
The 13th TALAS International Conference

Viji Vijayan
Associate Professor
Duke-NUS Medical School
Singapore
Established in 2005, first US-style graduate-entry medical school

>300 graduated as doctors

Strong PhD program

48 patents granted, 18 licenses awarded, 14 spin offs

4,500 peer-reviewed journal articles

Co-located – Singapore’s largest healthcare group – augments translational research

Research is organized into five Signature Research Programs

Four of the five are wet bench lab based programs

In total about 60 wet-bench-based research groups each led by a principle investigator
Vivarium

- 8 animal housing rooms with around 9000 cages
- Metabolic research rooms
- Behavioral research rooms
- Two Photon microscope
- Imaging Facility with several imaging modalities

Animal Biosafety Level 3 facility

- Modular facility with three labs
- In vitro work
- Rodent room
- Large animal room NHP and bats open cage system
Safety at Duke-NUS

- Safety is managed by the Department of Safety Health and Emergency Management
- Five staff in the Department
- The Safety Department works very closely with the labs to make sure that regulations are followed at the same time productivity does not suffer
- The entire School is OHSAS 18001 certified annually for the past five years

Together we strive....
Safety Science is an international medium for research in the science and technology of human safety. It can be related to work, home, leisure.
Safety Science is multidisciplinary

Introducing concepts from the field of safety science
Two key concepts:

Safety I – old view of safety

Safety II – new view of safety

Safety I

Safety I – old view of safety

Safety is a state where few things go wrong, when they do it is due to failure of the socio-technical system.

Humans, most unreliable component of this socio-technical system, a liability.

Starting point for safety concerns was always an accident, especially a major one.

When an accident occurred, an investigation was performed and when the investigators “found” the cause(s) the stop-rule was applied and the search ended.

Often, human error was found to be the cause!!
Safety II – new view of safety

Why does it go right most of the time?

Because the same humans who were considered a liability in Safety I are able to anticipate failures and adjust their daily work such that injuries are rare.

Safety II is about supporting the people to do their work in the right way such that accidents occur rarely.

Duke-NUS:
2017 data
400 researchers
44 hours a week
915,000 hours a year.
2016 - 26 cases of minor injuries.
Things that went right = 99.99716 %
Things that go wrong = 0.00284%

Erik Hollnagel:
“An unintended but unavoidable consequence of associating safety with things that go wrong is a creeping lack of attention to things that go right”
Two of the concepts that are relevant to laboratory animal facilities

1. Conflict at the work place

2. Work-as-planned and work-as-done

Conflict at the work place

Work place is dynamic with ever changing demands

Production pressure – economic output

Work load - human fatigue

Safety – accidents
Rasmussen model boundaries

Working Space

- Safety
- Error margin
- Accident
- Publication failure
- Experimental failure
- Career failure
- Grants failure
- Workload
- Long experiments
- Time constraints
- Lining up all resources
- Ethical treatment of animals

Transforming Medicine, Improving Lives.
### Examples

<table>
<thead>
<tr>
<th>Task</th>
<th>Human safety</th>
<th>Animal ethics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restraining an animal (restrainers, bite proof gloves, squeeze bar)</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Sedating animal even for minimally painful procedures – in ABSL3</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Anesthetising NHP animals when taking out of cage</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Sedating animals for surgery</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

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<td>Biosafety cabinet, cage change station – noise</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>What if the test requires the infected animal to be awake</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Working with bats in ABSL3 – catching the bats, sedating them</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Reducing the size of cages (IACUC approved)</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Positive interaction between workers and NHP is encouraged</td>
<td>X</td>
<td>✓</td>
</tr>
</tbody>
</table>
Examples

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Conflict Management

- One size does not fit all
- Veterinarians and safety people are not always right
- Researchers, animal husbandry staff, technicians need to be heard and given credit – sharp end workers
- Sacrifice decisions sacriﬁcing one goal in order to achieve another goal often productivity vs safety.
- Humans, environment and animals have to be safe in this order
Conflict Management

- Safety is simply the way we work
- IACUC’s involvement
- IBC’s involvement
- Enrolment in occupational health program
- Vaccinations
- Project by project – kick-off meeting with safety, vet, husbandry and research staff to consider all aspects of the project in totality

Safety Science

Two of the concepts that are relevant to laboratory animal facilities

1. Conflict at the work place
2. Work-as-planned and work-as-done
Human work can be understood in four varieties:

**work-as-imagined**
- written by middle/senior management
- SOP with a mental image of how work should be done

**work-as-prescribed**
- formal laws, regulations, rules, etc
- rules by which the correctness of work done judged

**work-as-done**
- is the way in which work is really done

**work-as-disclosed**
- is what the workers are willing to describe

Work-as-done is dependent on the local situation and if nothing goes wrong the gaps are not even visible and the productivity is rewarded.

When something goes wrong these gaps between work-as-imagined and work-as-done become glaringly visible and investigations often blame the fact that written rules are not followed exactly so additional rules are made.

This in and of itself can create conditions that are new threats to safe production.
Work

1994
Northern Iraq
Shootdown of friendly helicopter carrying peacekeeping personnel by F-15 pilots

Examples

In NHP study, the protocol says NHP sedated before taking out of the cage

It was just blood taking but the time taken can be very different quick or long
So if the animal starts to wake up and the needle is in the vein what do you do?
re-anaesthetise or try to take the blood

This is a million dollar question and only the people doing the work can actually made quick decisions no amount of SOP will help
It is about training, expertise and awareness and comfort levels of the team

New WHO lab manual has paradigm shift on risk management now emphasizes on training, expertise and human factor
Conclusion

Safety is simply the way we work

There is always conflict that pull us in different directions, we have to manage it

In hindsight everything seems easy to figure out

Researchers will do everything they can not to jeopardize their results

My message today

Hybrid of rule-based and risk-based safety

What needs to be regulated to ensure compliance and what the worker will assess and manage on their own based on all the vast variety of work situations they face

The rule-based organization-wide instructions will invite compliance when they are correct (commensurate on risk) and rewarding. These will always lack the requisite variety needed to deal with constantly changing work demands which need to be dealt with using local risk-based practices.
Thank you