2014 in Gdynia, with approx. 150 bloggers in attendance. As the online community developed and the popularity of social media grew, the event's popularity also began to flourish and the target group has expanded significantly. 'Influencer' has become an everyday word, while the power and reach of online creators increased and continues to expand year by year. We decided to meet the trends head on and create the largest festival for influencers in Poland,” Jakub Zając, CEO of See Bloggers Łódź explains and emphasises that it was no coincidence that Lodz was chosen as the venue for the event's following editions.

The organisers underlined the importance of the city as an inspiring place, one definitely worthy of discovery, in how they constructed the programme – for the first time See Bloggers lasted three days instead of two. During the additional day, Lodz was the name of the game for guests from all over Poland. Photo tours with various interesting routes were conducted and the Lodz Challenge, an original urban game that saw well-known influencers act as team captains, was played.

STARS, CREATORS, EXPERTS, WINNERS...

On Saturday, after See Bloggers Łódź was officially opened by the city's mayor, Hanna Zdanowska, presentations that drew participants from all over Poland to EC1 started on three stages. On the Main Stage one could listen to Filip Chajzer, Natalia Kukulska, Dorota Wellman, Lara Gessler, Katarzyna Zielińska, Sonia and Maja Bohosiewicz, Maryla Rodowicz, Anna Lewandowska and a talk between Maffashion and Red Lipstick Monster. The Creators Stage was taken over by authors of popular channels, including: Jan Kuroń, Martin Stankiewicz, Wiktor Mrozik, Anna Makowska (known as Doctor Ania), as well as the creators of such channels as Matura To Bzdura, Suchar Codzienny, Szparagi, Mnie Śmiesz and Busem Przez Świat! The Educational Stage also drew quite a crowd. Here Internet creators were joined by people active in influencer marketing from the business



Concert of Natalia Kukulska during the evening party after the #Hashtagi of the Year 2019 Competition Gala



Stand of Indigo – Partner of the Strategic Beauty Zone

side. The organisers offered participants workshops with experts, while partners hosted various attractions in themed areas, i.e. Lifestyle, Technology, Beauty, Fashion, Family and Cooking. The EC1 Centre for Science and Technology also presented its offer, inviting influencers to participate in a robo-car race.

The #Hashtagi Roku 2019 (#Hashtags of the Year 2019) Gala, which took place on Saturday night at the Stefan Jaracz Theatre, was the high point of the event. Awards were presented to the most active Internet creators. A concert by Natalia Kukulska was the icing on the cake at the evening party, which moved to EC1 Lodz – City of Culture.

OFFLINE EVENT – ONLINE STREAMING

Admission to the event was contingent on a qualification by the organisers, which was based on applications filed several weeks before the festival. Such a formula meant that only the most active Internet creators and influencers participated. Those who did not qualify or could not reach the event were given the option to view all the action online. The Facebook and Instagram accounts of See Bloggers featured live coverage of the Main Stage and the Creators Stage, while the evening gala was shown on the TVN channel on YouTube. This allowed everyone to participate in this unique event, which might have been held offline, in EC1's spaces, but concerned the online world, which for the participants is an everyday reality and often also their place of work.

The next opportunity to meet the most important figures of the Polish Internet is in one year in Lodz – we can't wait! ●

BY MALWINA WADAS

IT for healthcare? We've got it!

In completing projects for, broadly understood, healthcare, companies from the IT sector design, implement and ensure the stable operation of digital solutions. They change the reality of patients, carers, medical staff, as well as health care facilities and organisations. R&D activities and innovative solutions offered by IT companies from Lodz make them competitive not only on the domestic, but also on the global market.

We present three companies that are growing into industry leaders and changing the face of modern healthcare.

EVERYTHING FOR HEALTH

Software House HTD has an office in the glass Brukowa Business Center and specialises in creating digital health projects. It implements mobile and Internet applications, and integrates IT systems for many healthcare industry areas. On the one hand, these are solutions that improve contact between doctors and patients, while, on the other hand, supporting research activities, e.g. DNA research, as well as addiction therapies and prevention. The recipients of HTD

services are: hospitals, clinics and individual customers associated with the medical industry.

Work on digital projects in the healthcare industry is similar to manufacturing products in others, even though it requires greater focus on the security of systems and processed data. That's why all solutions offered by HTD are based on the Health Insurance Portability and Accountability Act (HIPAA) security policy. Thanks to this, customers can be confident that their data and confidential treatment information are securely stored, transmitted and protected from unauthorised access. In addition, it's important for the design to be conceived and adapted in



Szymon Ciołkowski, Software House HTD developer

appearance and functionality to the individual nature of users, often from a non-typical group, for example, patients undergoing therapy.

It's not easy to choose one or two projects the company implements for the healthcare industry, because Software House HTD currently has several in the works. These include programs that support and automate the internal business processes of hospitals, expert systems to support doctors in decision-making, as well as IT solutions to help IT specialists in the bio field construct algorithms for human DNA processing. Other examples of projects implemented by the company include: a system supporting nurses in the event of the patient undergoing cardiac arrest, a platform for managing patient data or an application supporting patients undergoing cancer treatments.

“Nutrimedy is a platform that supports healthy eating and enables video consultations with dietitians. It's available both on the Internet and as a phone app. When making an appointment, the patient can rest assured that they will see a qualified specialist, because every dietitian undergoes a thorough vetting process before being allowed on the platform. Furthermore, the proposal is based on the analysis of various data, such as the patient's health, the dietitians' specialisations, preferred meeting times for both parties, the dietitian's rating among users and their current availability. Thanks to this, the probability is high that a specialist ideally suited to the patient's needs will be at the top of the list. This and similar solutions using available technologies mean that contact with a physician is possible from anywhere in the world, e.g. using video or chat,” explains



Bogumił Zięba, CEO of Inovatica

Szymon Ciołkowski, HTD developer, talking about one of his current projects.

ECG IN CLOTHING AND A SYSTEM IN THE UNITED STATES

Inovatica's main product is an autonomous driving system for forklifts. In addition to this, the company specialises in offshoring programming services – from design through coding to the maintenance of developed solutions. Bogumił Zięba and Wojciech Młynarczyk, the company's founders, graduated from the Faculty of Electrical Engineering and Electronics of the Lodz University of Technology and already in 2008 established creating innovative ideas and implementing innovative solutions as their goal and development objective. With this mission in mind, the company has acted as a technological partner in many R&D projects, including IT for the healthcare industry. One of their most spectacular achievements is undoubtedly the ECG shirt for monitoring heart rate, created in co-operation with the Medical University and the Lodz University of Technology. The project embodies the innovative integration of textile measurement sensors, cardiological devices and mobile solutions. The results of the heart or pulse measurement are obtained without additional electrodes and sent to the acquisition module, which transmits them to the user's phone or computer. A lot has changed in the company during this time, but the overarching goal remains unchanged. These are innovations, also for healthcare-related industries.

“In recent years, we have specialised as a technology partner for US companies also operating in the healthcare industry and creating digital products,” says Bogumił Zięba, Inovatica's owner.

One of the many activities the company can boast of is its technological partnership with Empathiq, which offers, for example, a system for managing the opinions of doctors, hospitals, clinics and health care units in the United States. Thousands of doctors, clinics, hospitals and organisations use the Empathiq.co system, which acts as a Healthcare Reputation Management system. In this business partnership, the company from Lodz is tasked with developing, maintaining and building new system functions, which is part of its activities as an outsourcing service provider. Inovatica provides more than just programming services under this co-operation, as its employees constitute a permanent part of the team responsible for the client-side development of this product.

“Despite the geographical distance and the time difference, such co-operation is possible thanks to our teams' very direct and close communication,” explains Bogumił Zięba.

Inovatica has a great range of proprietary products, all of a quality allowing it to successfully compete on international markets. However, operations abroad are not everything! The company is a vendor of solutions, such as those used for mobile and web applications, as well as the Internet of Things for the healthcare industry, also for customers from Poland who design, build and implement various IT solutions bringing business value to this sector.

FROM SURGERY TO DIGITISATION

Transition Technologies PSC (TT PSC) is a subsidiary of a Polish IT holding company that has been on the market since 1991. When it started, it concentrated on creating advanced IT systems for industry and the energy sector. Currently, however, it's easier to list industries in which it doesn't work than those in which it's a business partner. Therefore, IT projects implemented by TT PSC are used in industry, in the automotive, construction, architecture and transport sectors. Healthcare support is also a part of the business area in which TT PSC creates new IT solutions, designs software from the ground up, helps develop and build existing products and systems used by customers, e.g. one of the healthcare industry projects assumed the use of augmented



Błażej Dunajczyk, AR developer Transition Technologies PSC

reality in aesthetic medicine procedures. Working with outstanding surgeons, the company developed a technologically advanced application supporting both education and aesthetic surgery. For this purpose, cutting edge augmented reality (AR) equipment was used, in this case HoloLens glasses from Microsoft and the latest phone model from Apple. The iPhone X scans the shape and facial expressions of the patient, and then transfers the collected information to the glasses. After pre-processing this data is applied in real time in the form of three-dimensional holograms, to the patient's face for example. This allows tissues and their behaviour to be visualised, and then locations for hyaluronic acid injections aimed at achieving specific effects to be shown.

“The innovative nature of this solution stems not just from the combination of co-operation between outstanding doctors with software development experts, but also from the use of devices that just a few years ago one could only have seen in science fiction films,” says Błażej Dunajczyk, AR developer working every day in the Lodz branch of TT PSC. “Fast infrared scanners analysing distinctive points of the human face, touchless operation using hand gestures and three-dimensional animated holograms displayed in a physical space are just some of the features offered by our applications. That's why I deeply believe that Lodz, as an innovation incubator, can become one of the most important and fastest expanding players on today's global software market, not just in the healthcare industry, but also in other industries, businesses and in our lives.” ●



Joanna Guszta & Maciek Błażniak

Illustrations, books, apps – Ładne Halo is nice whichever way you look at it!

Ładne Halo (Nice Halo) is a creative studio specialising in illustrations for books, press and advertising, as well as designing applications, publications and visual identification. It was co-founded by MACIEJ BŁAŻNIAK and JOANNA GUSZTA. Their “NIEMAPA” (“NOT A MAP”) city guides have many fans, the Halobajki application for Microsoft Polska with multimedia fairy tales has seen great success, while their children's books are available for a whole new generation of readers. They talk with Malwina Wadas about their work and “not work”, challenges and triumphs, as well as inspirations and dreams.

In the beginning, Ładne Halo was known first and foremost as a publishing house specialising in children's books, which published original stories with thoughtful designs and drawings of young Polish illustrators. The modern picture books you publish have been very positively received not only by young and older readers, but also by the Polskie Towarzystwo Wydawców Książek (Polish Society of Book Publishers), the Polish Section of IBBY, Klub Twórców

Reklamy (Advertising Creators Club) and the Lodz Design Festival. How did the idea for this creative business come about?

Joanna Guszta: First, the idea for a publishing house came about and since Maciek was already working for a creative agency, he continued that and combined it with work on expanding the publishing house. We received a subsidy to start a business from the Poviast Labour Office and used it to partially finance the first book.

Maciej Błażniak: It turned out that the more buzz there was surrounding our books, the more customers we got. Finally, we reached a point where we decided to only be our own bosses. Prizes and awards have also played a part – they brought us popularity and were like the wind beneath our wings.

You expanded the business from books that today can be found on the shelves in many Polish homes. Could you tell me more about this?

JG: We work as a publishing house and a design studio simultaneously. We're developing constantly and here I mainly mean Maciek, who's always learning something: if not rendering, then programming, and a moment later he changes the drawing program completely and starts learning everything from scratch. One thing that probably hasn't changed is that we're still mainly active in illustration work. And that's great! Over time, Ładne Halo has been focusing on design work for customers in the fields of business and culture. This has resulted in more books for publishing houses, the "NIEMAPA" series of city guidebooks for families together with interactive exhibitions for children (in cooperation with Mamy Projekt), participation in collective exhibitions, as well as numerous press and commercial illustrations. Our activities are complemented by creative workshops for children, which popularise picture books, illustrations and industrial design. We're also very happy that there are more and more interesting orders related to new technologies. This is something that interests us. We dream of publishing an adventure game for tablets and we've been working a lot on this lately.

The studio and the publishing house are still not enough for you though...

MB: We're active in the children's publishing industry, which is why we participate in various artistic initiatives, such as the one in Zachęta, where we showed our books and my process of work on an illustration at an interactive exhibition on Polish illustrations. As the authors of the "NIEMAPA" graphic design, we take part in exhibitions designed by Mamy Projekt in cooperation with architects, which are presented in select Polish cities. In them, our illustrations for "NIEMAPA" are used to make cardboard cities with various interactive attractions for children. As an illustrator, I am sometimes invited to collective projects, such as "Ilustrowany Elementarz Polskiego Dizajnu" (The Illustrated ABCs of Polish Design), which resulted in a book and exhibition presented in several countries.

JG: I also conduct book-centric workshops and undertake what can be broadly described as design work at various festivals for children. It's an artistic offer for children,



Illustration from the book "Ale miasta!", Wytwórnia publishing house, 2018

an invitation to get closer to books and design through creative activities. In April, I finished a series of classes for families in cooperation with the Pan Tu Nie Stał brand from Łódź. And in June I once again visited Festiwal Książki Obrazkowej dla Dzieci LiterObrazki (LiterObrazki Children's Picture Book Festival). I also sometimes visit kindergartens and libraries, sometimes even students.

How do commercial projects intertwine with your artistic activities now?

MB: As a studio we implement commercial orders, while the publishing house is our place for artistic work. We have various customers. They include publishers (of books, textbooks, magazines), cultural institutions, large corporations and local producers. Our rather broad competences related to graphic design are our strong point. Not every illustrator can and likes to design. Ładne Halo is definitely not only about illustrations or designing publications. We also create visual identification and mobile applications, in which we specialise aside from books. Here we work with customers and try to translate their expectations into our visual language. If necessary, Asia also takes part in the creation of the textual content.

JG: The publishing house was established, because we needed to completely control the book creation process: starting from an idea, through writing, cooperation with an illustrator or designing original illustrations, finishing with the selection of paper, format, binding and all decisions related to production. Here we rely completely on our intuition, we don't have to listen to anyone. We make



"NIEMAPA" city guides

mistakes, of course, but this freedom gives us a lot of happiness. Occasionally we publish books sent by the authors, but then we realise our own desires by deciding on the manner of publishing, suggesting some final revisions to the author or selecting the cover. We're aware that "Skrytki", "Ptakty" and "Lala Lolka" are not easy or straightforward books, they won't please everyone, but we're happy that we can help bring them to market, and thus enrich it.

The design of the Halobajki application for Microsoft Polska, which translates your books into the language of interactive technologies, received the prestigious Red Dot Design Award, while the National Centre of Culture and "Dziennik Łódzki" (Lodz Journal) gave you the title of Grand Creator.

What did this success change?

MB: After the Red Dot Design Award for Halobajki the design of mobile applications has become a strong point in our offer. I definitely feel good in this area and I always treat it as an interesting diversion from illustration work. So far, I've worked in this field with Agora and Microsoft, among others. I designed Fiszki Polityki for "Tygodnik Polityka", – an app directed to young people who want to be up to date, while avoiding informational noise, verbosity and advertising. I really liked the editorial approach to this project. The brief was perfectly tailored to the needs of the target, while the customers, with Mariusz Herma at the helm, were open and cooperation with them was great. I really appreciate that we were included not only in work on the graphics, as a sort of icing on the cake, but in developing the entire user experience, which always assures optimal results. The effect turned out to be satisfactory for both parties to such an extent that this year we also worked together on the graphic design of the "Tygodnik Polityka" website.

What other projects do you consider particularly important?

JG: For several years now cities, architecture, urban planning and urban activism are in vogue and this definitely draws me in – I like to work around such themes. That's why I'm so happy with the entire "NIEMAPA" series, prepared in cooperation with Mama Projekt, which uncovers the city for families and helps parents spend time with their children in places not necessarily directed to the youngest ones, but definitely friendly for them. We're parents ourselves and instead of going to a park with inflatable castles I prefer to pump water at Księży Młyn or make faces in mirrors in the Pasaż Róży with my two-year old. I also had a lot of fun working with the Wytwórnia publishing house on the book "Ale miasta!". This is the largest book that Maciek illustrated and it definitely gave him the opportunity to spread his wings, and I'm very happy with the final result. Since this was a team effort (ours, the author's and the publisher's), I also felt fulfilled, because many ideas and solutions came from me.

You operate as a professional and life duo. How do you divide work? What are the benefits and what complications arise because of this?

JG: I write, am responsible for promotion and communication, talking with clients, helping in conceptual work on illustrations, reporting any comments to Maciek's projects, conducting workshops and taking care of paperwork in Ładne Halo. First and foremost, I like working at the cusp of text and illustrations. Maciek draws, designs, invents, prepares for print, submits comments to what I wrote. It seems that I won't say anything unusual about the complications: it's difficult to separate work from "not work".

Today, is Ładne Halo more of a business or passion for you?

MB: In practical terms, Ładne Halo is more of a business, because that's what we use to support ourselves and everything has to be in the black. However, I can't deny there's passion there. Especially when we were able to reach a point, in which we can only work on orders that are truly interesting for us.

What are your dreams and plans for the future related to Ładne Halo?

JG: I'd like to write more, for example for magazines and children's publications.

MB: For me it's designing games, also as an art director. This is what we wish for each other!

And I also wish you the same, thank you for your time. •



BY KATARZYNA JÓZWIK

Not only to medicinal waters

Travelling for health purposes was already popular in ancient times. However, it wasn't until the 21st century that trips, the primary goal of which is to take advantage of a medical procedure, have gained popularity. Medical tourism, as this is the phenomenon in question, is one of the fastest growing branches of tourism in Poland and the world. The Institute for Medical Tourism Research and Development estimates that 182,000 medical tourists visited Poland last year alone.

Lodz has recently become a place of interest for foreign patients. Visitors to the city – British, French, Americans or Scandinavians – use services such as: dermatological surgery (skin surgery), oculoplasty (eyelid plastic surgery), refractive surgery (laser vision correction), aesthetic medicine or infertility treatments.

IN SEARCH OF MEDICAL EXPERTS

When discussing medical tourism, one needs to first explain what this phenomenon is. Medical tourism is defined as “voluntary travel to a foreign country to undergo planned treatment (to save health and life or improve its quality) for financial or quality

reasons, or due to the inaccessibility of services at one's place of residence (lack of staff, knowledge, equipment, or excessive waiting time or legal restrictions), often combined with sightseeing of the visited destination”¹.

What attracts foreign tourists to Poland? The price most often plays a role. Some treatments can cost even two or three times less in Poland than in the tourist's country. However, as Dr. Anna Białk-Wolf, Chairwoman of the Institute of Medical Tourism Research and Development (pl. IBiRTM) underlines, in this case health is much more important than money. Thanks to many years of research on medical

tourism in Poland, it can be concluded that one of the main factors influencing a foreign tourist when they choose a medical centre is “trust”.

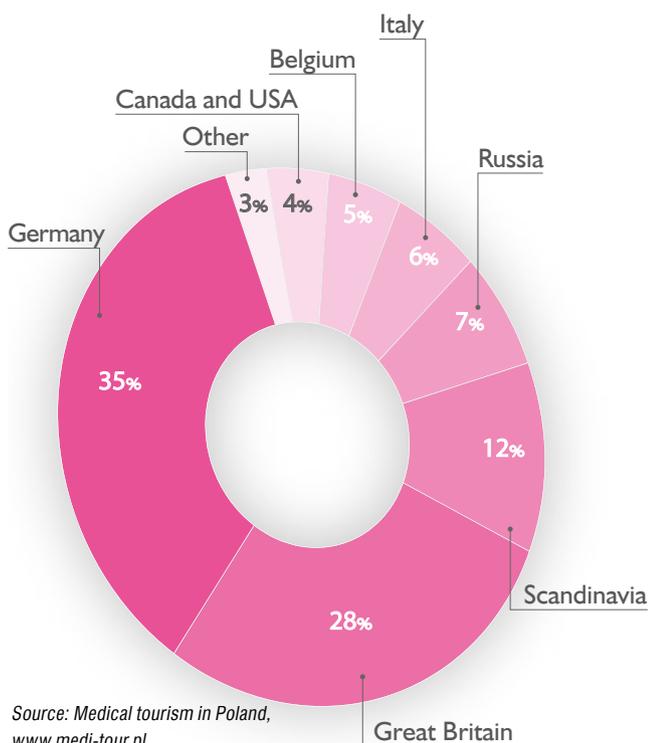
“Medical tourists are mainly people who know our country. A significant group are Poles living abroad, who re very willing to return to their homeland for treatment,” Dr. Anna Białk-Wolf explains. “The patients' Polish roots, as well as the very good quality and comprehensive services offered by some Polish clinics are all factors that encourage the use of medical services in Poland.”

WORLD-CLASS POLISH MEDICINE

The growth of medical tourism in Poland is influenced by the use of modern technologies and treatment methods in our medical facilities, the presence of highly qualified specialists and the ever better communication accessibility of the country. As a result, Polish medicine has become attractive not only to our closest neighbours, but also to citizens of the United States and Arab countries.

Foreign tourists take advantage of a very wide range of medical services. Specialised procedures (e.g. in the field of oncology, dermatosurgery, bariatrics), as well as those falling under the broad category of aesthetic medicine (beauty treatments, dentistry, hair transplants) are all popular. Of course,

Countries and regions of origin of people visiting Poland for medical purposes



RAY.MED Dermatology Clinic – treatment: HIFU (High-Intensity Focused Ultrasound) lifting using the ZENISE device

interest in particular categories is closely related to the tourist's country of origin.

“While dental services and aesthetic medicine treatments are most popular among the Germans and Scandinavians, patients from the east look for oncological and surgical care,” Dr. Anna Białk-Wolf admits.

Numerous tourist attractions also have an impact on Poland's growing popularity among medical tourists. Visitors to Poland not only want to entrust their health to highly qualified specialists, but also wish to visit interesting places or use recreational and spa facilities.

“Poland has an extensive medical tourism, spa and wellness offer. As many as 45 towns or their parts have the status of a health resort,” emphasises Witold Bańka, Minister of Sport and Tourism.

The great potential of our country as a destination for medical tourists is confirmed by its position in the Medical Tourism Index, an international medical tourism ranking. In the 2016-2017 ranking Poland took 24th place, moving ahead of Turkey and Russia.

● ROBERT ANDRZEJCZYK, PRESIDENT OF THE POLISH TOURISM ORGANISATION

“Widespread promotion of Polish health tourism is very necessary to strengthen local businesses. Our country has enormous potential in this regard and can easily compete with other countries. We have well-educated and experienced medical staff, our facilities are modern and the prices very competitive.”

● MEDICAL TOURISM IN POLAND IN 2018

Estimates of the Institute for Medical Tourism Research and Development:

182 thousand medical tourists visited Poland, of which:
55 thousand spent time in spas,
12 thousand went in for hospital treatment,
90 thousand had dental treatment,
25 thousand visited our country to take advantage of aesthetic medicine treatments.

LODZ IS GROWING IN STRENGTH

Medical tourists are increasingly interested in services offered by medical facilities in Lodz. Although the report "Ruch turystyczny w Łodzi i województwie łódzkim w 2016 roku" (Tourism in Lodz and the Lodz voivodeship in 2016), prepared by the Institute of Urban Geography and Tourism Studies of the Faculty of Geographical Sciences of the University of Lodz, combined the health-related goal of travel to Lodz with active tourism, medical tourists amounted to 12 percent of all tourists visiting the city. Mainly British citizens come to Lodz for medical reasons.

"Our patients are mostly English and Irish," explains Joanna Kowalska-Brocka, Doctor of aesthetic medicine and specialist in dermatology and dermatosurgery at Medical Margaret Spa. "However, patients from the United States are also growing in numbers. This is mainly due to the fact that Lodz is a student city. Our American customers are those studying in the city and their visiting family members.

Other medical centres indicate that citizens of France, Norway or neighbouring Germany also use their services."

● MEDICAL MARGARET SPA

The first family-run medical spa in central Poland, with 19 years of experience in the field of medicine and cosmetology. It offers patients professional treatments in: aesthetic medicine, dermatology, dermatological surgery, plastic surgery, ophthalmology, ophthalmic surgery, laser vision correction, permanent make-up and cosmetology. There are 13 medical and cosmetology treatments available, while the facility is equipped with: modern, certified medical equipment, a professional treatment room and a swimming pool with saunas and hydromassage. Medical Margaret Spa also has a branch, Klinika Broccy, in the świętokrzyskie voivodeship.



Salve Medica Medical Centre – checks in embryological laboratory

HIGH STANDARD AND LOW PRICE

Medical tourism services in hospitals in Lodz are offered on a smaller scale. This is mostly due to the problematic financial settlement for commercial patients in the case of facilities financed by the NFZ (National Health Fund). However, private centres are taking advantage of this niche. More and more clinics and medical spas are opening up to foreign customers, who represent approx. 5-15 percent of all patients. In most cases, the professionalism of the medical team is the main reason behind their choice of a medical facility in Lodz.

"What certainly attracts foreign patients is the efficiency and the high level of services that in no way differs from that in western European Union countries," emphasises Karolina Fraszczyńska, PR and marketing specialist at Salve Medica Medical Centre. "Our effectiveness and the experience of the medical team are reasons to choose our facility."

Modern equipment is also a strong point of the medical centres in Lodz.

"Our clinic has world-class aesthetic medicine equipment. We work with manufacturers of ophthalmic and dermatological equipment used on



Medical Margaret Spa – treatment: laser vision correction using the latest Schwin Amaris ophthalmic laser for laser vision correction

international markets,” says Joanna Kowalska-Brocka, Doctor of aesthetic medicine. “Thanks to this, we're in no way worse than foreign facilities.”

This is perfectly reflected in the satisfaction of foreign patients with the quality of treatments and with the infrastructure at medical facilities, which is often better than that of similar facilities in their home countries.

Owners of private clinics point out that foreign tourists choose their services due to the relatively low price in comparison to the level of services provided.

“Price is definitely the main factor behind the use of our services. The differences are especially visible in aesthetic medicine: the difference is usually fourfold,” explains Małgorzata Berner-Rutkowska, Doctor of aesthetic medicine, dermatology specialist at RAY.MED Dermatology Clinic. Our service costs PLN 500, while in other European countries it's also 500... but euros! In addition, in many cases, access to specialists and the opportunity to take advantage of high-quality dermatological treatment is definitely more difficult abroad than in Poland.

HEALTH ALONG THE WAY?

Foreign tourists most often take advantage of one-day stays in medical centres in Lodz. Dermatological treatments, aesthetic eye procedures, dentistry or aesthetic medicine do not require several days of observation of the patient, so the length of stay is mainly dependant on the type of treatment.

“As far as medical tourism is concerned, in our facility's case it's mostly diagnosis and the treatment of infertility. The length of the patients' stay depends on the type of treatment recommended by the doctor,” Karolina Fraszczyńska explains.

The stay of a foreign patient is very often associated with a visit to family living in Lodz or exploring the city.

● RAY.MED DERMATOLOGY CLINIC

A dermatological clinic with 10 years of experience in dermatology, aesthetic medicine, skin surgery and cosmetology. It specialises, among others, in: the treatment of skin diseases, diagnostics of moles and their removal, eyelid plastic surgery and beauty treatments. The clinic provides highly qualified medical care and world-class services.

● SALVE MEDICA MEDICAL CENTRE

Medical offices that have been on the market for 26 years and specialise in treating infertility, diagnostic imaging and specialist medical consultations. The centre currently operates two facilities in Lodz and Warsaw. It is the only place in the Lodz region that performs prostate cancer surgery using the da Vinci medical robot. The centre's mission is to provide comprehensive medical care of the highest level.

“Patients from the United States are especially impressed by Lodz,” says Joanna Kowalska-Brocka, Doctor of aesthetic medicine. “They really like the look and the vibe of our city.”

The owners of Lodz clinics agree that a large group of foreign patients are in fact people with Polish roots and Poles living abroad.

POTENTIAL THAT CANNOT BE WASTED

The highly qualified personnel working in medical facilities in Lodz and the growing interest among foreign tourists are ideal proof that Lodz has great medical tourism potential. That's why it's important to use it properly. The city's extensive promotional campaign for the title of one of the best destinations in the world helps a lot. However, promoting medical tourism belies a great challenge not only to the city, but primarily one for all the owners of medical facilities.

“One has to remember that acquiring foreign patients requires specific procedures, for example precisely defining treatment conditions (including the price) or providing patients with individual caregivers. Clinics are often not prepared for this,” admits Beata Szilf-Nitka, managing director of Go4HealthTravel.

It's also important to understand that this type of tourism is not only a temporary trend in travel, but a real opportunity to strengthen Poland's image on the international arena and gain economic benefits.

“Considering our accessibility in terms of communication, our image of a safe country, innovative treatment methods, high quality of services and competitive prices, we clearly have a chance to make it an important export product,” emphasises Dr. Anna Białk-Wolf. ●

1 Białk-Wolf Anna, *Potencjał rozwojowy turystyki medycznej*, Zeszyty Naukowe Uniwersytetu Szczecińskiego, Ekonomiczne Problemy Usług 591 (53), 2010, s. 655.

ŁÓDŹ OF FOUR CULTURES FESTIVAL

6-14 SEPTEMBER
WWW.4KULTURY.PL

FREEDOM GAMES 2019: HOW DO DEMOCRACIES WIN?

13-15 SEPTEMBER
ATLAS ARENA, AL. BANDURSKIEGO 7
WWW.IGRZYSKAWOLNOSCI.PL

17th INTERNATIONAL PET FAIR

13-15 SEPTEMBER
LODZ INTERNATIONAL FAIR, UL. KS. SKORUPKI 21
WWW.TARGI.LODZ.PL

PLEASE, STAND-UP!

16 SEPTEMBER, 8:30 pm
WYTWÓRNA CLUB, UL. ŁĄKOWA 29
WWW.WYTWORNIA.PL

MICHAEL BUBLÉ CONCERT

19 SEPTEMBER, 8:00 pm
ATLAS ARENA, AL. BANDURSKIEGO 7
WWW.ATLASARENA.PL

TO BE LIKE MONIUSZKO – INAUGURATION CONCERT OF THE 2019/2020 SEASON

21 SEPTEMBER, 6:00 pm
TEATR WIELKI, PL. DĄBROWSKIEGO 1
WWW.OPERALODZ.COM

ADAM PALMA MEETS CHOPIN

27 SEPTEMBER, 8:00 pm
WYTWÓRNA CLUB, UL. ŁĄKOWA 29
WWW.WYTWORNIA.PL

9th KINETIC ART FESTIVAL OF LIGHT

27-29 SEPTEMBER
LUX PRO MONUMENTIS FOUNDATION
WWW.LIGHTMOVEFESTIVAL.PL

30th INTERNATIONAL FESTIVAL OF COMICS AND GAMES

27-29 SEPTEMBER
HALA EXPO-ŁÓDŹ, AL. POLITECHNIKI 4
WWW.KOMIKSFESTIWAL.COM

MODOPOLIS – 2nd POLISH FASHION FORUM

4-6 OCTOBER
ART_INKUBATOR, FABRYKA SZTUKI,
UL. TYMIENIECKIEGO 3
WWW.MODOPOLIS.PL

DAVID GARRETT'S CONCERT

5 OCTOBER, 8:00 pm
ATLAS ARENA, AL. BANDURSKIEGO 7
WWW.ATLASARENA.PL

IV REGIONAL LABOUR MARKET AND PERSONAL DEVELOPMENT FAIR IN LODZ

9-10 OCTOBER
HALA EXPO-ŁÓDŹ, AL. POLITECHNIKI 4
WWW.TARGI.LODZ.PL

10th FESTIVAL OF FILM ART CRITICS CAMERA ACTION

17-20 OCTOBER
WWW.KAMERAACJA.COM.PL

12th INTERNATIONAL ORGANIC AND NATURAL FOOD FAIR NATURA FOOD & 8th ECOLOGICAL LIFESTYLE FAIR BEECO

18-20 OCTOBER
HALA EXPO-ŁÓDŹ, AL. POLITECHNIKI 4
WWW.TARGI.LODZ.PL

SOUNDEDIT'19 FESTIVAL OF MUSIC PRODUCERS

24-27 OCTOBER
WYTWÓRNA CLUB, UL. ŁĄKOWA 29
WWW.WYTWORNIA.PL

ŁÓDŹ YOUNG FASHION

22-26 OCTOBER
WWW.LODZYOUNGFASHION.COM

TATTOO FESTIVAL

2-3 NOVEMBER
HALA EXPO-ŁÓDŹ, AL. POLITECHNIKI 4
WWW.TATTOODAYS.PL/LODZ

SUKHISHVILI GEORGIAN NATIONAL BALLET

4 NOVEMBER, 7:00 pm
TEATR WIELKI, PL. DĄBROWSKIEGO 1
WWW.OPERALODZ.COM

PLAY-ARENA BOARD GAMES AND CREATIVE PLAY FAIR

22-24 NOVEMBER
HALA EXPO-ŁÓDŹ, AL. POLITECHNIKI 4
WWW.TARGI.LODZ.PL

9th INTERESTING BOOK FAIR

22-24 NOVEMBER
HALA EXPO-ŁÓDŹ, AL. POLITECHNIKI 4
WWW.TARGI.LODZ.PL

24th CINERGIA EUROPEAN CINEMA FORUM

22 NOVEMBER-1 DECEMBER
WWW.CINERGIAFESTIVAL.PL

2nd POLISH GARDEN CENTRE AND SHOP PURCHASING FAIR GARDENCONTRACTING

28-29 NOVEMBER
ATLAS ARENA, AL. BANDURSKIEGO 7
WWW.ATLASARENA.PL