TWINCORE

# *Übertragung und Inaktivierung des Hepatitis C Virus*

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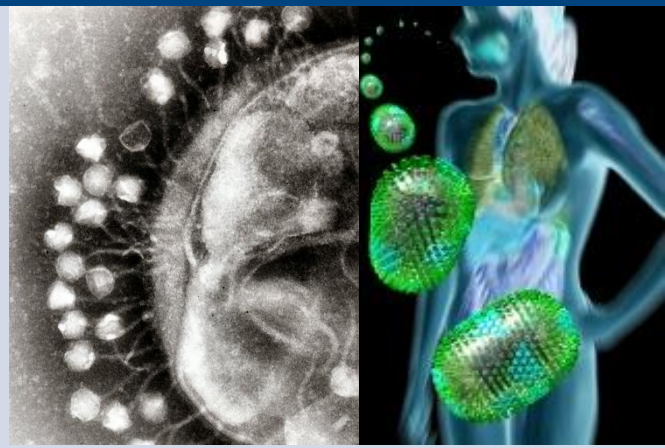
**Centre for Experimental and Clinical Infection Research**

**Institute of Experimental Virology, Twincore***

***joint venture between Medical School Hannover and Helmholtz Centre for Infection Research**



# *Stability of human pathogenic viruses*

**with envelope**

**without envelope**

**strong lipophilic character**

**weak lipophilic character**

**hydrophilic character**

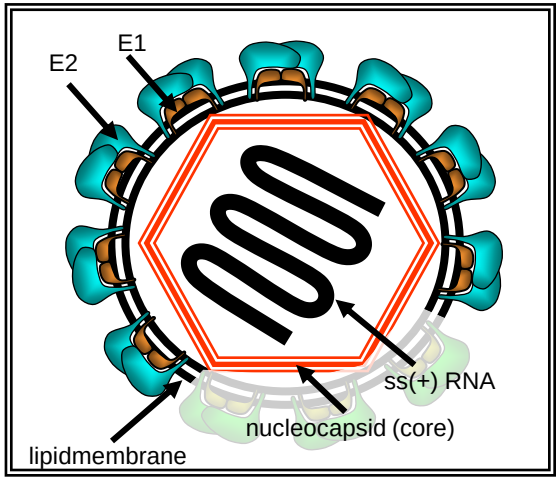
**lipophilic character**

**Retroviridae**
**Flaviviridae**
**Togaviridae**
**Herpesviridae**
**Orthomyxoviridae**

**Poxviridae**
**Hepadnaviridae**

**Picornaviridae**
**Parvoviridae**

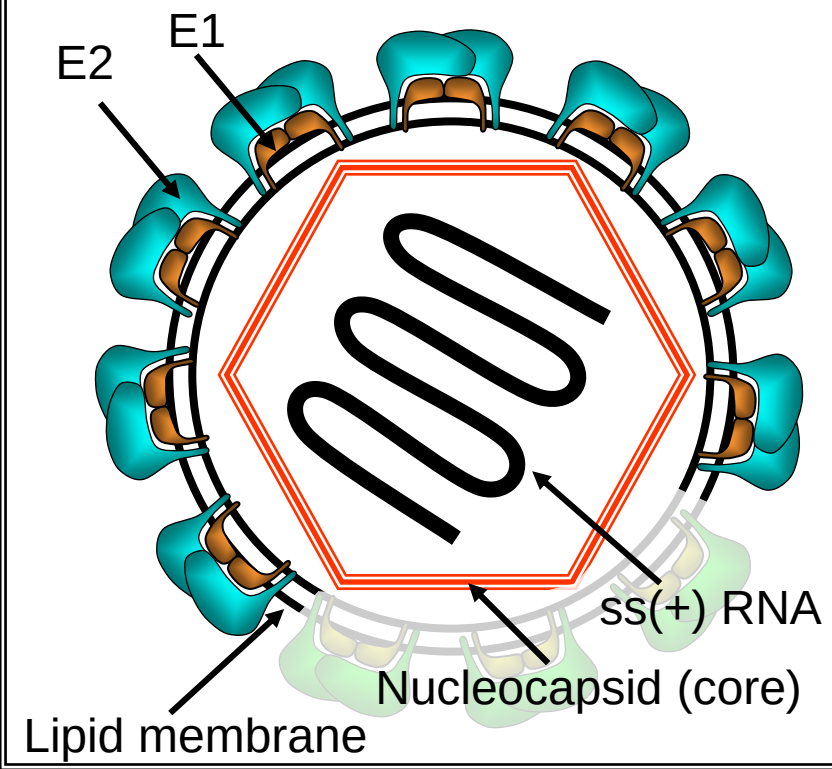
**Adenoviridae**
**Reoviridae**
**Caliciviridae**




based on Klein and Deforest (1963)

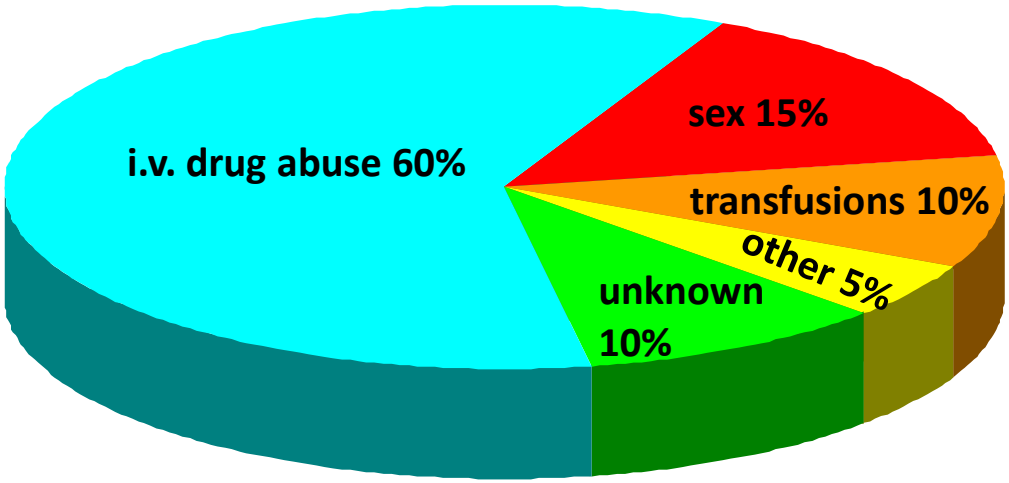
# Hepatitis C Virus (HCV) Profile

| | |
|---|---|
| **Family:** | *Flaviviridae* |
| **Genus:** | *Hepacivirus* |
| **Species:** | *Hepatitis C virus* (7 genotypes) |
| **Size:** | 50-60 nm |
| **Genome:** | (+) ssRNA, ~9.6 kb |
| **Prevalence:** | 160 million patients |
| **Therapy:** | next talk |



# *Ways of HCV Transmissions*

**drug abuse**




**medical procedures**

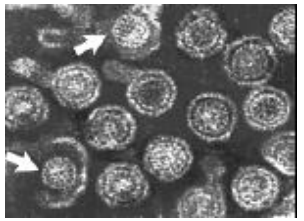
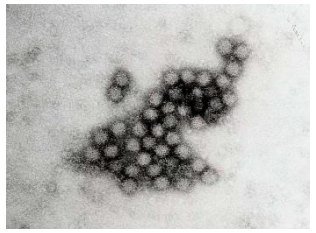
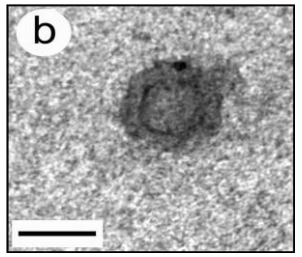
**transfusion**

**sex**

**vertical**

**other**

## *Virucidal testing using surrogate viruses*

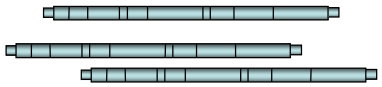
| **testvirus** | **surrogate-virus** | |
|---|---|---|
| Hepatitis B Virus | Duck hepatitis B virus (DHBV) |  |
| Norovirus | feline Calicivirus (FCV)<br>murine Norovirus (MNV) |  |
| Hepatitis C Virus | bovine viral diarrhea virus (BVDV) |  |

# *HCV infection system*

**HCV RNA transcriptes**

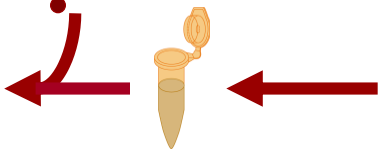
**In vitro Transcription**

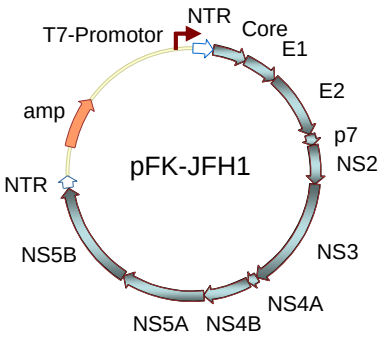
**Plasmid**



HCV RNA

T7-Polymerase






**transfection**

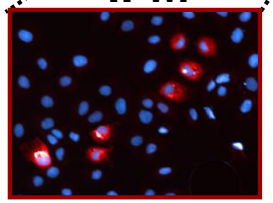
**96 h**

**72 h**

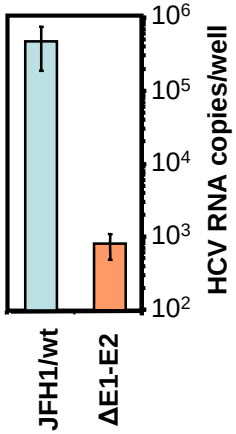
**Detection infected cells (IFM, qRT-PCR)**

**Huh7 hepatoma cells**

**IFM**



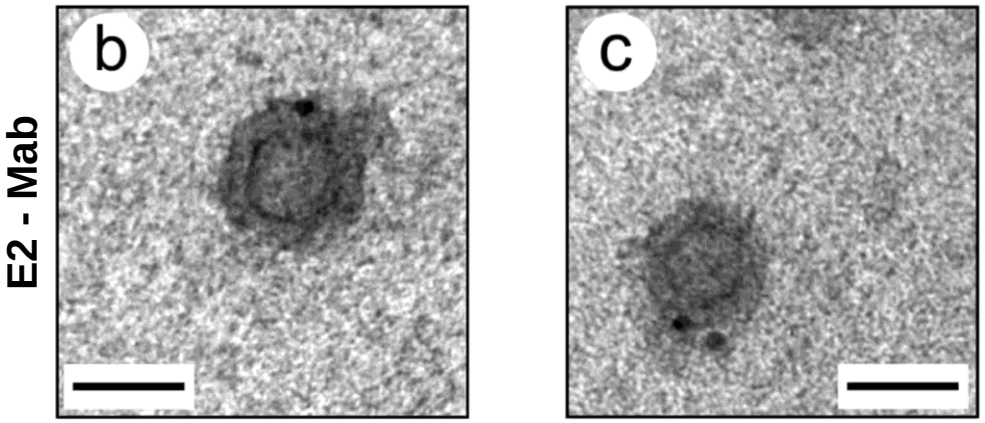
**α – NS3**




*Wakita and Pietschmann et al., Nat Med 2005*

# Properties of cell culture-grown HCV particles

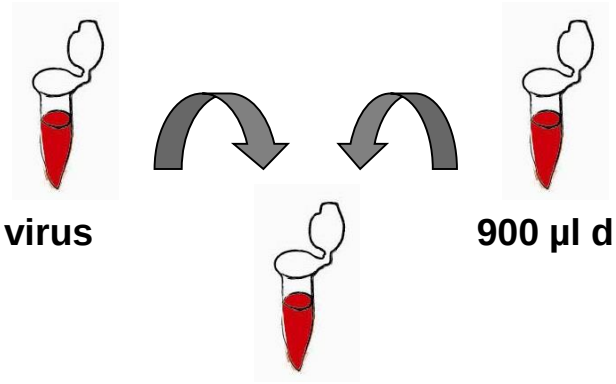
- Density peaks in sucrose gradient ca. 1.15 g/ml
- Spherical particles with diameter of ca. 55 nm




- Infectivity can be neutralized by CD81-specific antibodies
- Infectivity can be neutralized by Ig from patients and anti-E2 Mab
- Cell culture-grown HCV is infectious *in vivo* (chimp; chimeric mouse)

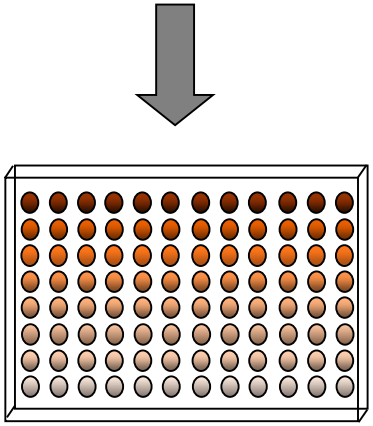
# *Virucidal efficacy of different alcohols against HCV*

**Quantitative suspension:**



**100 µl virus** **900 µl disinfectant**

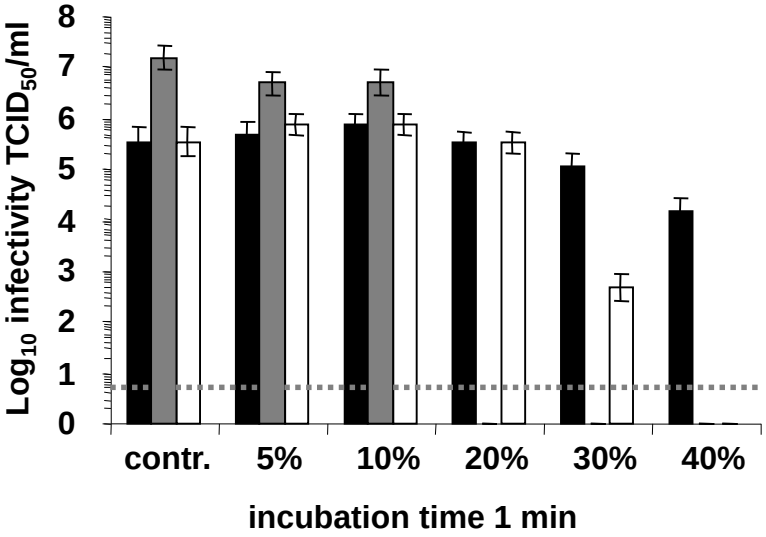
**mix, incubation, mix**

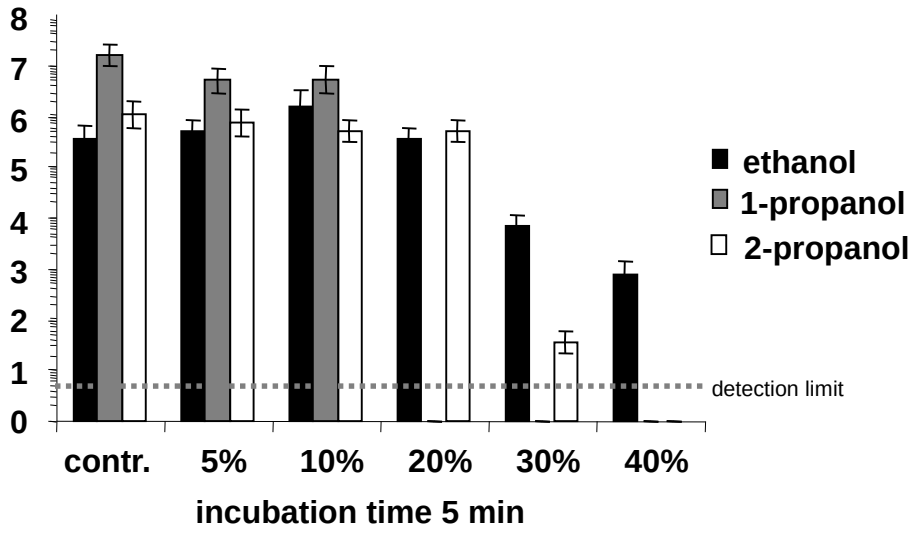


**titration infectivity ($TCID_{50}$/ml)**

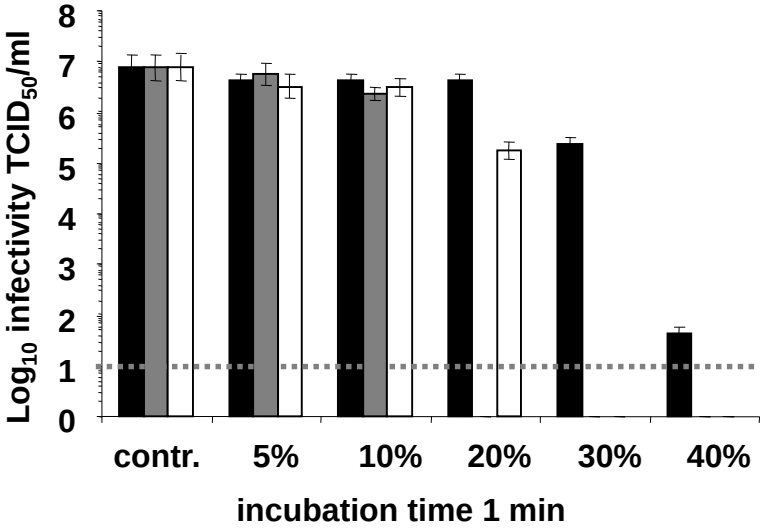
# *Effect of ethanol, 1-propanol and 2-propanol on HCV/BVDV*

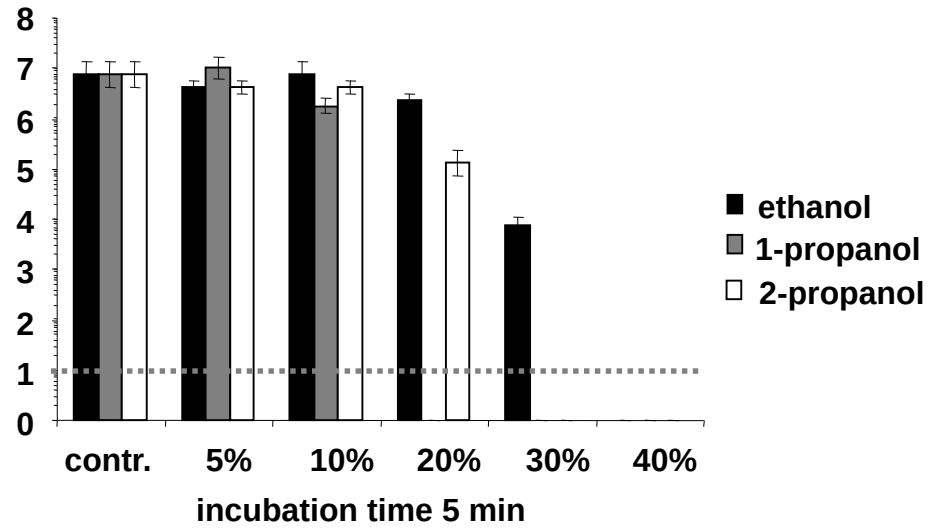
## HCV



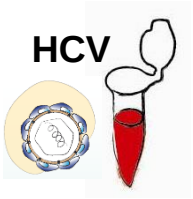



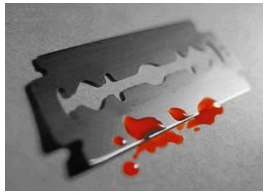

## BVDV



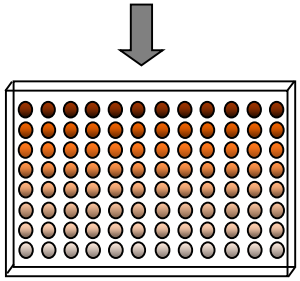
# *HCV infectivity in comparison with HCV-RNA copy numbers*



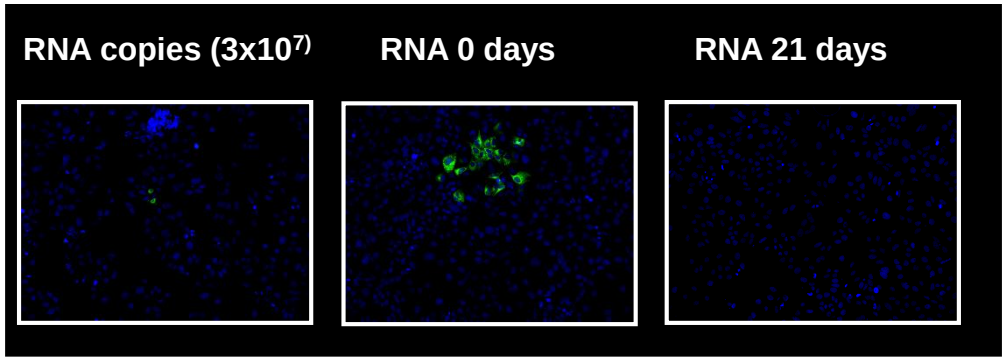
21°C

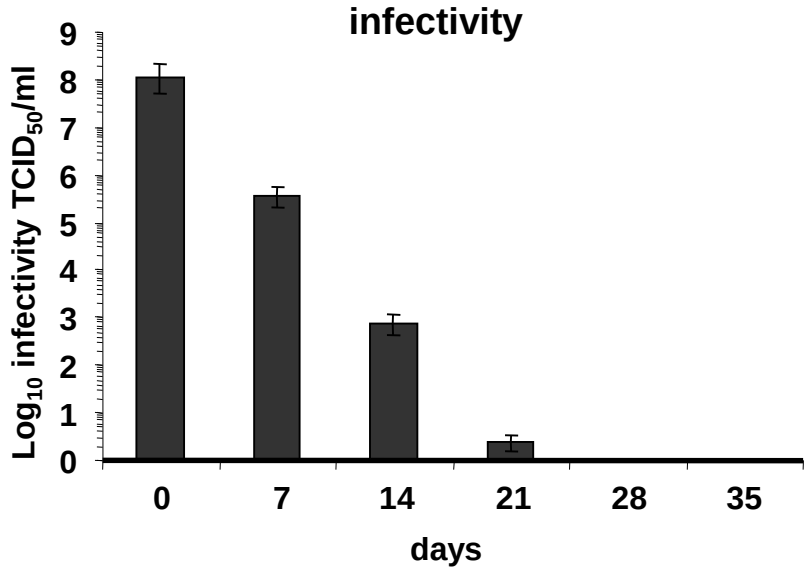
0, 7, 14, 28, 35 days

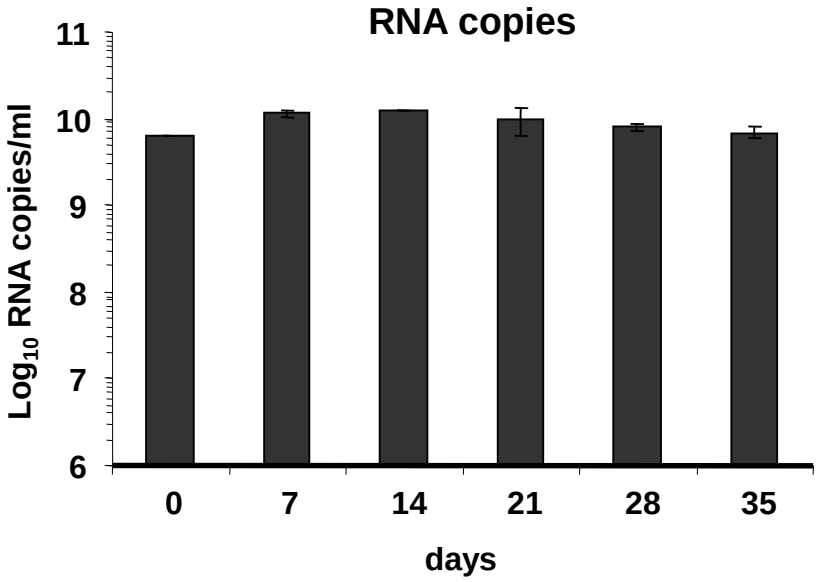


titration infectivity ($TCID_{50}$/ml)

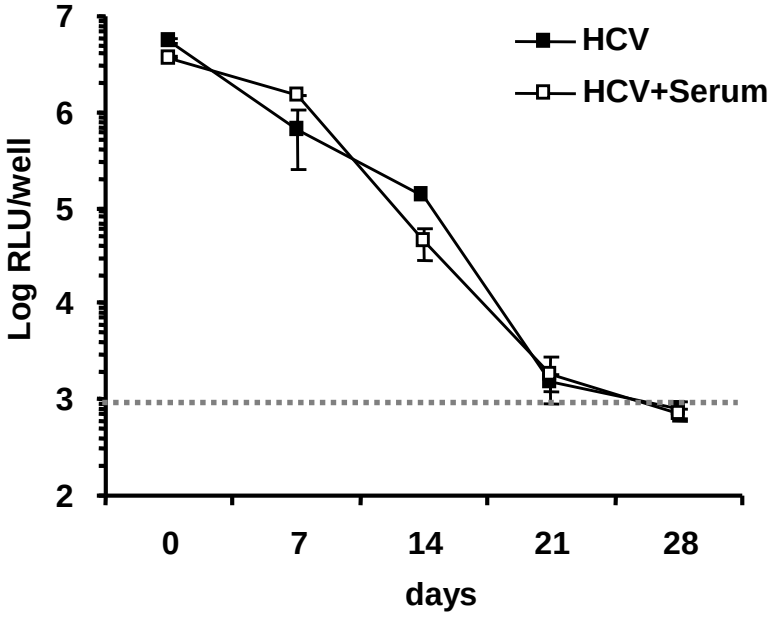
RNA isolation and quantification (qRT-PCR)

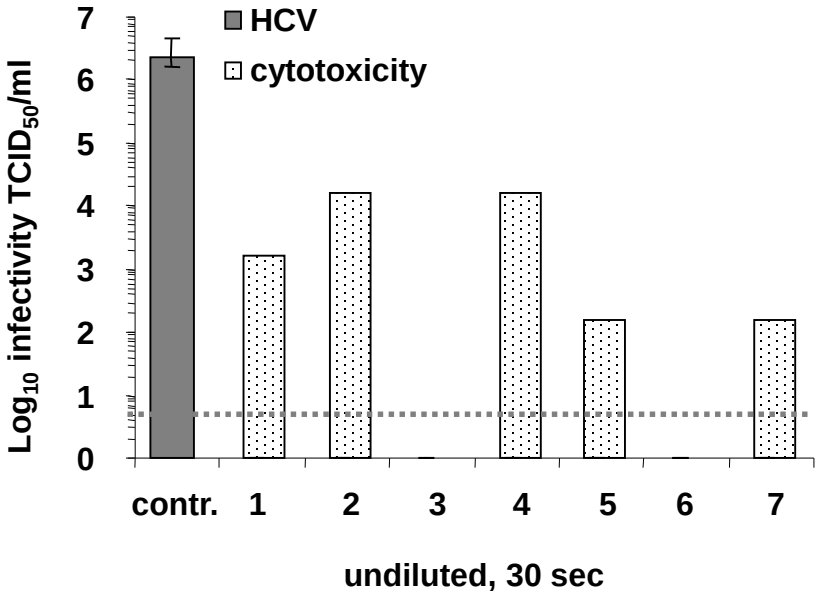


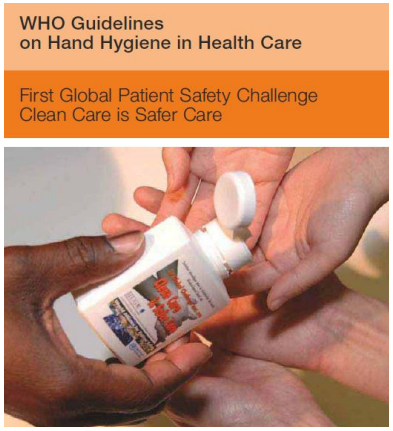



# *HCV stability and inactivation in suspension*




World Health Organization | Patient Safety
A World Alliance for Safer Health Care

*Ciesek et al. Journal of Infectious Diseases 2010*

*Steinmann et al. American Journal of Infection Control 2010*

*Steinmann et al. Antimicrobial Resistance and Infection Control 2013*

# *Virucidal activity of two hand rubs proposed by WHO*

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

WHO Guidelines
on Hand Hygiene in Health Care

First Global Patient Safety Challenge
Clean Care is Safer Care

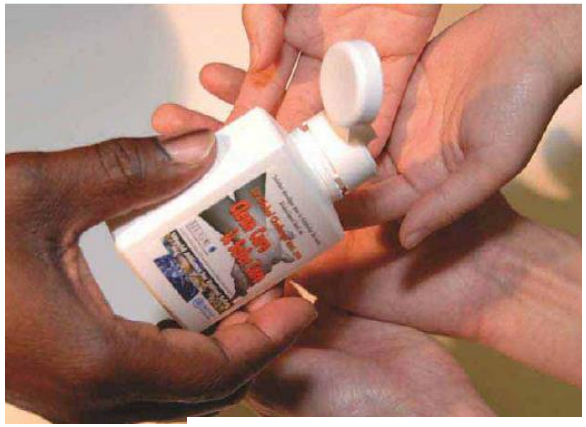





**Fig 1.** Virucidal activity (reduction factors) of WHO formulations I (white columns) and II (black columns) against BVDV (A), HCV (B), poliovirus (C), adenovirus (D), and MNV (E) as a surrogate for human NoV following EN

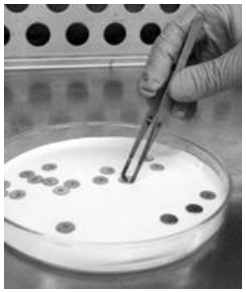
***Steinmann et al. American Journal of Infection Control 2010***

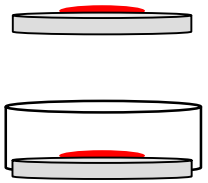
# *Establishment of a HCV carrier assay*

virusinoculum

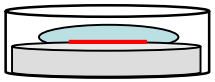
50 µL

(drying)





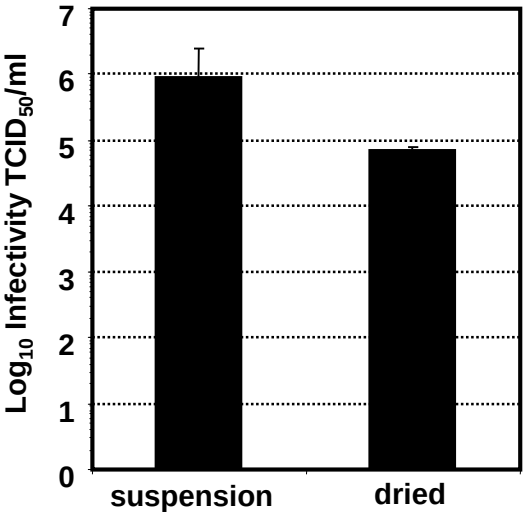
100 µL
test substance

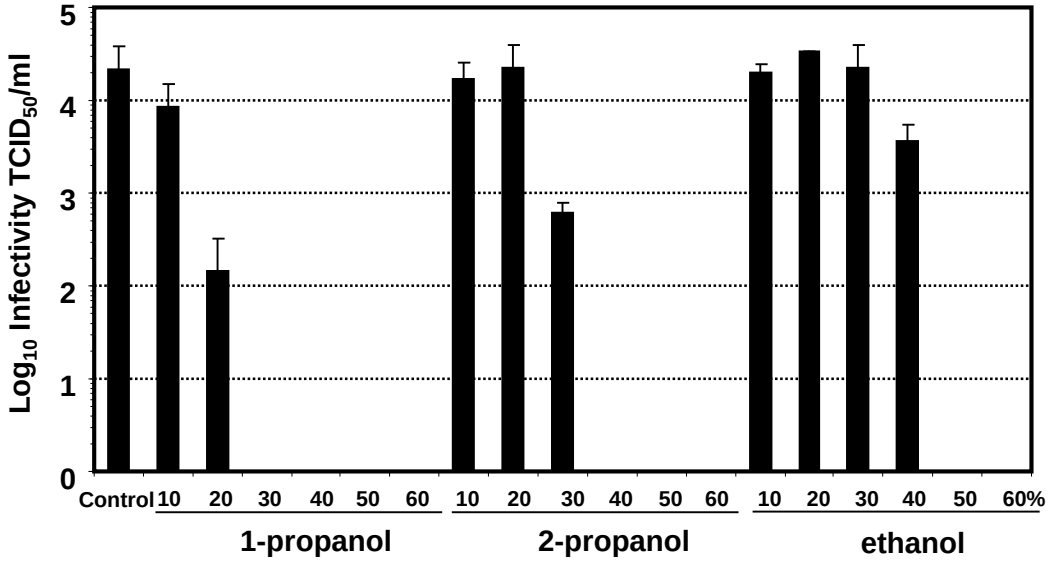


(incubation for 1 min)

900 µL
medium Ø FCS
(1 min vortex)

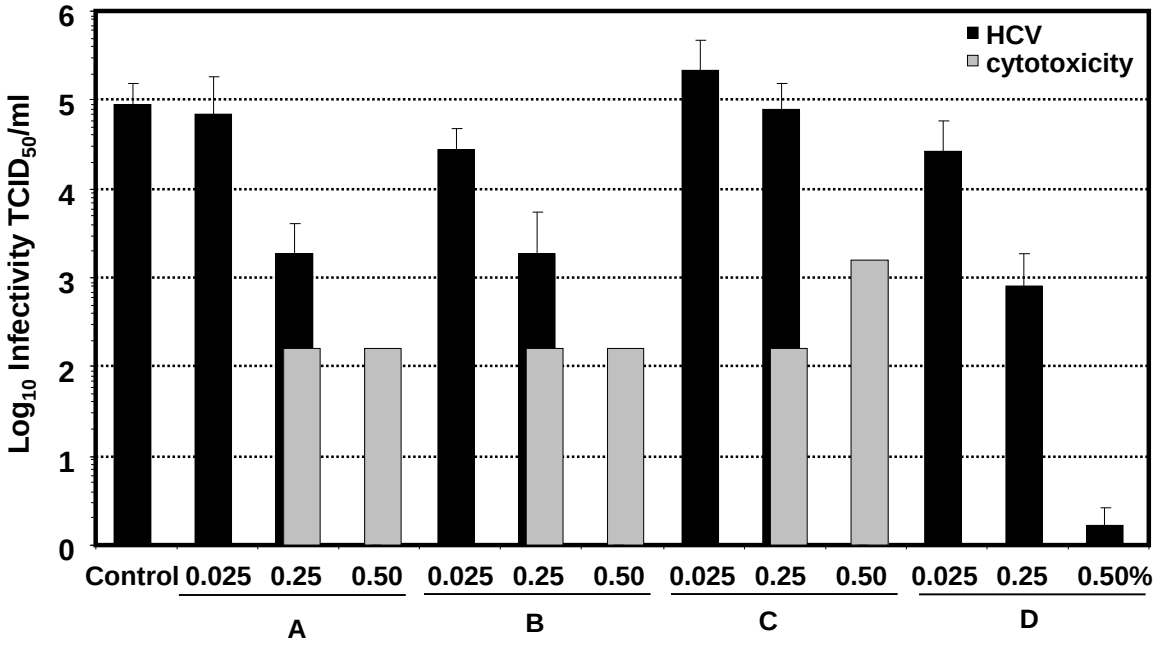
titration infectivity

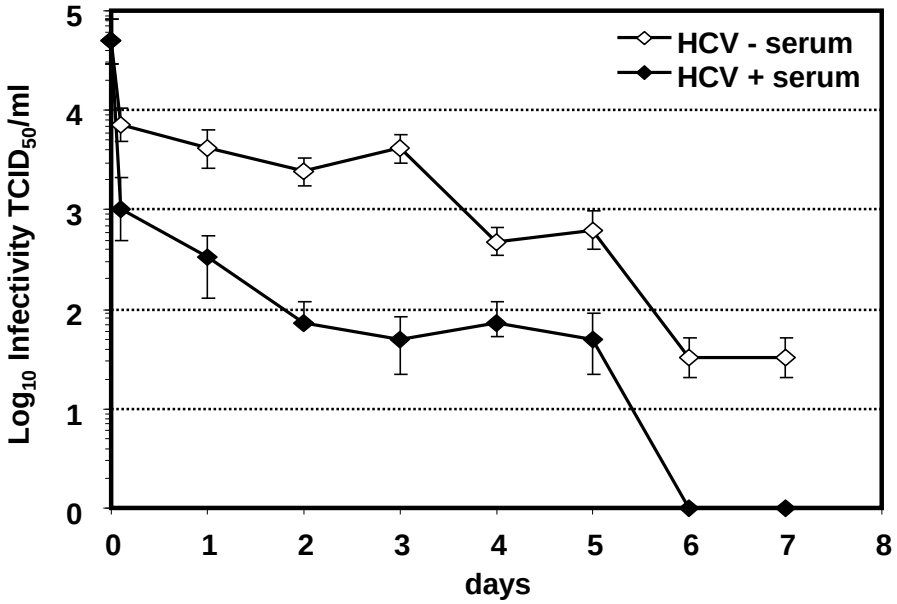


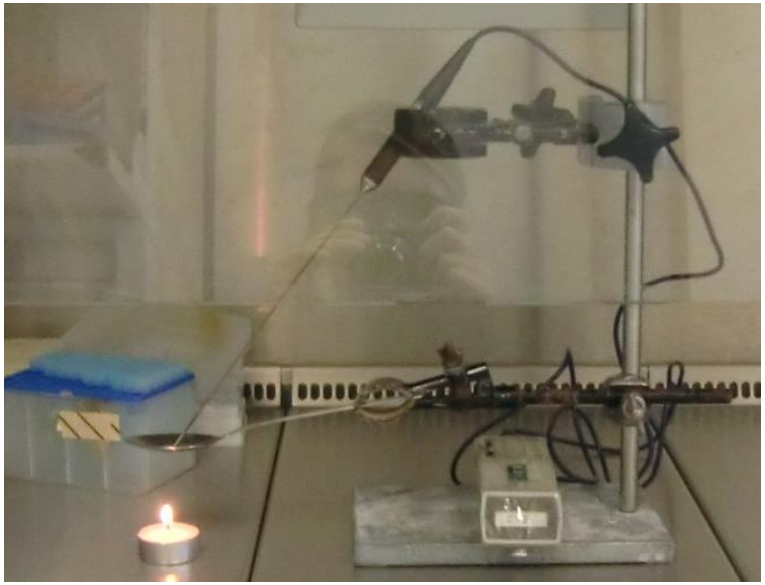

*Dörrbecker et al. Journal of Infectious Diseases 2011*

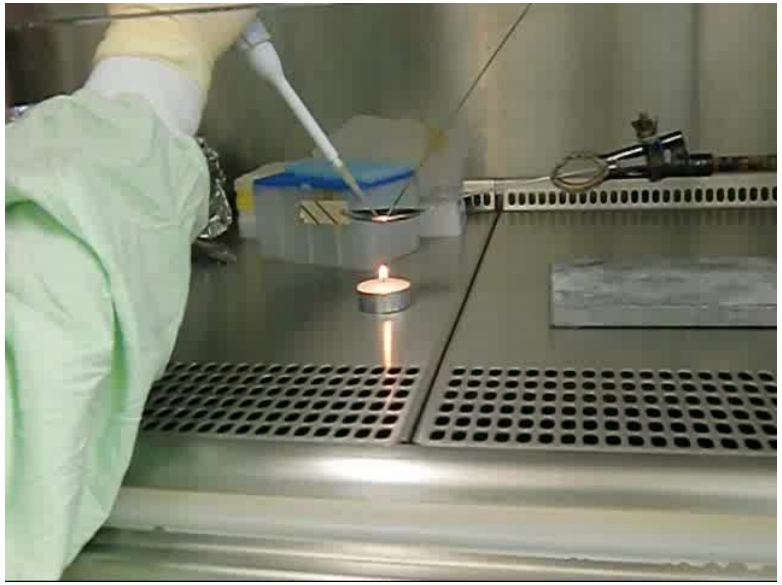
# *Survival of dried HCV on inanimate surfaces*

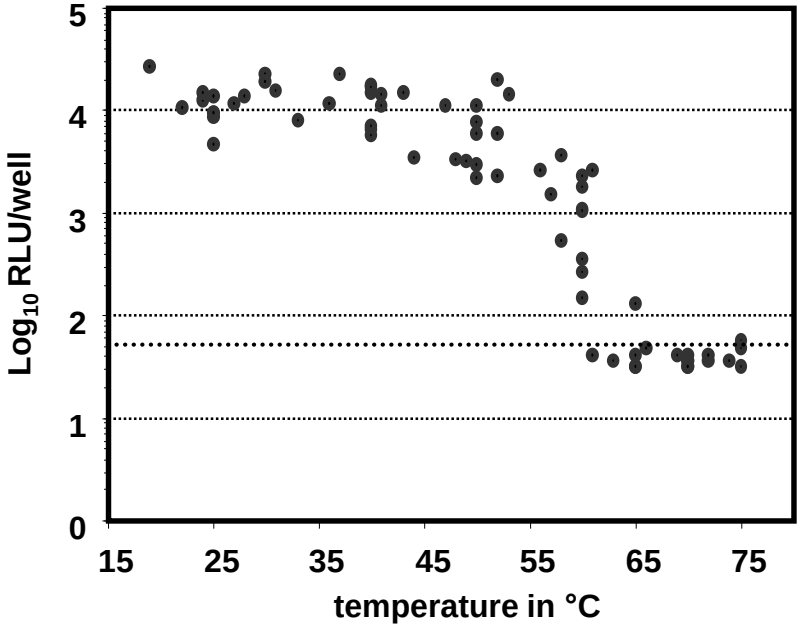



# *Development of a drug transmission assay*

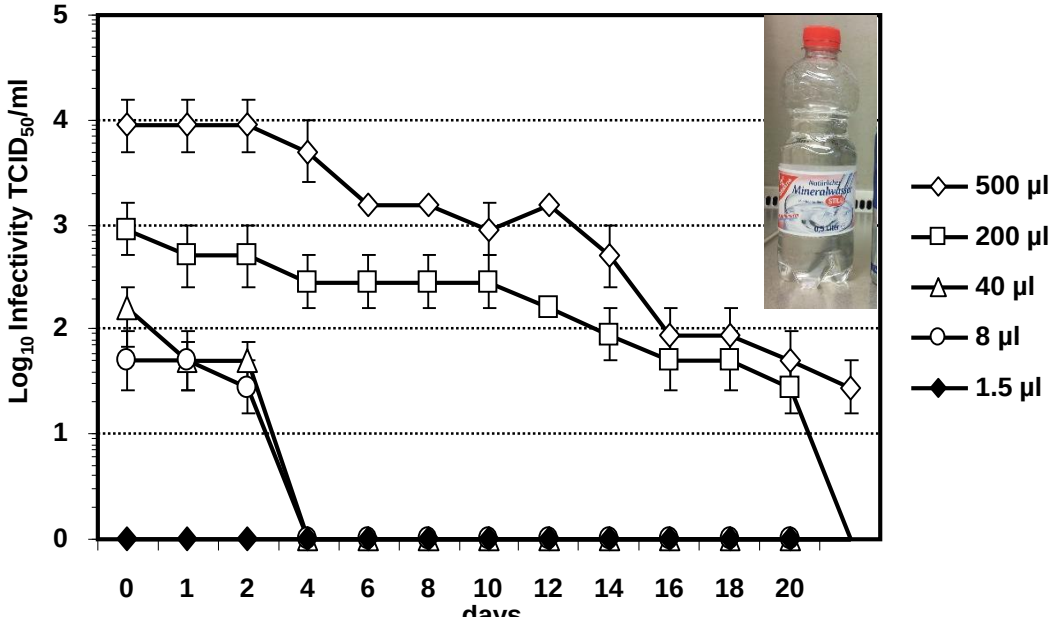


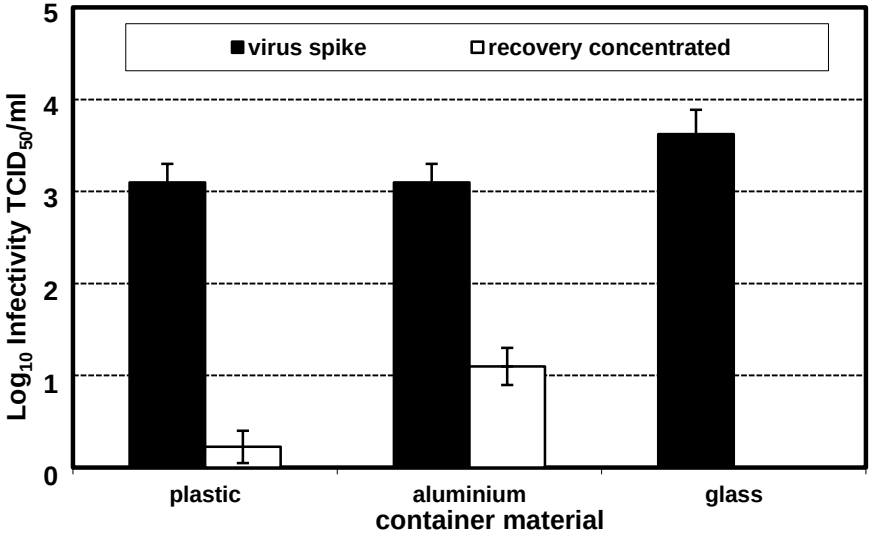





*In collaboration with NDRI, NY, USA Dr. Mateu-Gelabert, Prof. Hagan, Prof. Des Jarlais and Fixpunkt Hannover*

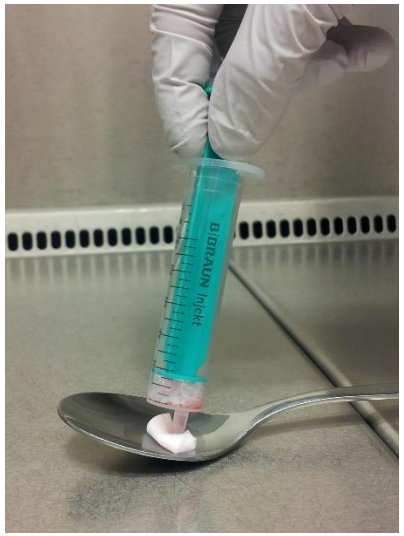
# *Transmission of Hepatitis C virus among injecting drug users: viral stability and association with drug preparation equipment*

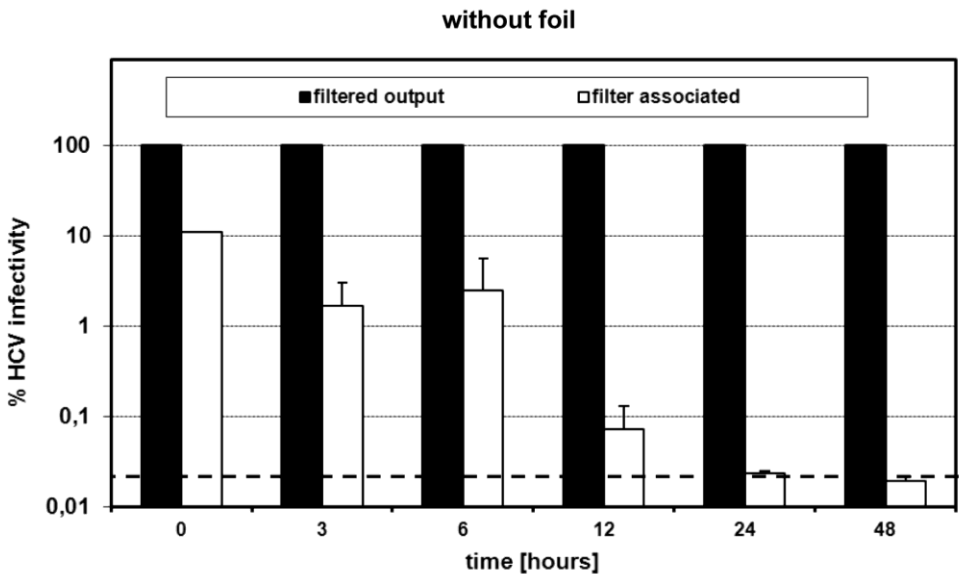


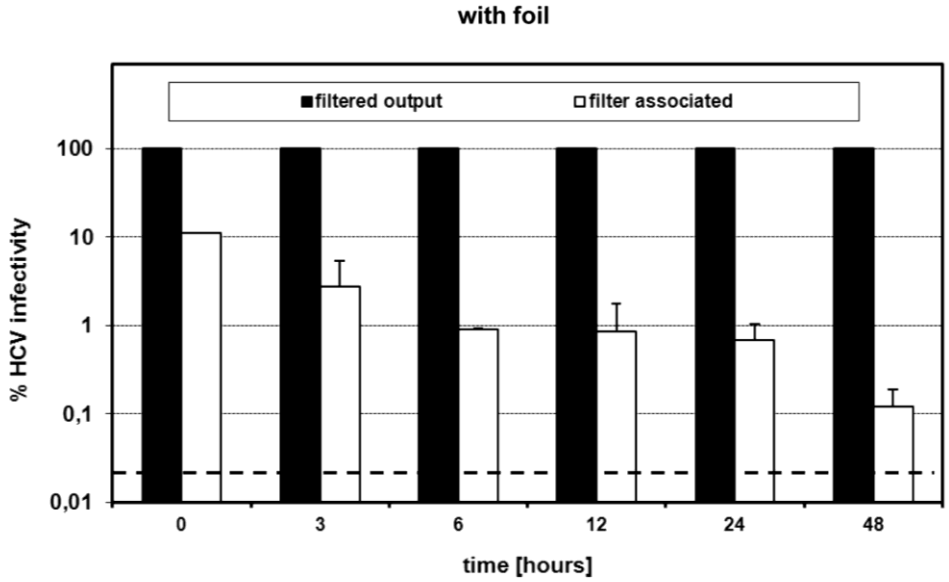




*Dörrbecker et al. Journal of Infectious Diseases 2013*

# *Transmission of Hepatitis C virus among injecting drug users: viral stability and association with drug preparation equipment*

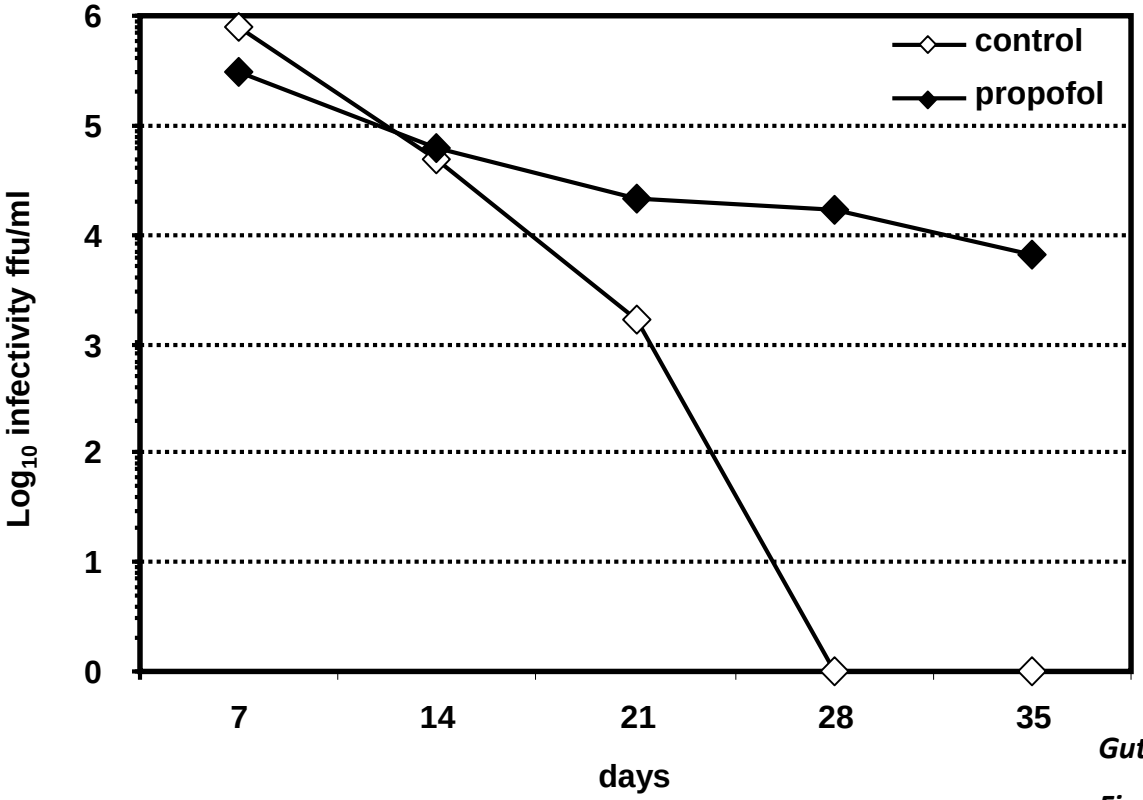


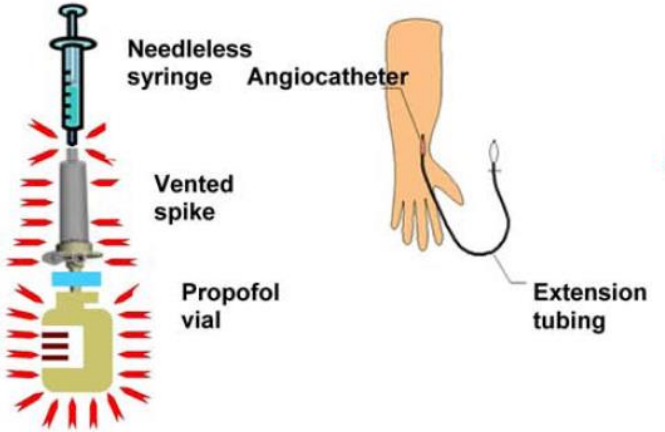




*Dörrbecker et al. Journal of Infectious Diseases 2013*

# *HCV transmission by anaesthetica*


*Gutelius et al. Gastroenterology 2010*

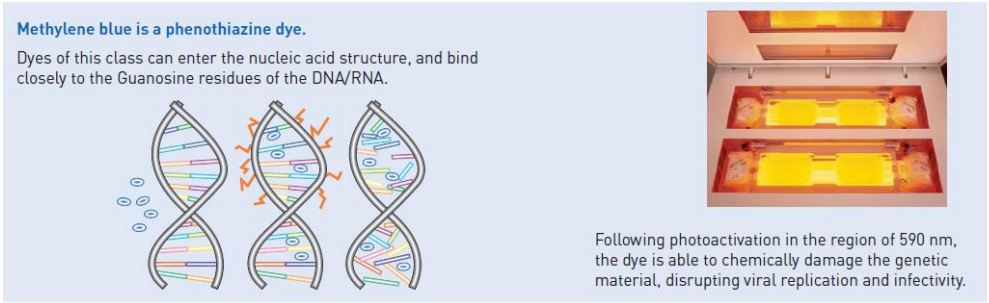
*Fischer et al. Clinical Infectious Diseases 2010*

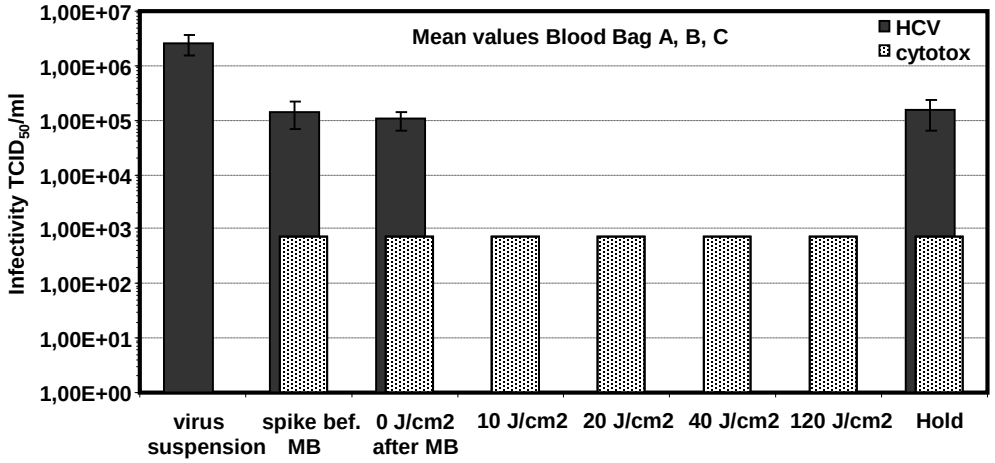
*Steinmann et al. Clinical Infectious Diseases 2011*

*Behrendt et al. American Journal of Infection Control 2013*

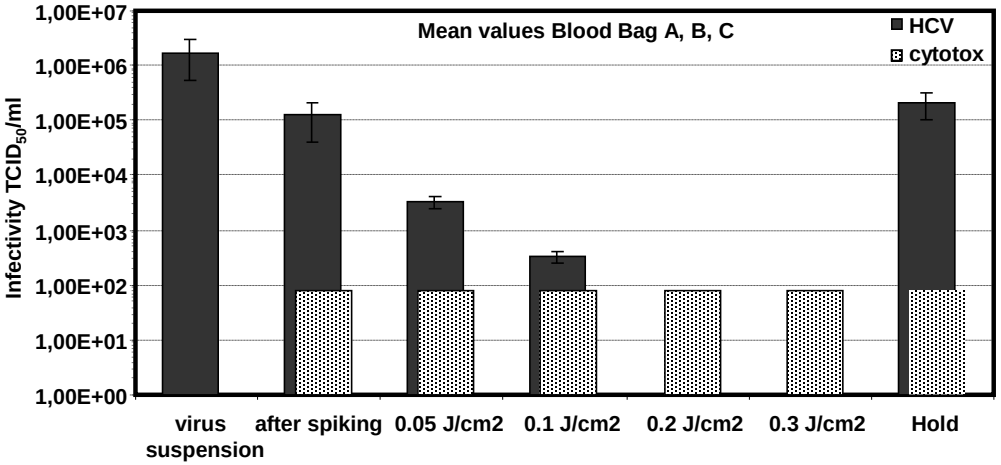
# *Inactivation of HCV in blood products*

Deutsches Rotes Kreuz




| Sample | $log_{10}$ $TCID_{50}$ ± SD | $log_{10}$ reduction factor |
|---|---|---|
| spike bef. MB | 5.41 ± 0.22 | |
| 0 J/cm² after MB | 5.29 ± 0.16 | 0.12 |
| 10 J/cm² | ≤3.15 | ≥ 2.26 |
| 20 J/cm² | ≤3.15 | ≥ 2.26 |
| 40 J/cm² | ≤1.58 | ≥ 3.83 |
| 120 J/cm² | ≤1.58 | ≥ 3.83 |




| Sample | $log_{10}$ $TCID_{50}$ ± SD | $log_{10}$ reduction factor |
|---|---|---|
| after spiking | 5.61 ± 0.54 | |
| 0.05 J/cm² | 3.80 ± 0.12 | 1.81 |
| 0.1 J/cm² | 2.81 ± 0.12 | 2.80 |
| 0.2 J/cm² | ≤ 0.62 | ≥4.99 |

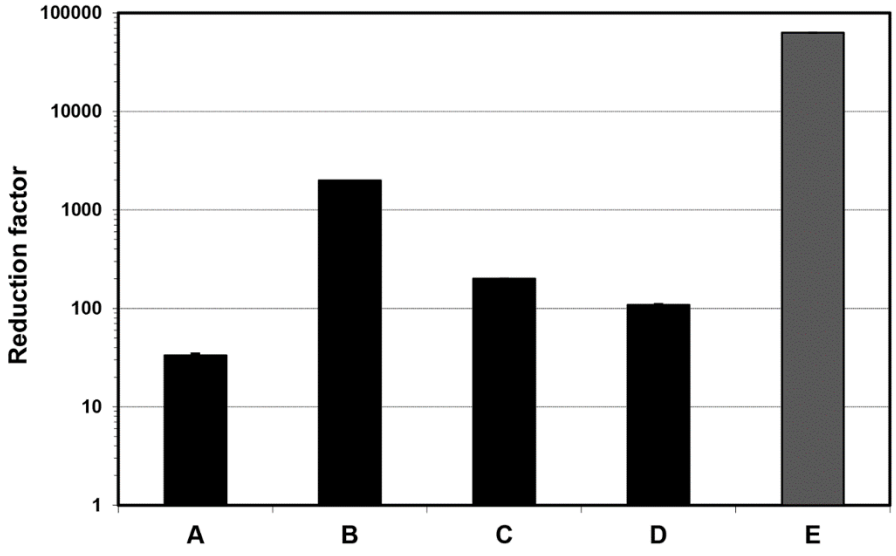
# *Influence of tattoo ink on HCV infectiousness*

HEPATOLOGY
Official Journal of the American Association for the Study of Liver Diseases

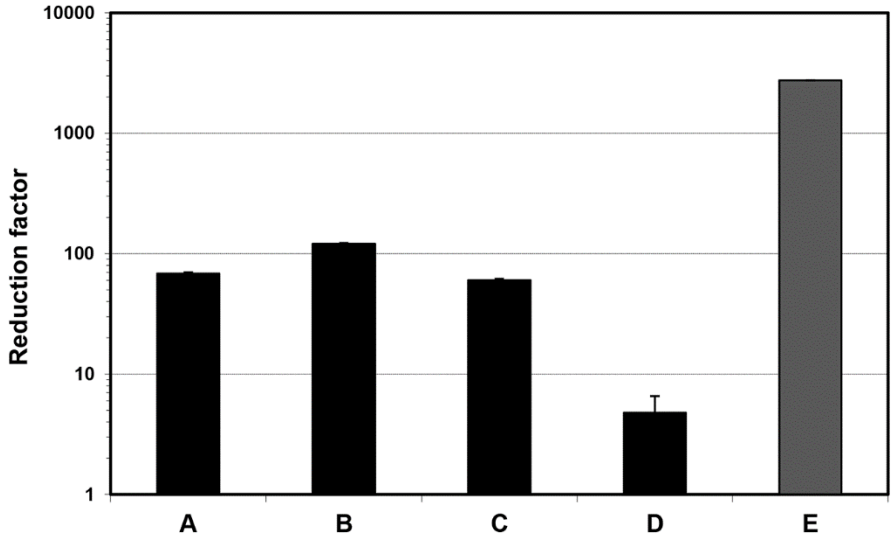
VIRAL HEPATITIS

## Association of Tattooing and Hepatitis C Virus Infection: A Multicenter Case-Control Study

Kerrilynn Carney,[1] Sameer Dhalla,[2] Ayse Aytaman,[4,5] Craig T. Tenner,[1,3] and Fritz Francois[1,6]

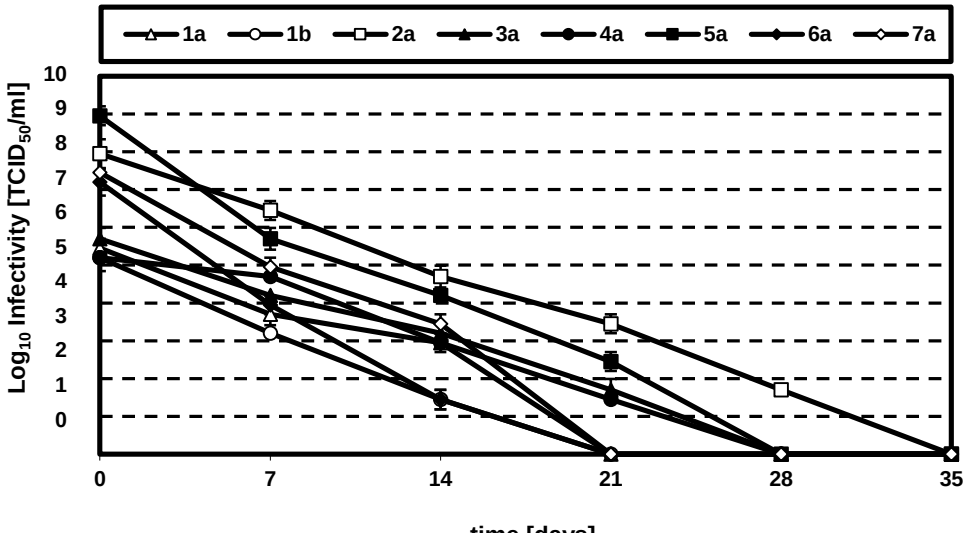


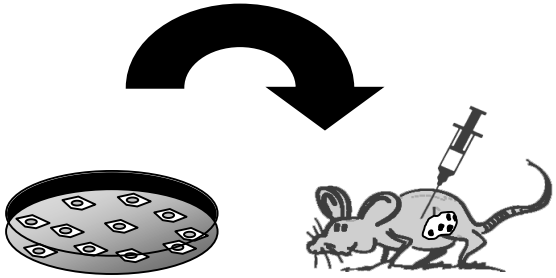

*suspension test*

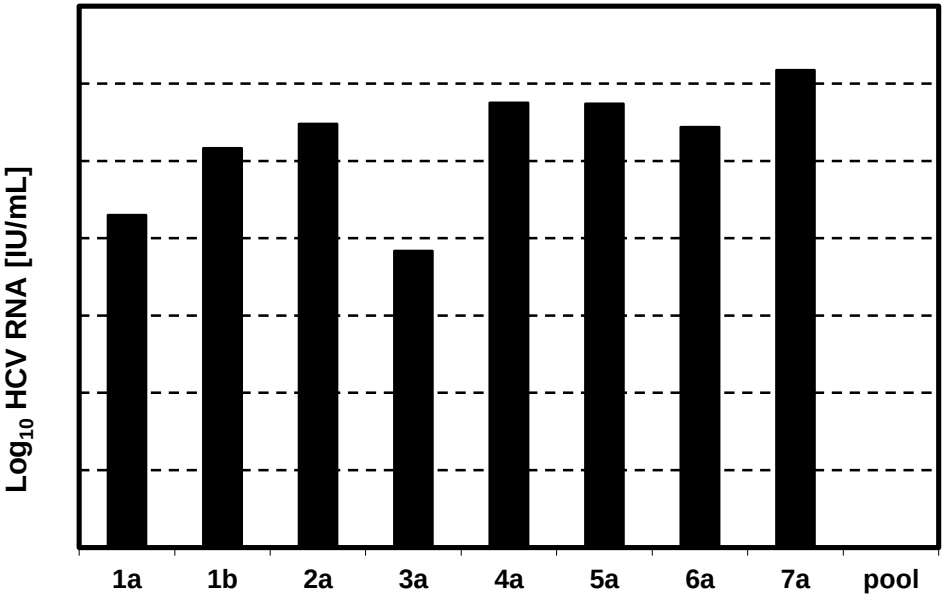



*carrier test*

# *Thermo-stability of seven Hepatitis C virus genotypes in vitro and in vivo*

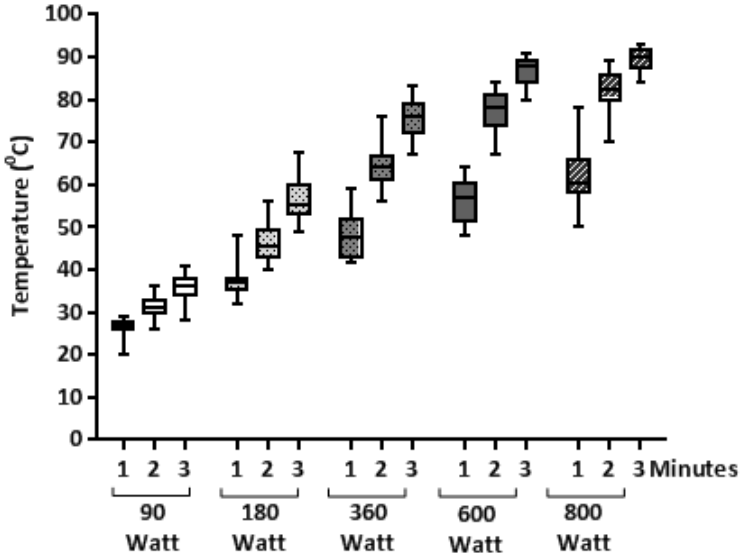


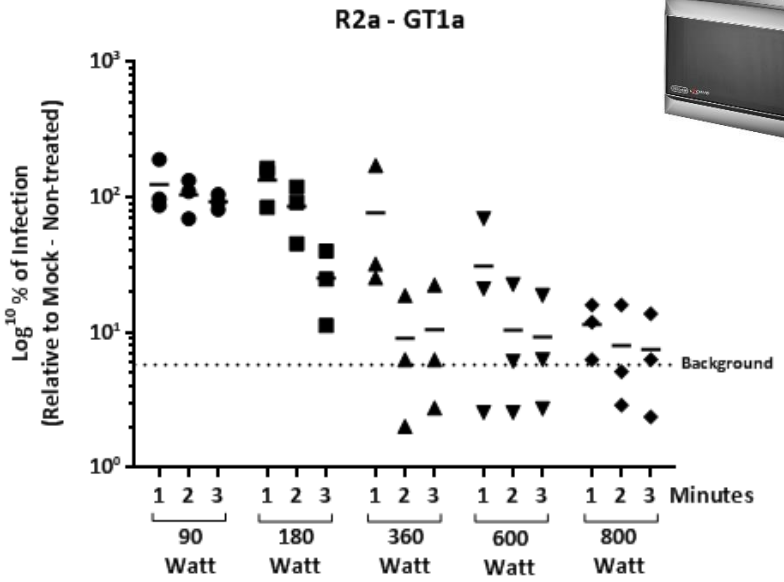



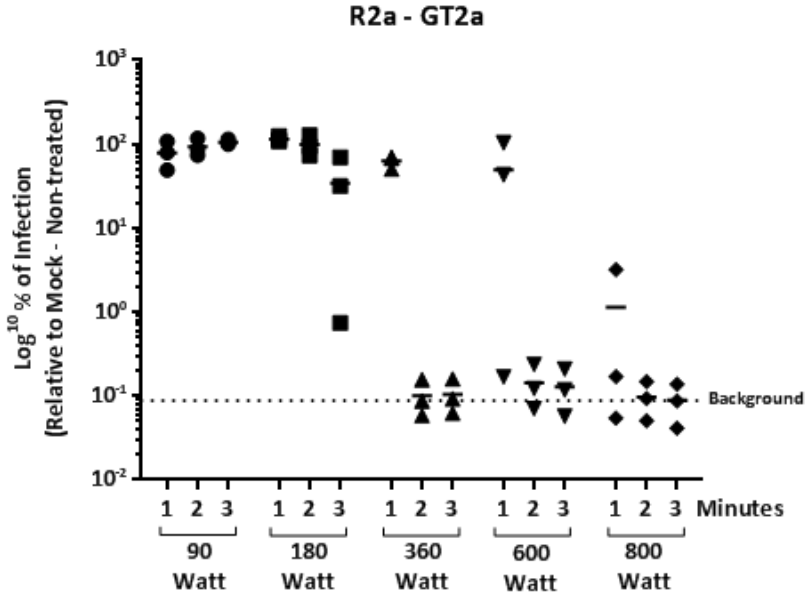


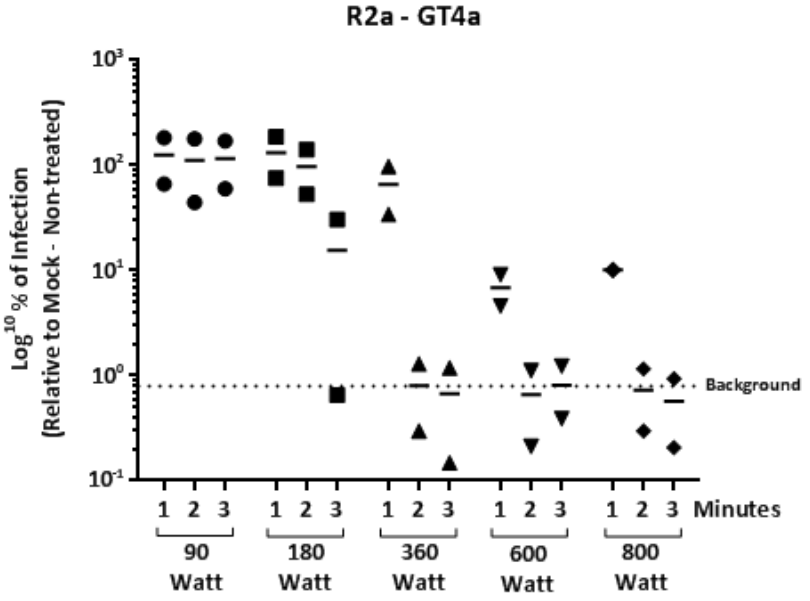

*Dörrbecker et al. Journal of Viral Hepatitis 2013*

# Inactivation of HCV and HIV by microwave!?



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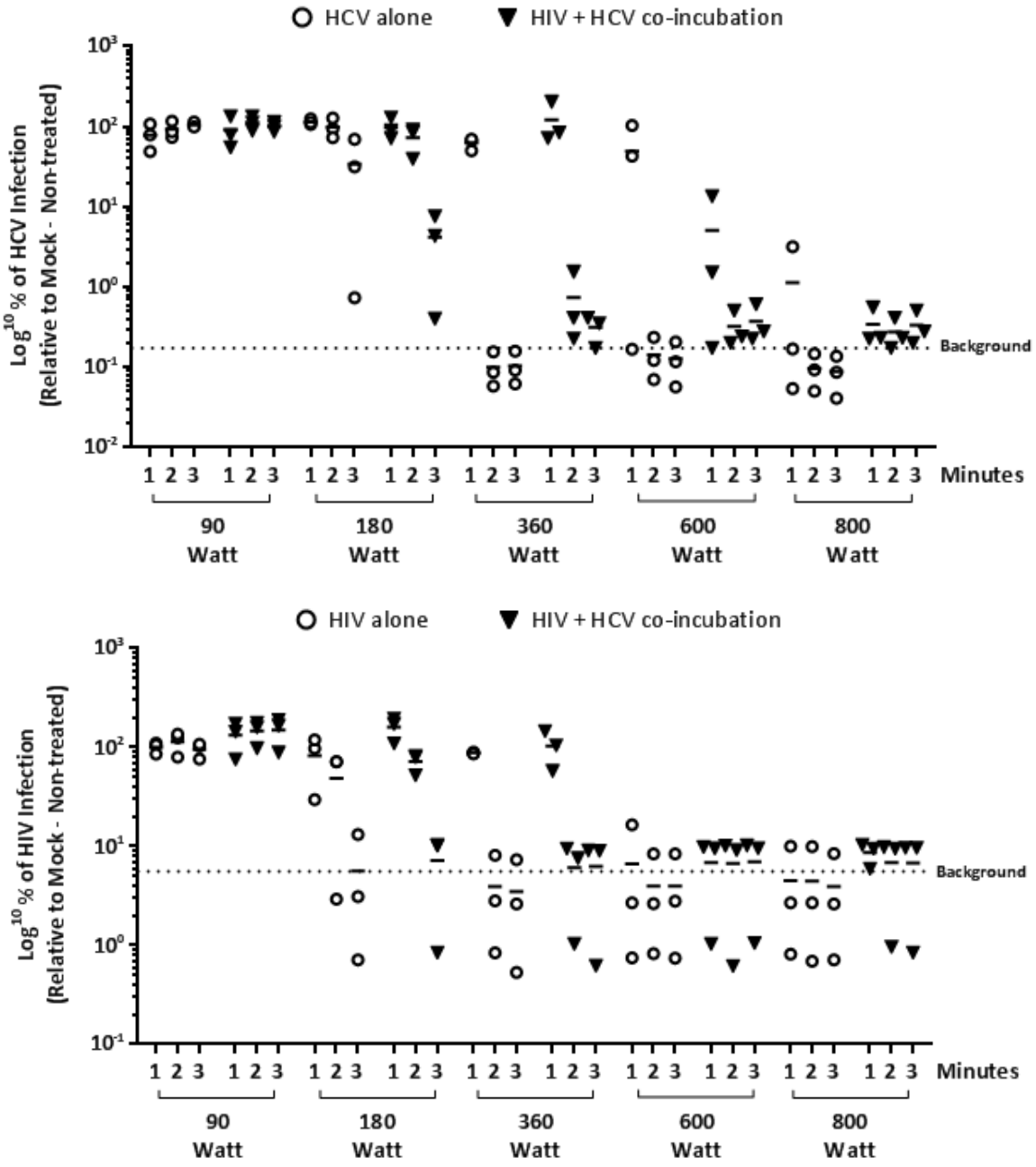
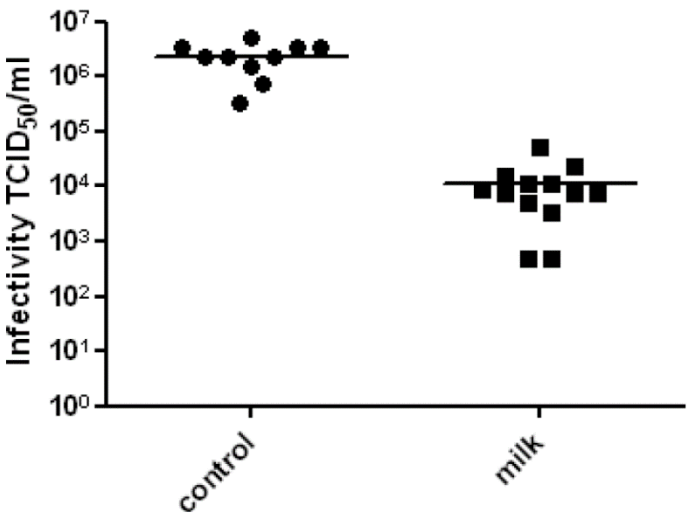
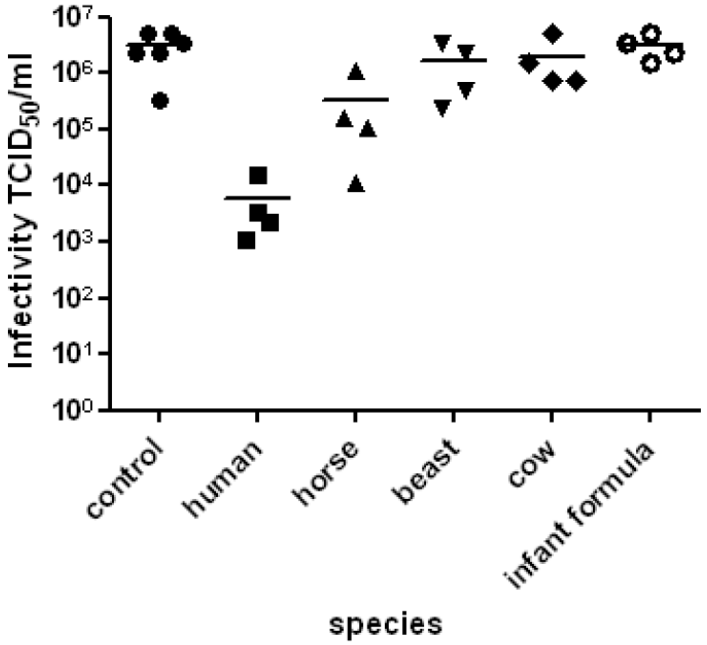
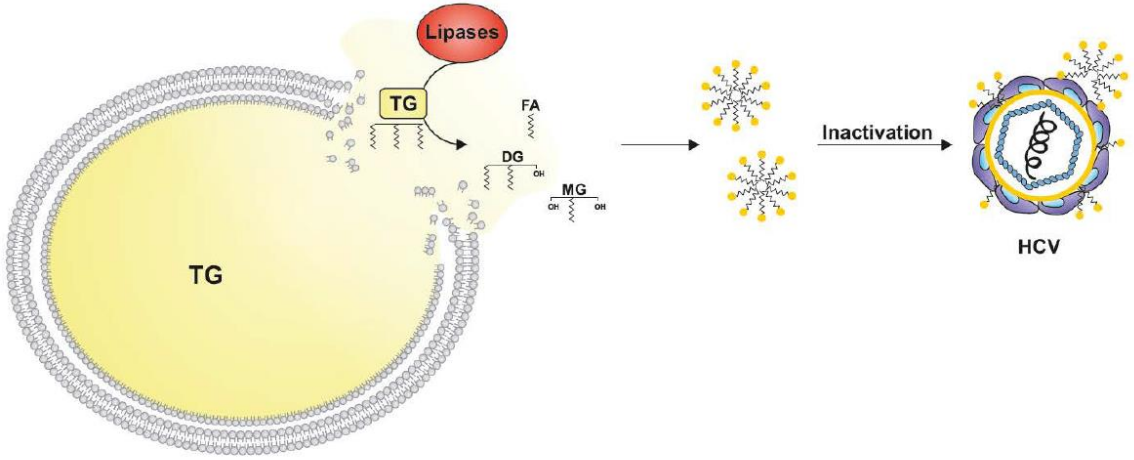


# *Inactivation of HCV in human mother's milk*




| Fatty acid | | Conc. [mg/ml] | RF | SD |
|---|---|---|---|---|
| Butyric acid | 4:0 | 10 | - 0.17 | ± 0.53 |
| Caproic acid | 6:0 | 10 | ≥ 3.71 | - |
| Caprylic acid | 8:0 | 10 | ≥ 3.71 | - |
| Capric acid | 10:0 | 5 | ≥ 3.71 | - |
| Lauric acid | 12:0 | 5 | ≥ 3.71 | - |
| Myristic acid | 14:0 | 20 | 0.96 | ± 0.71 |
| Palmitic acid | 16:0 | 20 | 0.58 | ± 0.18 |
| Stearic acid | 18:0 | 20 | 1.08 | ± 0.18 |
| Palmitoleic acid | 16:1 | 2 | ≥ 2.46 | ± 1.7678 |
| Oleic acid | 18:1 | 10 | ≥ 3.71 | - |
| Elaidic acid | 18:1 | 20 | 0.21 | ± 0.35 |
| Linoleic acid | 18:2 | 5 | 3.46 | ± 0.3536 |
| Linolenic acid | 18:3 | 5 | ≥ 3.71 | - |
| Arachidonic acid | 20:4 | 1 | ≥ 3.71 | - |

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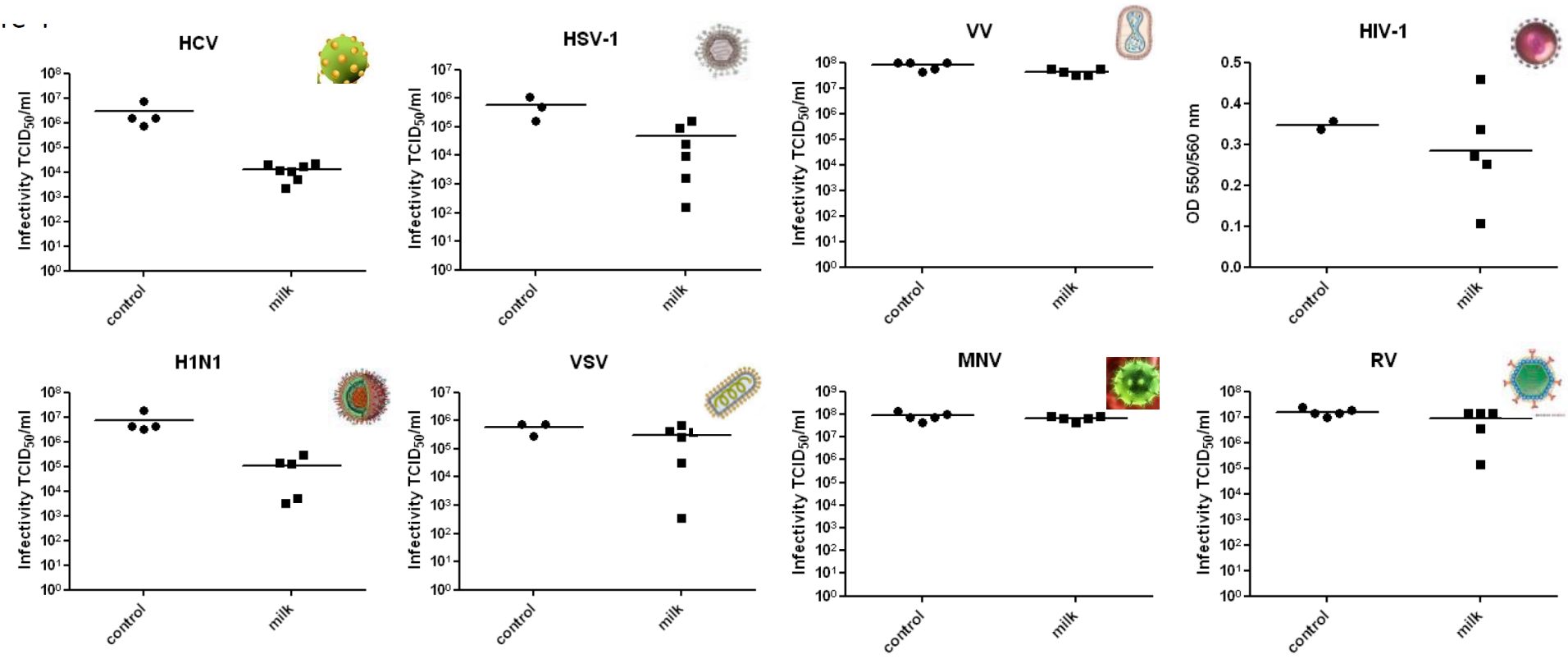


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*Editorial Jhaveri: Protection againts HCV and other env viruses: „why breast is the best"*

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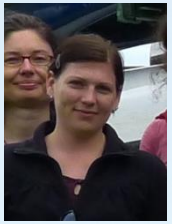
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