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## THE CAGE CHANGE: A MAJOR IMPACTOR OF THE IN-CAGE LIFE OF SMALL RODENTS

On behalf of the authors, Brun Ulfhake sums up for us the recent paper on the use of DVC® System during the cage change

Although alternatives are becoming more numerous and (are) validated, non-animal experiments can still not substitute all in vivo experiments. Studies that need to use live animals should be conducted deploying all possible refinements to minimize the harm inflicted and, furthermore, designed to produce conclusive results using the smallest number of animals possible.

Optimisation of husbandry routines is an important component of refinement and for laboratory rodents a cage-change has proven to be one key element. Indeed, many studies have given evidence that the cage change is quite intrusive and stressful for the inhabitants, upsetting behaviour and sleep pattern, impacting the heart rate and blood pressure to name a few examples.



The impact of cage-change is a factor that clearly could impact the results of any study on small rodents. A good balance between leaving the animals undisturbed and an in-cage hygienic situation fitting the needs of the animals must be achieved.

**Brun Ulfhake, MD, PhD, Senior Professor** - Department of Laboratory Medicine at Karolinska Institutet, is one of the authors of the multicentre study on spontaneous in-cage activity and micro-environmental conditions of IVC housed C57BL/6J mice during consecutive cycles of bi-weekly cage-change.

**Dear Brun, your article is important for the LAS community both for PIs and Facility Managers. Can you summarize it for our readers?**

The reason for our study was to provide a more complete description of in-cage life and animal health during repeated bi-weekly cage changes.

We chose to study a mouse strain (C57BL/6J) which is very commonly used in life science research. **By using the DVC® for housing, we could record in-cage rest and activity day and night across the cage-change interval.** Furthermore, we used the DVC® technology to identify the position of the latrine(s) in the cages. The cages were custom adapted with small closable holes to enable

measurement of ammonia across the full width of the rear middle and frontal sections of the cage floor. Thus, ammonia levels were collected during flow conditions and without having to remove the cage from the DVC®. Ammonia measurements were measured using an electrochemical detector technique at regular intervals (6-7 times) of each cage-change cycle. By the longitudinal gathering of in-cage activity, latrine positioning and ammonia levels, it was possible to compare the first and second week of the cage-change cycle. By analysing repeated biweekly cage change cycles, variations across cycles could be estimated.

**Another important feature of this study was that it was conducted in parallel at facilities in four different countries within the EU.** This allowed us to identify observations that were common across sites from those that only showed at single sites. Finally, at one of the sites, the protocol was extended to include outcomes when housing density was changed from four to two animals, and when the bedding was changed from aspen chips to corn cob. Here we also measured in-cage bacterial load after bi-weekly and weekly cage-changes. At the end of the experiment, the upper airways of randomly selected mice were subjected to histopathological analysis.

**DVC® has been an important tool in conducting the study and collecting such important data. Can you comment on it?**

**Importantly, in this study the DVC® technology enabled us to continuously monitor the home cage activity and rest of animals, without disturbing them.** For us the spatial resolution provided by the twelve electrodes localized outside of the cage gave us the opportunity to analyse not only activity but also how the mice use the cage floor across cage-cycles. This is another important result of our study. Moreover, we used the drop in resistance due to wetting of the bedding to identify the location of the latrine inside the cage and relate this observation to the animals' use of the cage floor.

**What are the results of the study?**

**Our data show that cage change induces a marked increase in activity (~40%) being more pronounced during daytime when the animals normally rest than during nighttime.** The burst was followed by a decline in activity over days after the cage change. Thus, the data strongly support the notion that from the animal's perspective, **bi-weekly cage change is to be preferred over weekly cage change.** Irrespective of the cage change

frequency, **the impact of a cage change is such that it must be incorporated into the experimental design as a variable.** The histopathological examination of the nose cavity revealed mild to moderate signs of abnormalities that did not correlate with the recorded in-cage ammonia levels. Seven out of the nine morphological abnormalities were also present in germ-free mice with no lifetime ammonia exposure suggesting that these alterations be caused by other in-cage components such as dust or chemicals from the bedding material. Further studies on bedding materials are needed. A distinct improvement of in-cage microenvironment would be the development of a nontoxic and dust free material with properties that reduce the production of ammonia while meeting the demands of the mice.

**Can you comment on the DVC® technology and tell us your vision of DVC® in the lab animal industry in the short term?**

The DVC® technology is scalable using a standard IVC housing system. It is already used as a tool for facility management and emerging application may assist in early notification of a range of abnormal activities in the cage. The collection of data from the system does not call for an advanced digital infrastructure, such as massive data storage and processor power. **The 24/7 output of the system can be analysed in close-to-real time and provide unsupervised data on home-cage rest and activity, and with single housed animals also locomotion.** Several more recent papers have shown that it is also a powerful tool in research of spontaneous 24/7 behaviours of small rodents and **ideal for swift capturing of rhythmicities such as the circadian rhythm of day and night** (PONE, 2019). We have used the system to study rhythmicities in home-cage activity induced by husbandry routines (PONE 2019). Using cumulative records covering about 1.5 years, we were able to discover that laboratory mice show a spontaneous rhythmicity (~3 months) in activity with a large effect size ( $\geq 0.7$  SD) (Scientific Rep 2021). I would also like to mention that the system can be complemented with other features such as sound pickup, video capturing and more. It should be noted that such add-ons will increase the demand on the local digital infrastructure but feasible when only a smaller number of cages are equipped with add-ons. **I am convinced that home-cage monitoring is the future in studies of the spontaneous of small rodents.**

**GIORGIO ROSATI**

**SENIOR PRODUCT MANAGER DIGILAB  
TECNIPLAST S.P.A.**

# PANORAMANNEWS MEETS ROBERTO CRIPPA: WHAT IS THE SITUATION IN TECNIPLAST DURING THE RUSSIAN/UKRAINE WAR?

Roberto Crippa, Corporate Supply Chain Director in Tecniplast and IWT, tells us about the recent situation of war, reassuring our customers



On one side Tecniplast group condemns the actions taken by the Russian government against the people of Ukraine, on the other we can state that the Tecniplast situation is a safe situation because we have no operational footprint in Russia and minimal trading exposure.

## In addition to the above, can you summarize our supply chain situation?

None of our suppliers and/or Subcontractors are based in Russia and/or in Ukraine.

**The present situation of war in these 2 countries does not create any problem to our supply chain**, because we do not have incoming material flows from these countries.

Moreover, we state that our supply chain has a very low dependence on air freights, considering that most international transportation occurs by sea or road. Air freight has been, is and will continue to be, an exception.

## Can you tell us more about the Energy situation?

If significant Interruptions in the European Energy Market (natural gas and oil) occur this will have only a moderate impact on us, because **we do not use natural gas as an input for our manufacturing processes** and our supply chain is not energy dependent in a remarkable way.

## How would you define Tecniplast Group situation?

So, as an overall picture, we believe the current situation will have only a limited impact on productivity and delivery continuity.

## What do you think has been the added value in terms of management decisions to reach this situation?

I would underline that for several years now, Tecniplast has put in place **a strong and holistic Enterprise Risk Management approach** aiming at thoroughly and systematically reviewing business disruptions/continuity risks. Multiple sourcing, strategic materials hedging, Sales & Operations Planning as a risk management tool are just few examples of a way of acting that allowed the company not to suffer production stoppage/slow down during the SARS-COV2 Pandemics, or in the still ongoing global materials shortage of raw materials and components.

Thank you Roberto, in this situation of war it is important to reassure our customers about our management decisions and supply chain situation, considering that the human impact of this conflict is already devastating.

**LEOPOLDO ZAUNER**  
CORPORATE MARKETING &  
COMMUNICATION DIRECTOR  
TECNIPLAST S.P.A.



## **“HAPPY FISH MAKE FOR HAPPY RESEARCH!”**

**Alba Aparicio Fernandez, Facility Manager, was involved in the Aquatic facility project at Biozentrum Centre in Basel**



As a facility manager in Alex Schier Laboratory at the Biozentrum, the role of Aparicio Fernandez was to ensure the wellbeing of the animals so the research could take place. She was involved in the project to define the goals as a fish

facility and to supervise that those goals and requirements were achieved.

### **Can you tell us more about the new project in the Biozentrum Aquatic Facility?**

We are a big lab with lots of different projects, but our two main research activities focus on developmental biology and behaviour. We have a well established zebrafish colony and we've recently introduced cichlid species from Lake Tanganyika (Africa). The idea of the project was born from the necessity of creating a fish facility in a new research building

that could accomplish the expectations and requirements of a very dynamic and groundbreaking laboratory.

**Important for us was the capacity to house different species, the maximization and intelligent use of the space, a reliable emergency system, and the standardization and refinement of the different husbandry elements to create an ideal environment for both fish and research.**

### **What were your initial impressions with the Tecniplast CLS system compared to other systems you have worked with?**

I've worked with several systems in the past, and what I like best from Tecniplast is the capacity to maintain a healthy stable environment for the fish that is constantly measured and controlled in real time.

In the research field you want to have stable conditions to optimize your results, and our systems are always alert to ensure that for us.

**Another great feature is how user friendly and**

**intuitive Tecniplast systems are;** from basic things like taking tanks in or out of the system, up to technical procedures like replacing a mechanical filter.

We want our fish to be healthy, productive and happy, because **happy fish make for happy research!**

Therefore, **for us it is very important to have a reliable system that maintains a good environment for our fish.**

- Alba Aparicio Fernandez  
Facility Manager

Tecniplast has great features to help with this: robot feeders, automatic dosing tanks, self-filling reservoirs, remote access...

**What about training and technical support, how important is user training when you first started working with the equipment; also can you comment on the importance of ongoing training?**

User training and ongoing training is fundamental and it should be mutual. I had experience with fish systems before, but nevertheless, I benefited from the training Tecniplast technicians offered me when we started running our new facility. In the same way, Tecniplast experts were open to ideas and willing to help based on our requirements.



**What about access to local technical support?**

Monitoring and emergency systems are critical. You have to assume that complications will occur, that's inevitable. What you can do, is to make sure that you will be able to detect a possible problem as soon as it arises so you can, therefore, **minimize the consequences and resolve it before it affects your fish and research.**

**What recommendations do you have for other institutes embarking on a similar project?**

Think thoroughly on what your needs and goals are, define your objectives, talk and listen to everybody (researchers, techs, users, experts...), be open minded and willing to learn. And good luck!

**TOMMASO SALA**

**INTERNATIONAL SALES AREA MANAGER  
AQUATIC SOLUTIONS  
TECNIPLAST S.P.A.**



**TO KNOW MORE ABOUT THE PROJECT, WATCH THE VIDEO:**



# ADVANTAGES OF VIRTUAL MEETINGS: A GOOD TESTIMONIAL FROM GV-SOLAS

Tecniplast Germany, as well, organized a live session with more than 400 logged participants, that is a great success!



**Dr. Bettina Kraenzlin**, GV-SOLAS President and GV-SOLAS Meeting President had great courage in organizing the most important national event in Europe in virtual mode.

**Dear Dr. Kraenzlin, can you tell us a bit about expectations and results of this special GV-SOLAS meeting?**

We at the GV-SOLAS 2021 board hesitated to turn the face-to-face meeting into a virtual one for a long time. However, due to the uncertain pandemic situation, we had to decide in favour of the virtual format and, to be honest, we did not regret it. **One big advantage of virtual is that the participants can simultaneously attend presentations**, since there was a total of 2.5 weeks to view the conference content. **Thus the viewer can watch more presentations than at a 2.5-day face-to-face conference and can also scroll back and forth through recorded presentations to probably better understand the content.**

We provided 5 parallel sessions over 2 days with a very broad range of topics. We organized a total of 105 presentations in the GV-SOLAS and IGTP sessions as well as 9 workshops and roundtables. One third of the presentations and also of the workshops were in English. Especially for the English-speaking participants it was an advantage to pick out the appropriate lectures in English at their leisure. **Many participants told us that to them all that was very effective and also relaxing.**

**During the virtual sessions you and your team presented a very nice movie, giving a unique insight into your vivarium at the University Hospital of Mannheim. Can you please tell us a bit about your vivarium size, your organization and the equipment you are using for animal housing, logistics and cage cleaning?**

Our institute is a Core Facility of the Mannheim Medical Faculty and offers all researchers the opportunity of carrying out experimental animal science projects. We can keep rodents, rabbits and fish in three separate animal houses. 2/3 of the mice and rats are kept in IVC cages and 1/3

in open cages in the Experimental Unit. DoubleDecker IVC cages are used for rat breeding. Both the rats and their caretakers like that cage type because of its many advantages. Rabbits are kept in groups on the floor and only in special cases in cages. We also provide laboratory space and a broad range of equipment. Training in various laboratory animal science techniques can be offered. We also have an embryo transfer lab, a histology and a clinical chemistry laboratory for the determination of plasma and urine samples from small rodents. Each of our three animal facilities has its own cage cleaning area, which are equipped with bedding stations, rack washers, semi-automatic bottle washing lines and autoclaves. This separation is necessary for logistical reasons, but also has hygienic advantages!

**During the official opening of the virtual GV-SOLAS meeting, Tecniplast Germany organized a live session where we had more than 400 logged participants. Do you see benefits in virtual meetings also in future or can't you wait - as many people - to meet again live at the conference or something in between?**

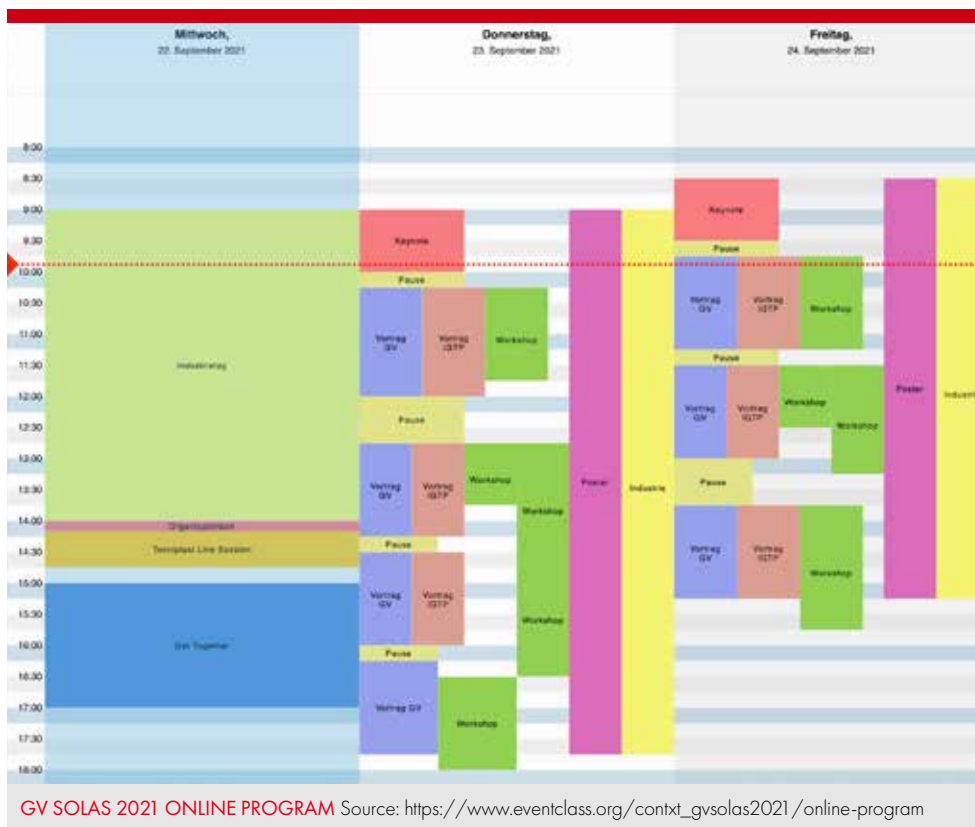
I mentioned earlier that there are certainly advantages to virtual meetings. But of course, **a virtual cannot create the atmosphere of a face-to-face conference and all its unique details**, such as meeting friends and colleagues, the conversations "in the corridor", the informal exchange of experiences while having a cup of coffee or a glass of wine, the "hands on products" at the industrial exhibition and, last but not least, the impressions of the venue, the flair of the city. **We tried to make at least a little informal communication possible at the virtual get-together and in the "Meet & Talk" break discussions.** Many participants took advantage of this and appeared there as "Avatars", but of course it is much nicer to meet live! I firmly expect that this will be possible again at the next GV-SOLAS meeting in 2023!



**Tecniplast Germany supported the scientific program with 4 interesting lectures. Can you evaluate the quality of them in terms of contents and communication efficiency? Do you have suggestions for Tecniplast Germany for future similar initiatives?**

Tecniplast Germany's lectures about automatic data monitoring and the digital future in laboratory animal husbandry were forward-looking and are certainly currently discussed in many animal labs. Lab Animal Facility Managers must be kept up to date in order to make the right decisions when replacing large-scale equipment or equipping new buildings.

One presentation explained how to make cage cleaning sustainable. Another one informed participants about news



from the AK KAB working group. It pays off that Tecniplast has been active in the AK KAB for many years, providing the chairman and passing on current information. For the first time at this conference, we dedicated a separate session to the topic "environmental protection and sustainability in laboratory animal facilities". I think that in the future we will have to focus much more on this than we did in the past. Personally I also see a lot of catching up for our house and therefore consider this topic to be particularly necessary and valuable in the future!

**The most successful Tecniplast virtual lecture was on DVC®, the automated data monitoring in vivariums. There was a high level of attention from both Lab Animal Facility managers and PIs. Can you tell us where you see the automated data monitoring in vivariums in 10 years from now and what benefits can be expected for LAF managers, animals and society?**

I think that automated collection of activity data of laboratory animals in cages is of great value, because **it provides us with reliable, statistically valid data on the well-being of the animals.** It on one hand makes it in an ideal way possible for the lab animal facility management to control and standardise husbandry conditions and to improve these in the interest of the lab animals. On the other hand,

these data can also support the experiments. **Experimental conditions can be checked and standardized.** Animal's stress and pain can be recognised better than by selective observations and unusual experimental results might be explained.

Nowadays with the limitation of personnel inside the vivarium and cage cleaning areas as well as cost pressure for investments and running of a facility, the latest new digital solutions as DVC® can help. Because the possible cage change on demand, due to the automated check of bedding condition inside the cage, **reduces the amount of cage and animal handling, the associated time and costs are significantly reduced.**

Unfortunately, I cannot predict to what extent the DVC® system will be established in 10 years, but the future of lab animal husbandry is certainly unthinkable without automated data collection.

**FLORIAN KELLNER-FENDT**  
**MANAGING DIRECTOR**  
**TECNIPLAST GERMANY**

# TECNIPLAST DIGITAL COMMUNICATION: NEW TREND IN USA!

**Dear Massimo, again TUSA is the leader in digital communication: can you briefly explain this new idea to our readers?**

A critical mission for a company is to stay up-to-date and on top of emerging technologies. This is true not only in terms of product development, but also in the way we communicate to our clients. QR code technology is surely not super new, but during the global pandemic, scanning QR codes has been widely adopted.

This is the backbone of our idea; **Why don't we leverage on the familiarity with QR codes to provide our clients (present and future) with a broader perspective of what Tecniplast offers?**

Starting from April 2022, at the end of each quote, there will be a related product feature which will include one or more QR codes, that when scanned will re-direct the user to dedicated flyers presenting products people may be interested in.

**Can you summarize the added value for our customers in this more complete value proposition?**

The immediate value for the customers is **the quick accessibility to more information about products that may complement what is included in the quotation.** Over the years, Tecniplast has expanded its portfolio quite broadly, and we understand it is not always easy to remember all that we have to offer. These flyers, which are linked to the QR codes, could be a quick reference point to generate new ideas, but most importantly show how small accessories and additional options to the main system could help optimize the functionality and the performance of the Tecniplast system. All of this can be done anywhere at any time.

**How do you see the integration of this new option in TUSA digital marketing?**

The beauty of digital marketing is **the direct exposure to metrics** and thus **a better indication to what truly interests the community.** The lack of direct feedback has



always been a limiting factor for traditional marketing activities, but now we will be able to see what clients prefer and what they don't like. **At TUSA, we are really convinced that having direct discussions with our clients is the best way to serve the industry and to constantly evolve our offerings.**

**Where do you see the Digitalization of marketing activities in 5 years from now?**

**I'd like to see digital technology applied to marketing and being able to provide the exact information our clients need at the right time,** in the format and shape that works best for them. I truly believe digital technology can lead us to personalized marketing... Digital technology will help everyone's individual exposure to information in the way they like to receive it. We are committed to broadening our communication channels to make sure we are present in the format that our customers prefer. **Check us out on our social media channels!**



**SILVIA DALLA COSTA**  
**COMMUNICATION & EVENTS MANAGER**  
**TECNIPLAST S.P.A.**

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