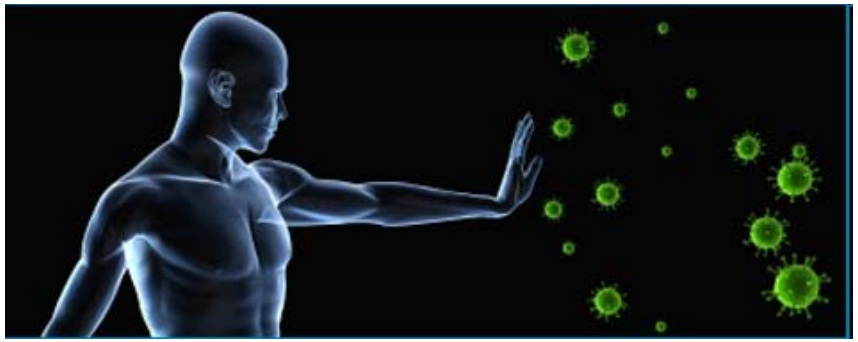


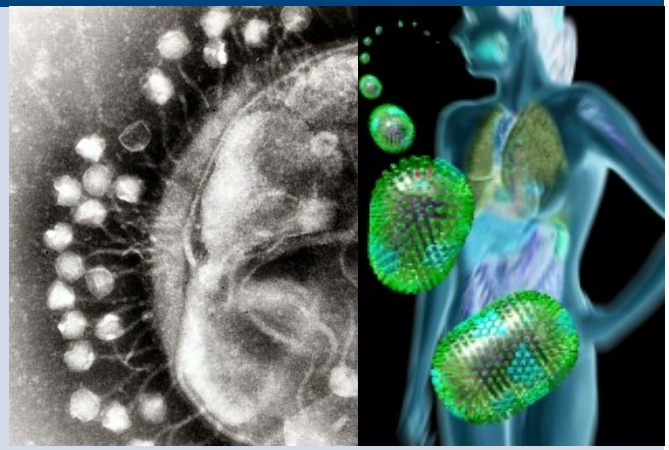
Inaktivierung von HCV und HIV

PD Dr. Eike Steinmann

Centre for Experimental and Clinical Infection Research

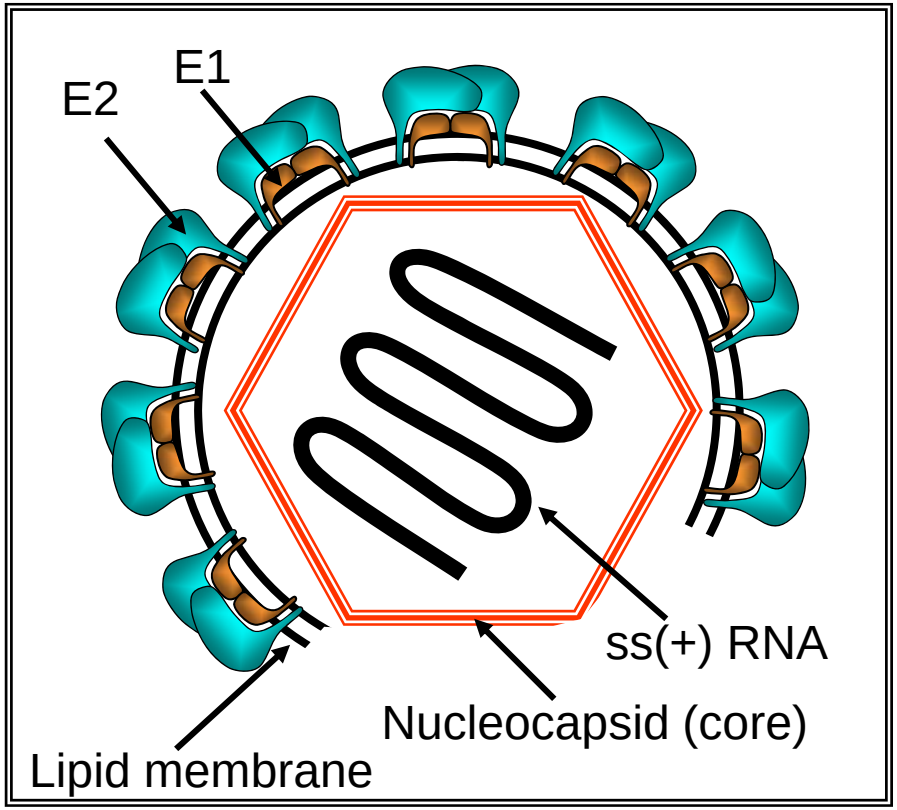
Institute of Experimental Virology, Twincore*

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



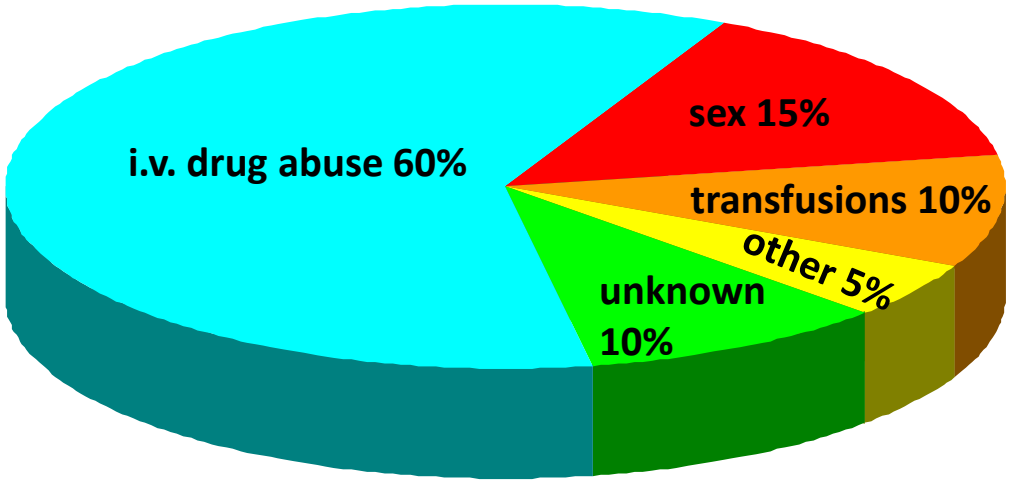
Hepatitis C Virus (HCV) Profile

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



Ways of HCV Transmissions

drug abuse



medical procedures

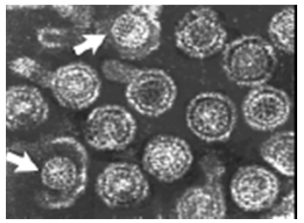
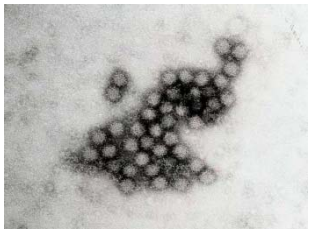
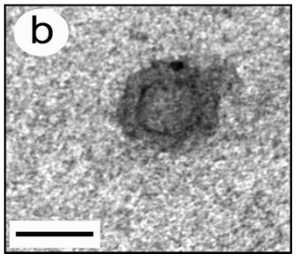
transfusion

sex

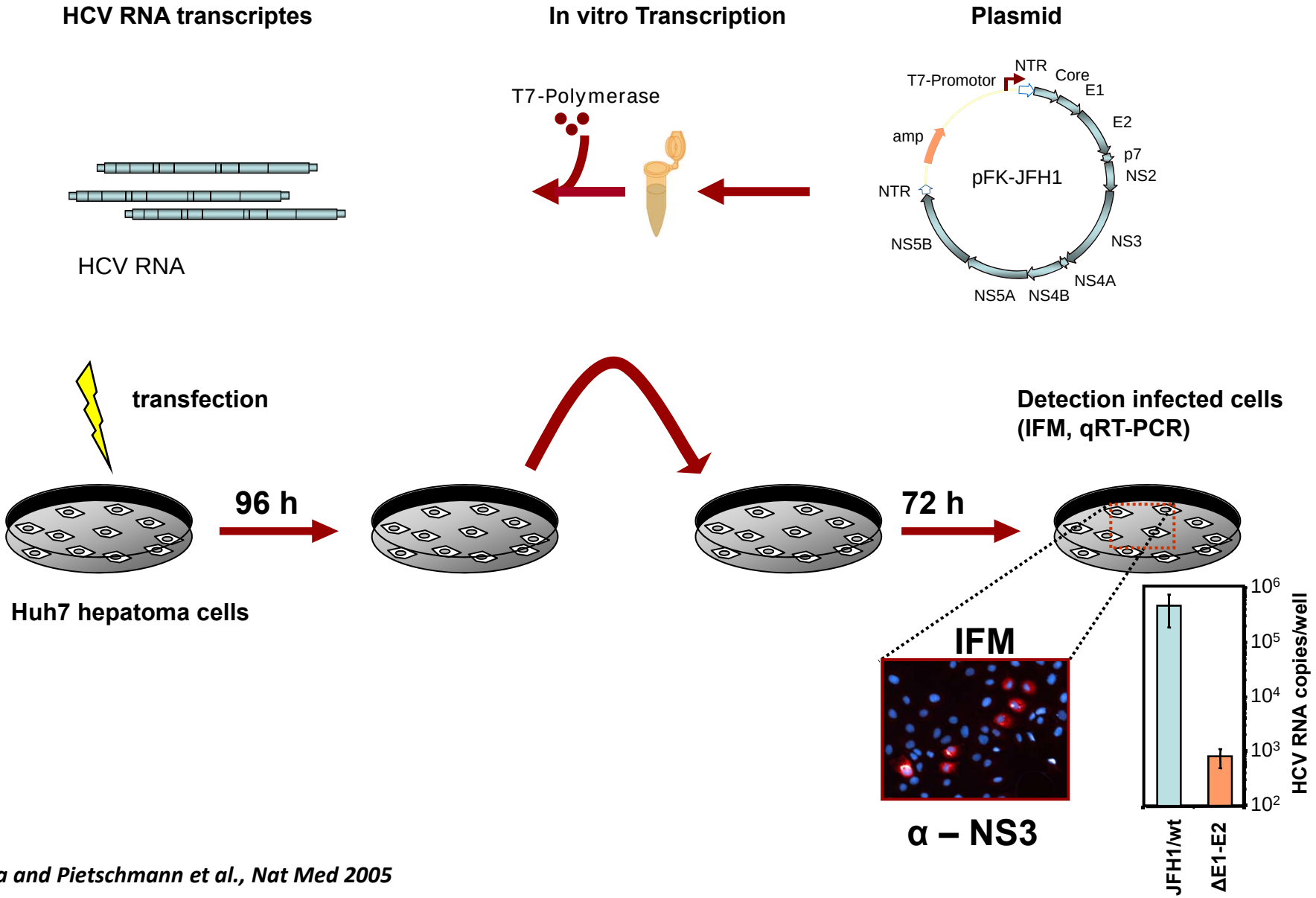
vertical

other

Virucidal testing using surrogate viruses

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

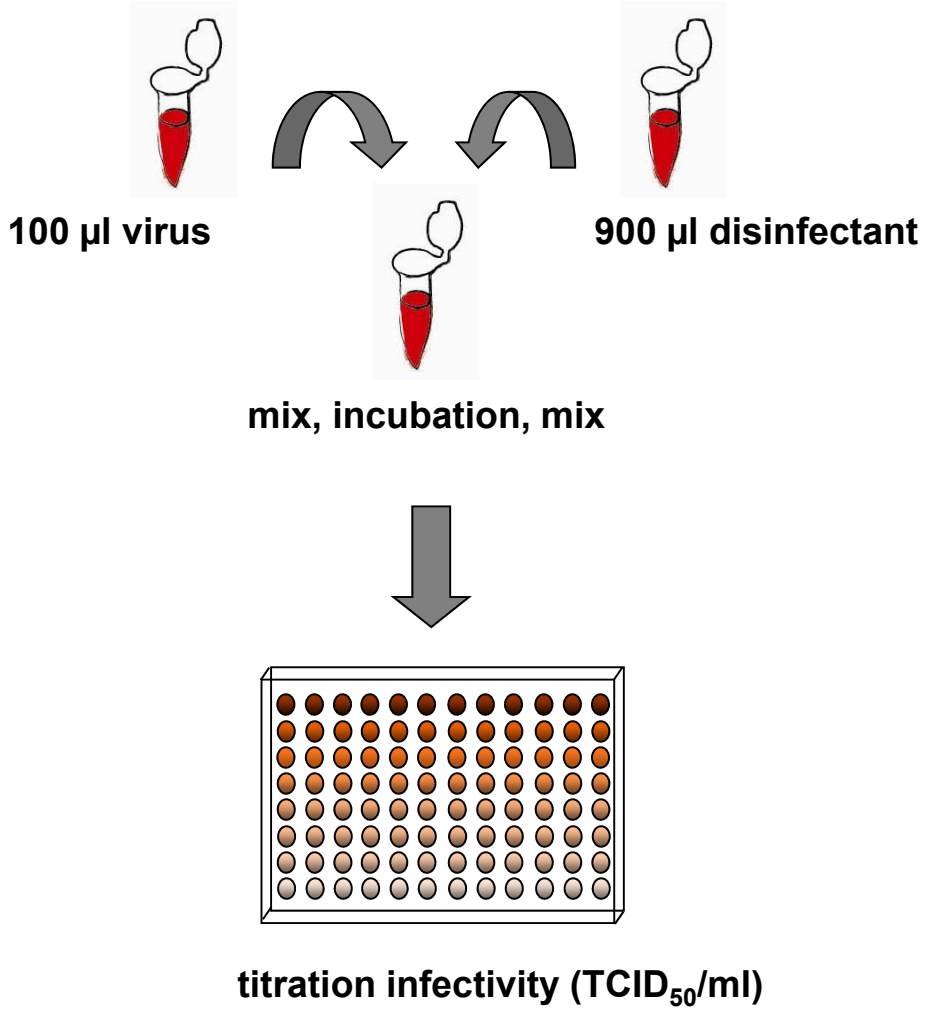
HCV infection system



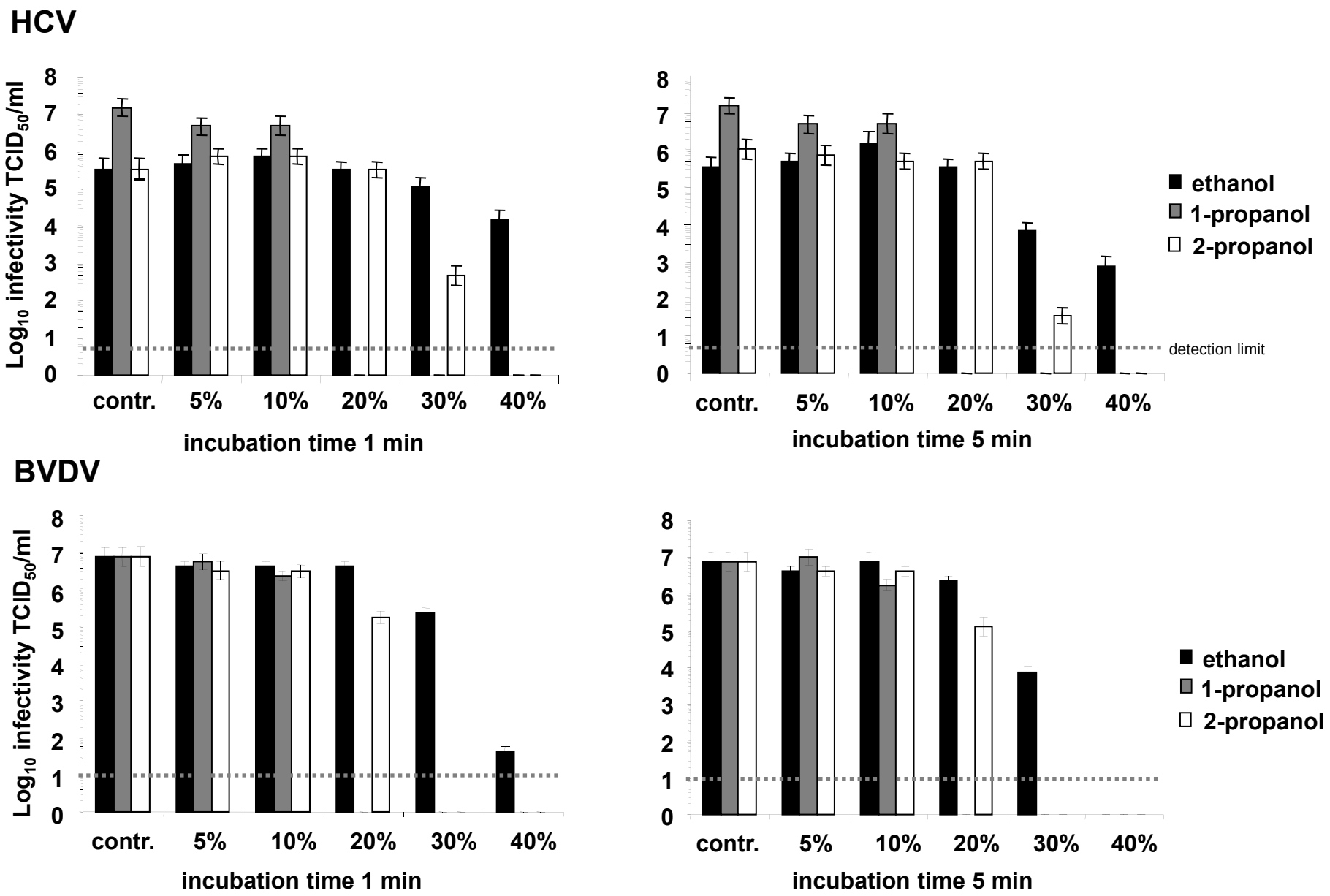
Wakita and Pietschmann et al., Nat Med 2005

Virucidal efficacy of different alcohols against HCV

Quantitative suspension:

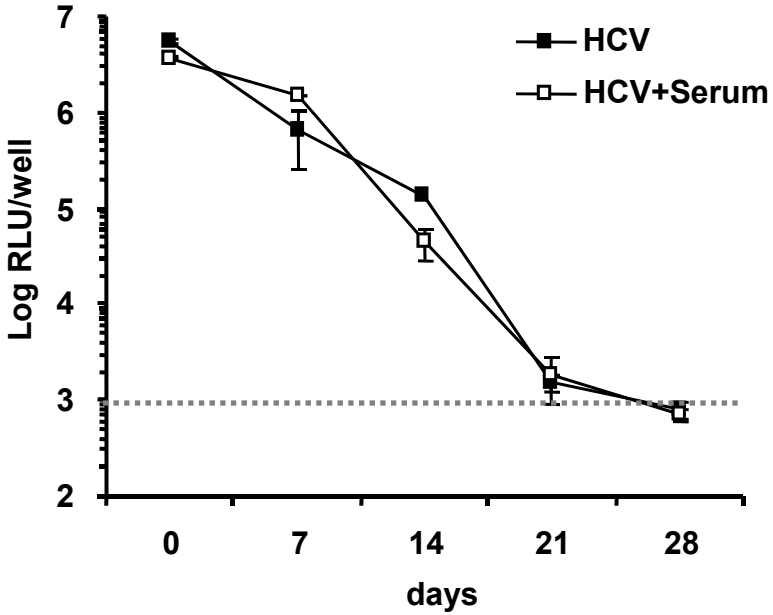


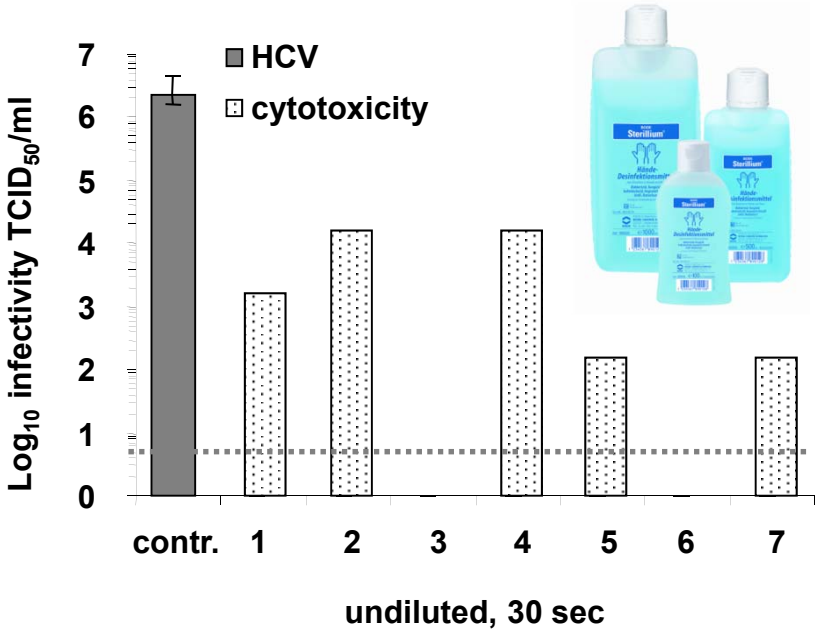
Effect of ethanol, 1-propanol and 2-propanol on HCV/BVDV

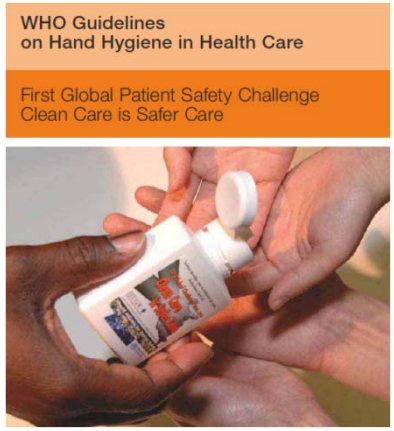


Ciesek et al. Journal of Infectious Diseases 2010

HCV stability and inactivation in suspension







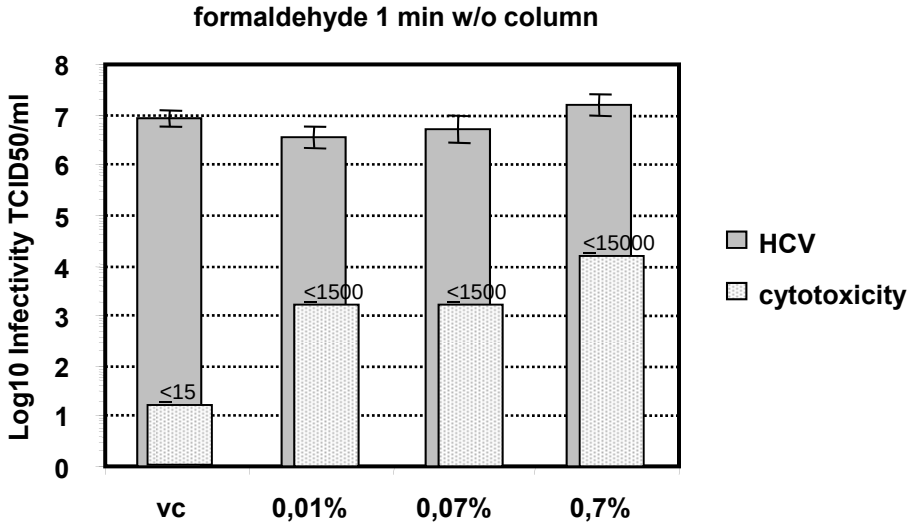
World Health Organization | Patient Safety
A World Alliance for Safer Health Care

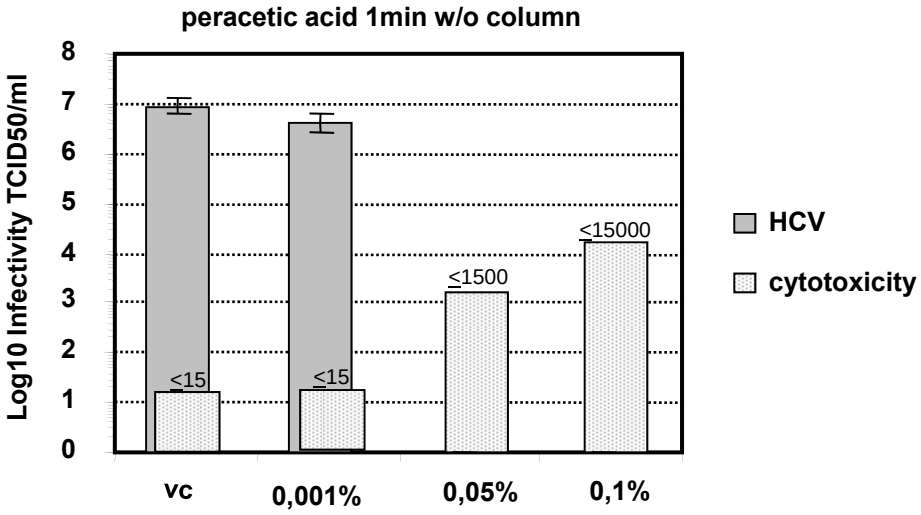
Ciesek et al. Journal of Infectious Diseases 2010

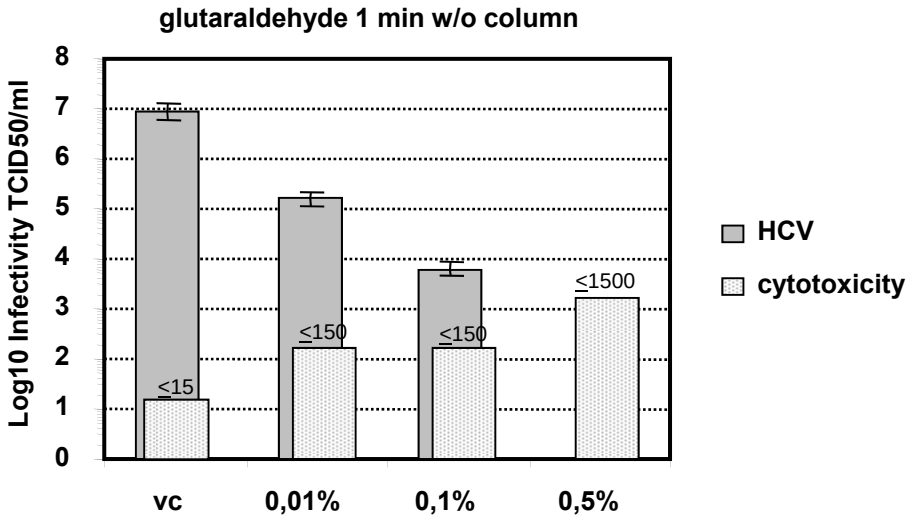
Steinmann et al. American Journal of Infection Control 2010

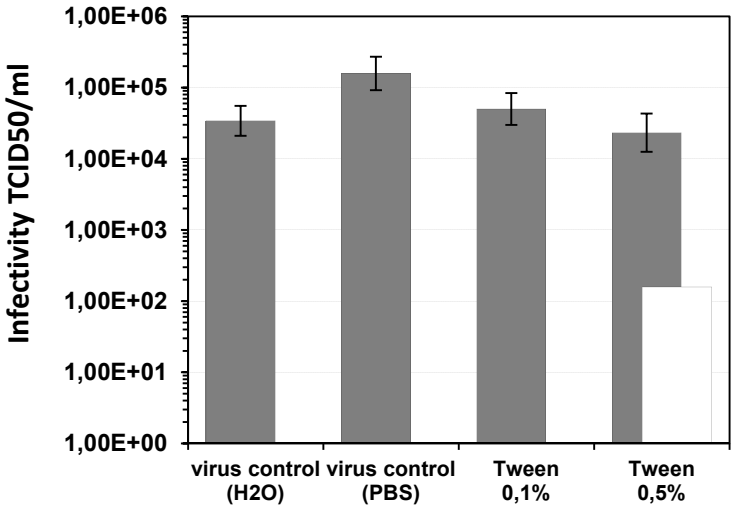
Steinmann et al. Antimicrobial Resistance and Infection Control 2014

Effect of different disinfectants against HCV

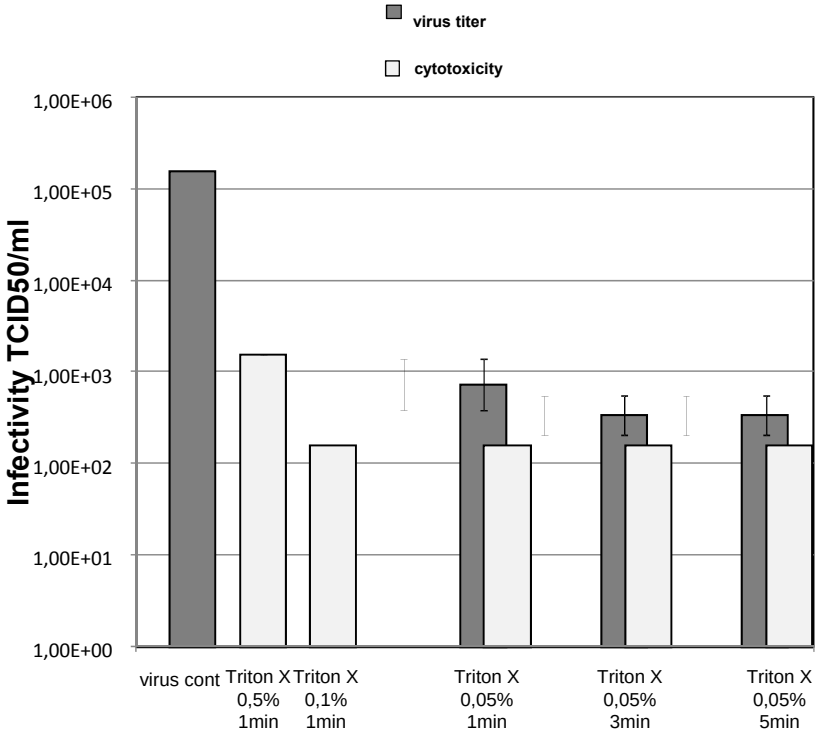


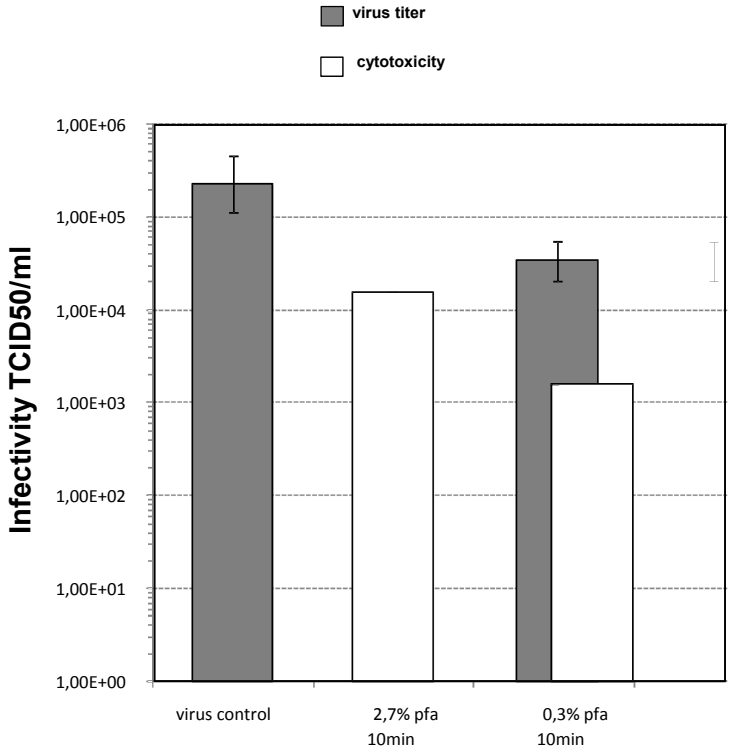




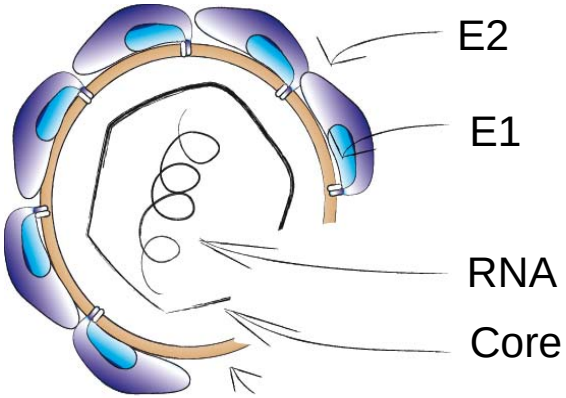


Inactivation of HCV: Triton-X and paraformaldehyde

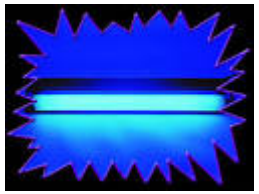




Mechanisms of viral inactivation methods against hepatitis C virus



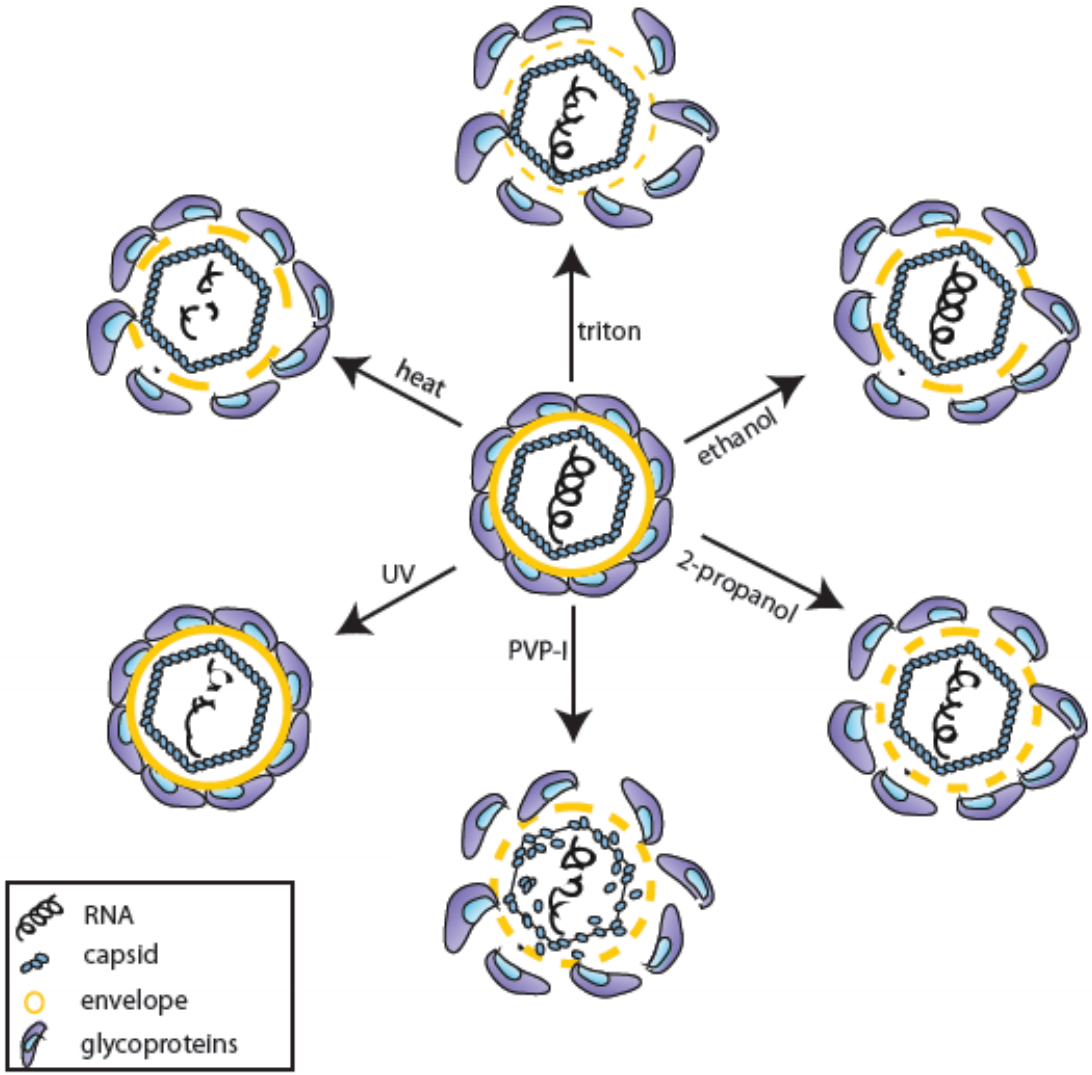
- Triton
- Ethanol
- 2-Propanol
- PVP-I



- UV

- Heat

Mechanisms of hepatitis C virus inactivation



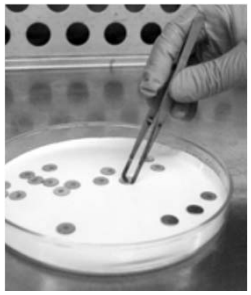
Pfaender et al. Applied and Environmental Microbiology 2015

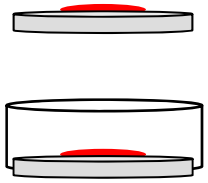
Establishment of a HCV carrier assay

virusinoculum

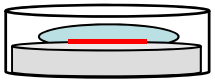
50 µL

(drying)





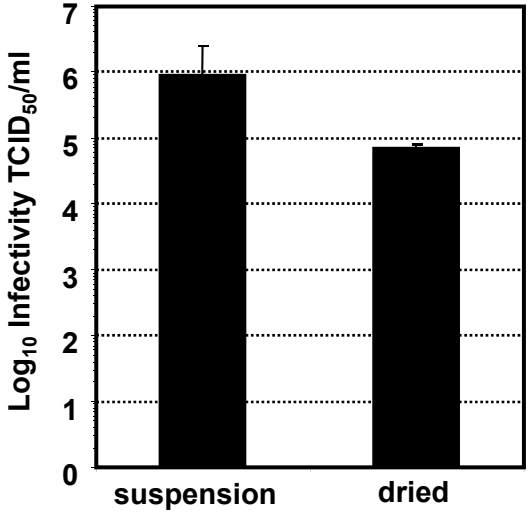
100 µL
test substance

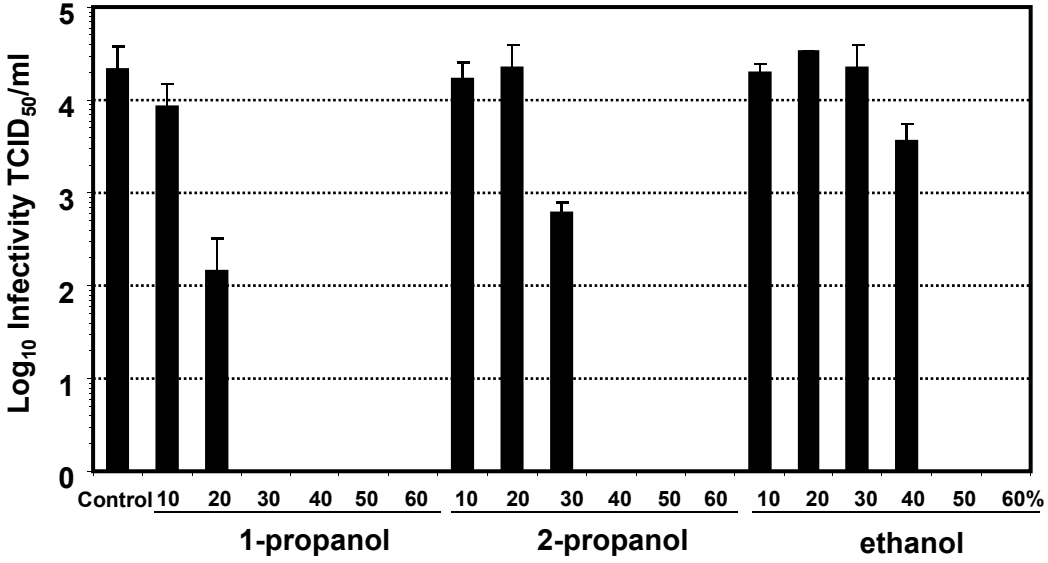


(incubation for 1 min)

900 µL
medium Ø FCS
(1 min vortex)

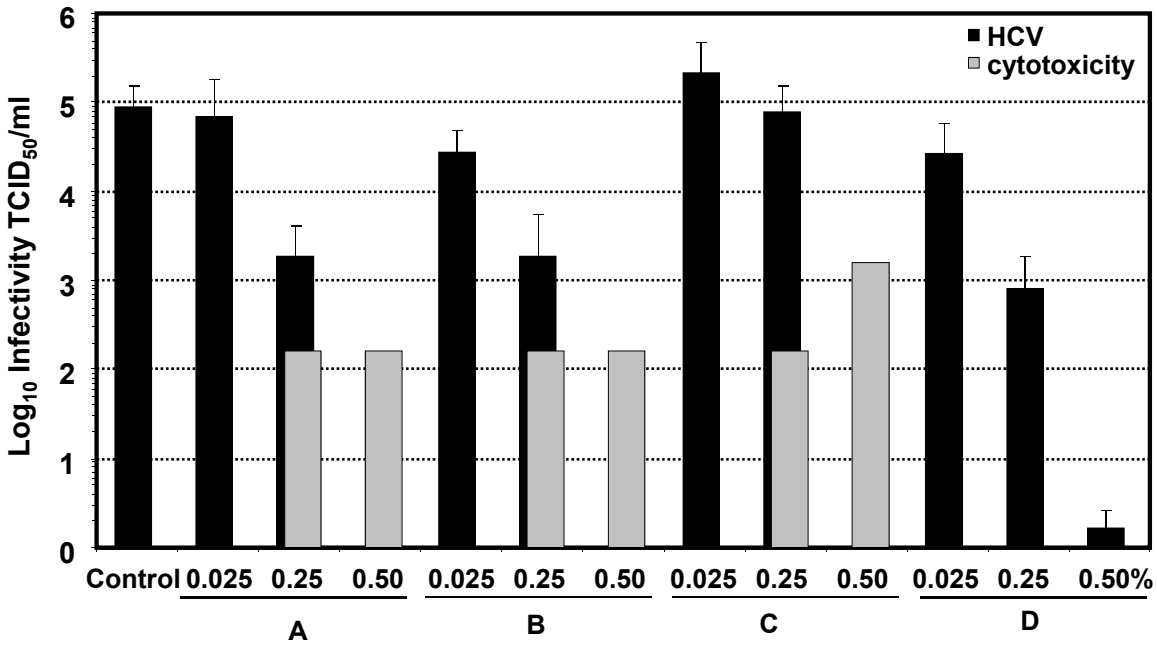
titration infectivity

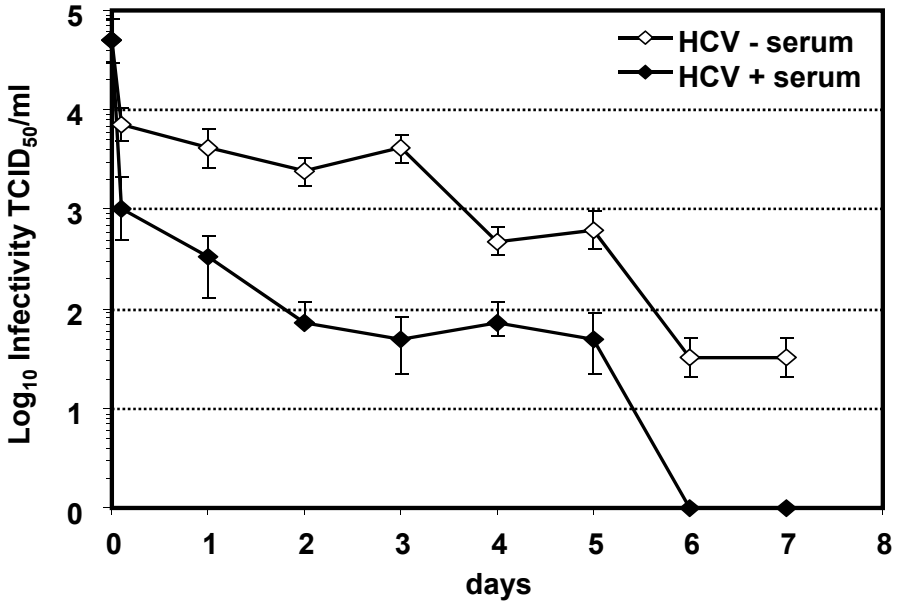


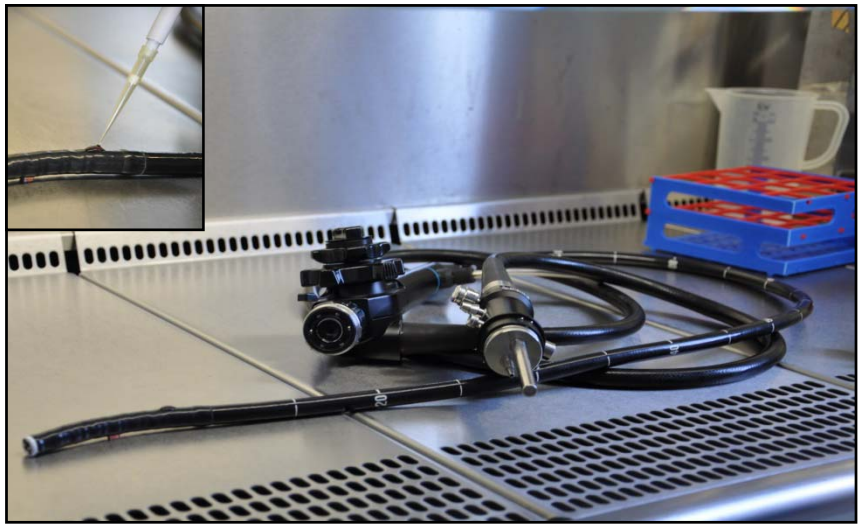


Dörrbecker et al. Journal of Infectious Diseases 2011

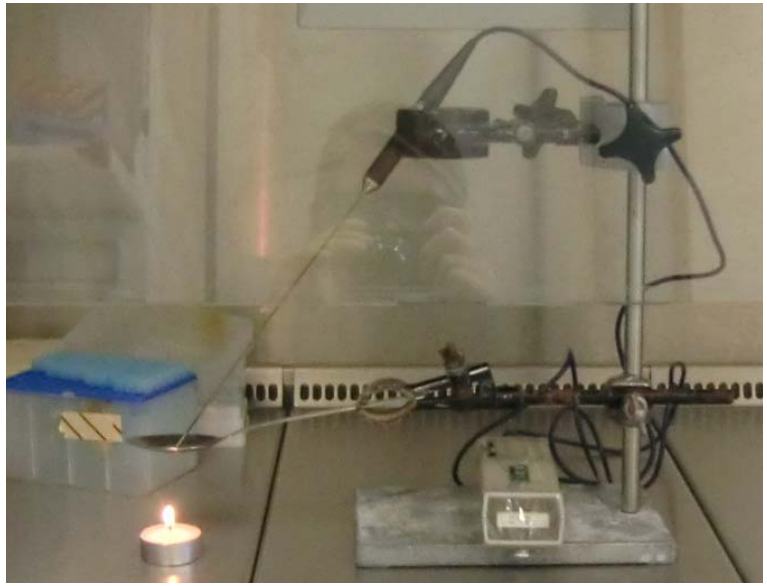
Survival of dried HCV on inanimate surfaces

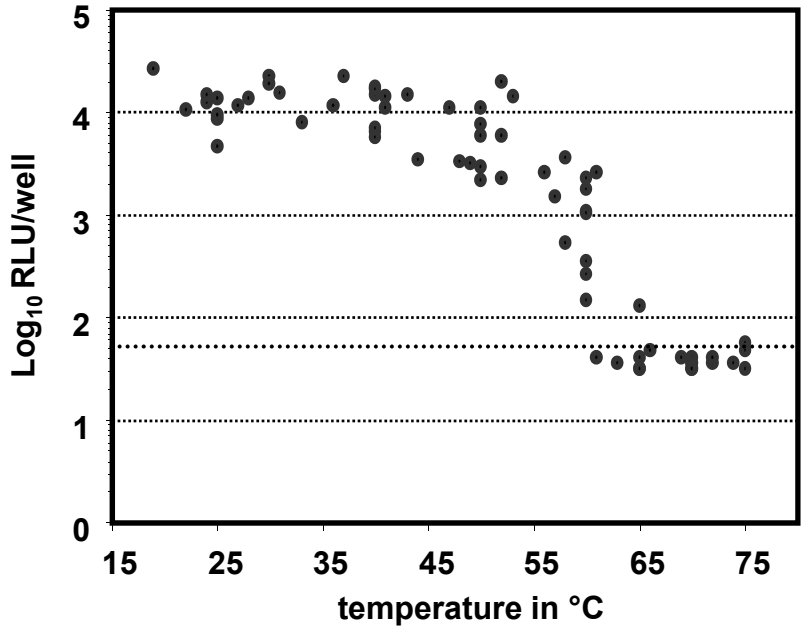






Development of a drug transmission assay

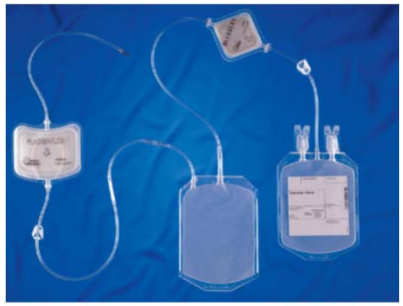


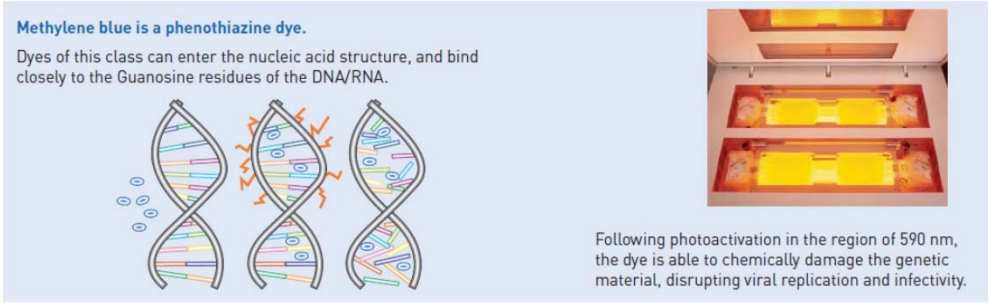


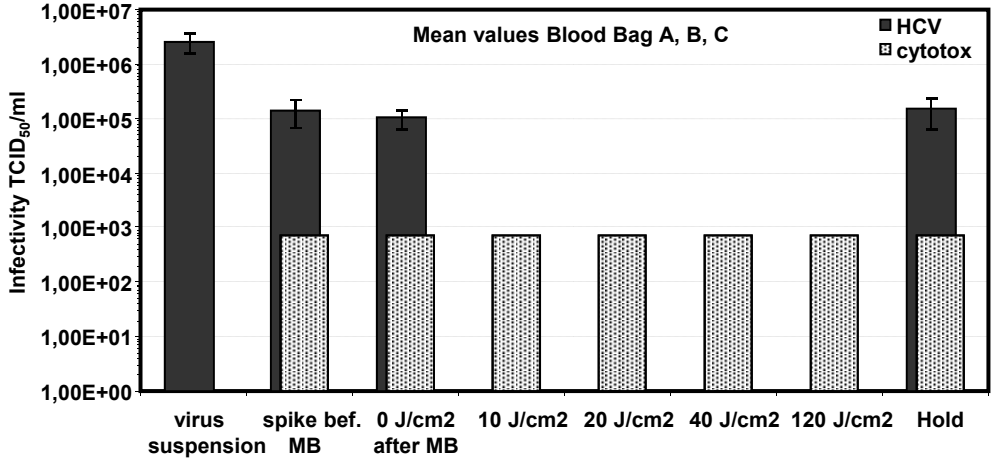
Dörrbecker et al. Journal of Infectious Diseases 2011

Inactivation of HCV in blood products

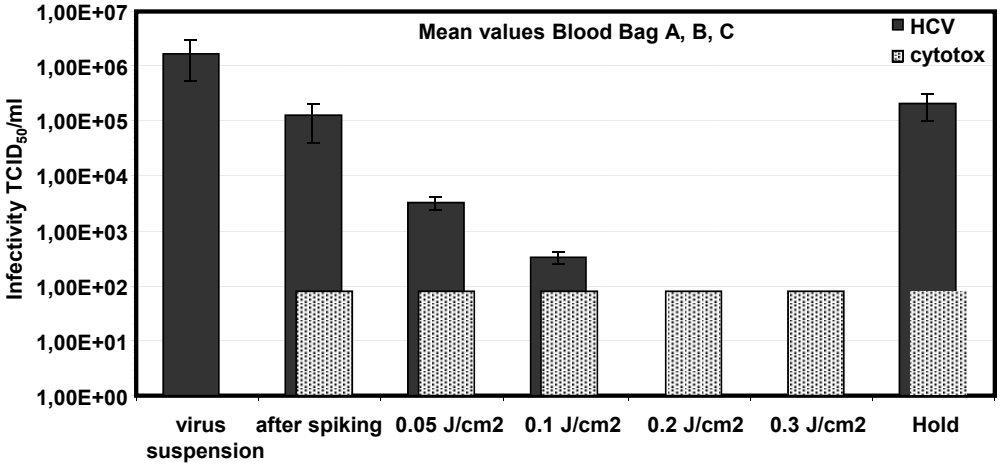
Deutsches Rotes Kreuz







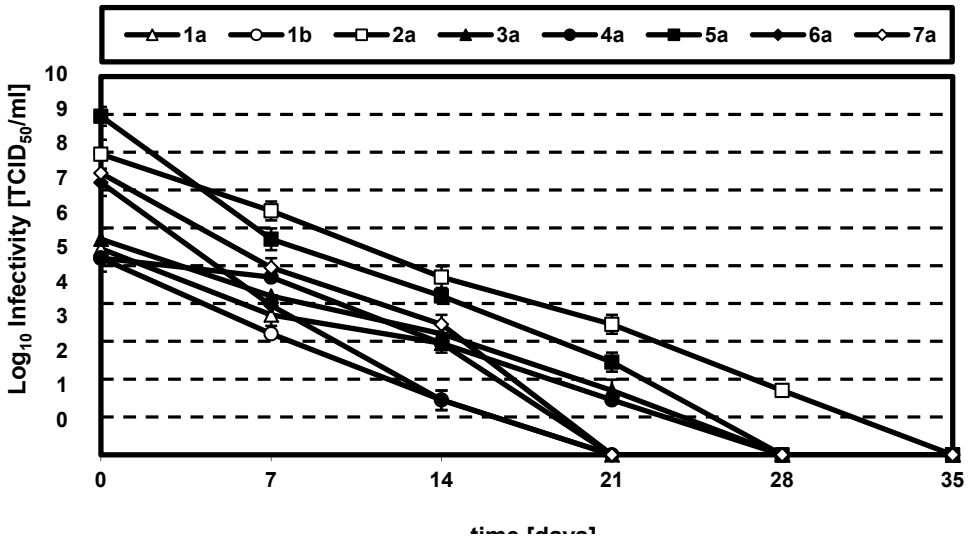
Sample	log_{10} $TCID_{50}$ ± SD	log_{10} reduction factor
spike bef. MB	5.41 ± 0.22	
0 J/cm² after MB	5.29 ± 0.16	0.12
10 J/cm²	≤3.15	≥ 2.26
20 J/cm²	≤3.15	≥ 2.26
40 J/cm²	≤1.58	≥ 3.83
120 J/cm²	≤1.58	≥ 3.83

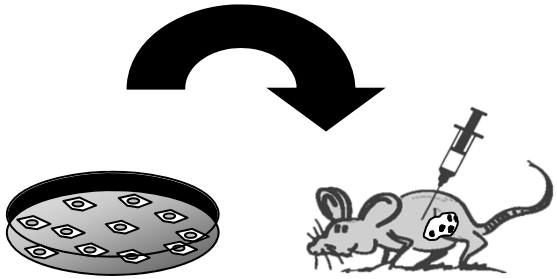


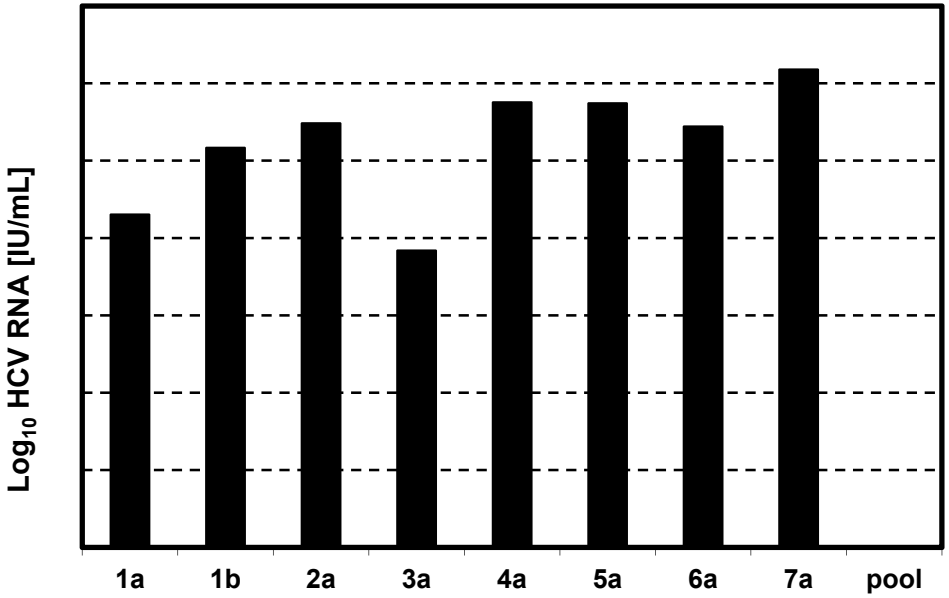
Sample	log_{10} $TCID_{50}$ ± SD	log_{10} reduction factor
after spiking	5.61 ± 0.54	
0.05 J/cm²	3.80 ± 0.12	1.81
0.1 J/cm²	2.81 ± 0.12	2.80
0.2 J/cm²	≤ 0.62	≥4.99

Steinmann et al. Transfusion 2012

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

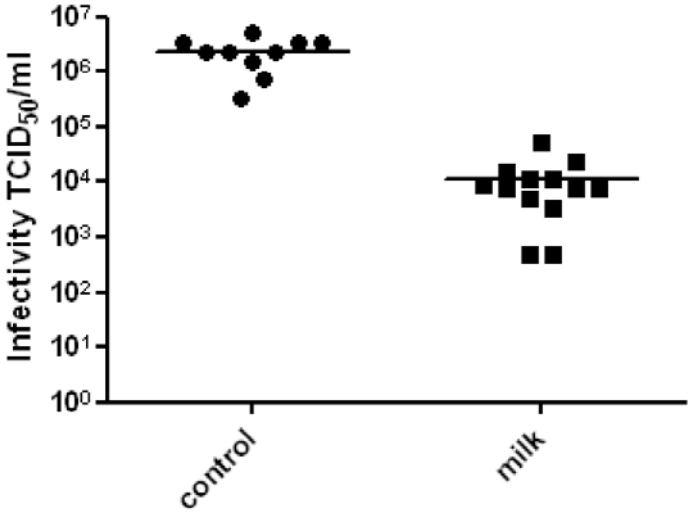


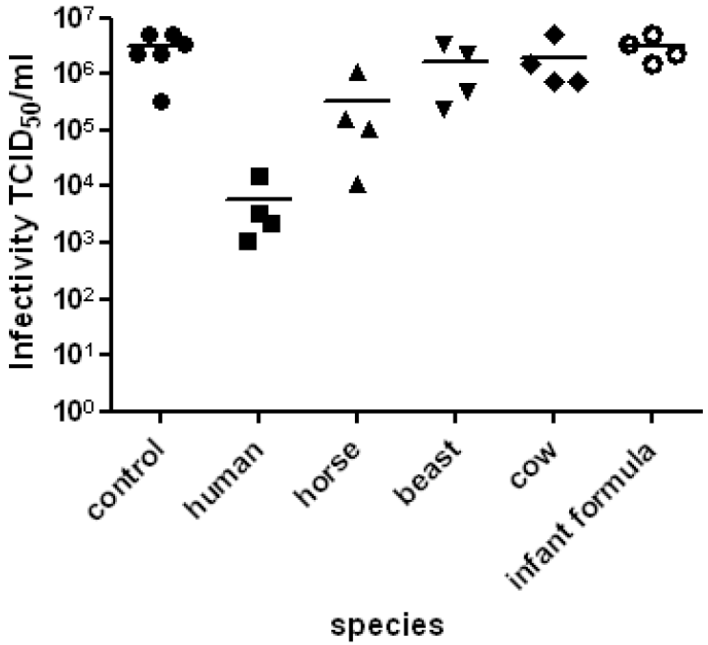




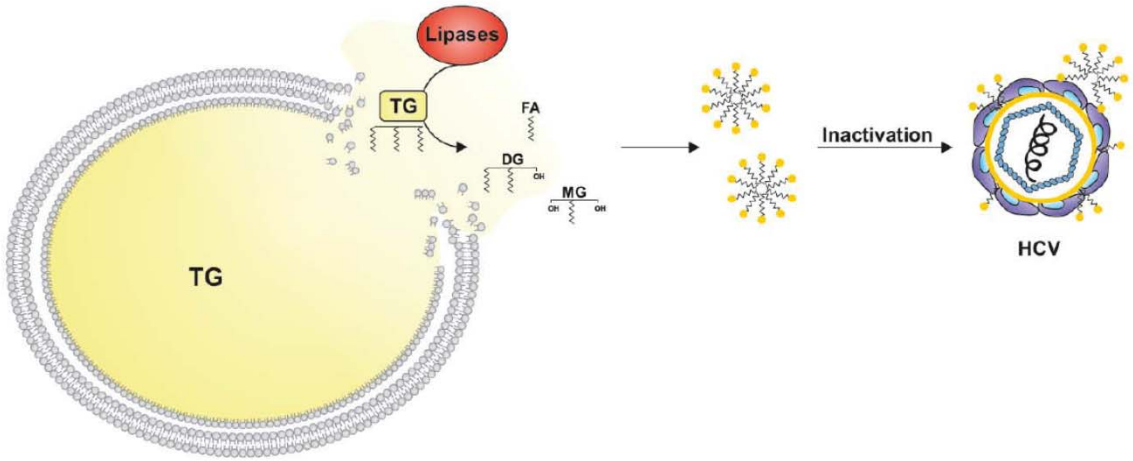
Dörrbecker et al. Journal of Viral Hepatitis 2013

Inactivation of HCV in human mother's milk



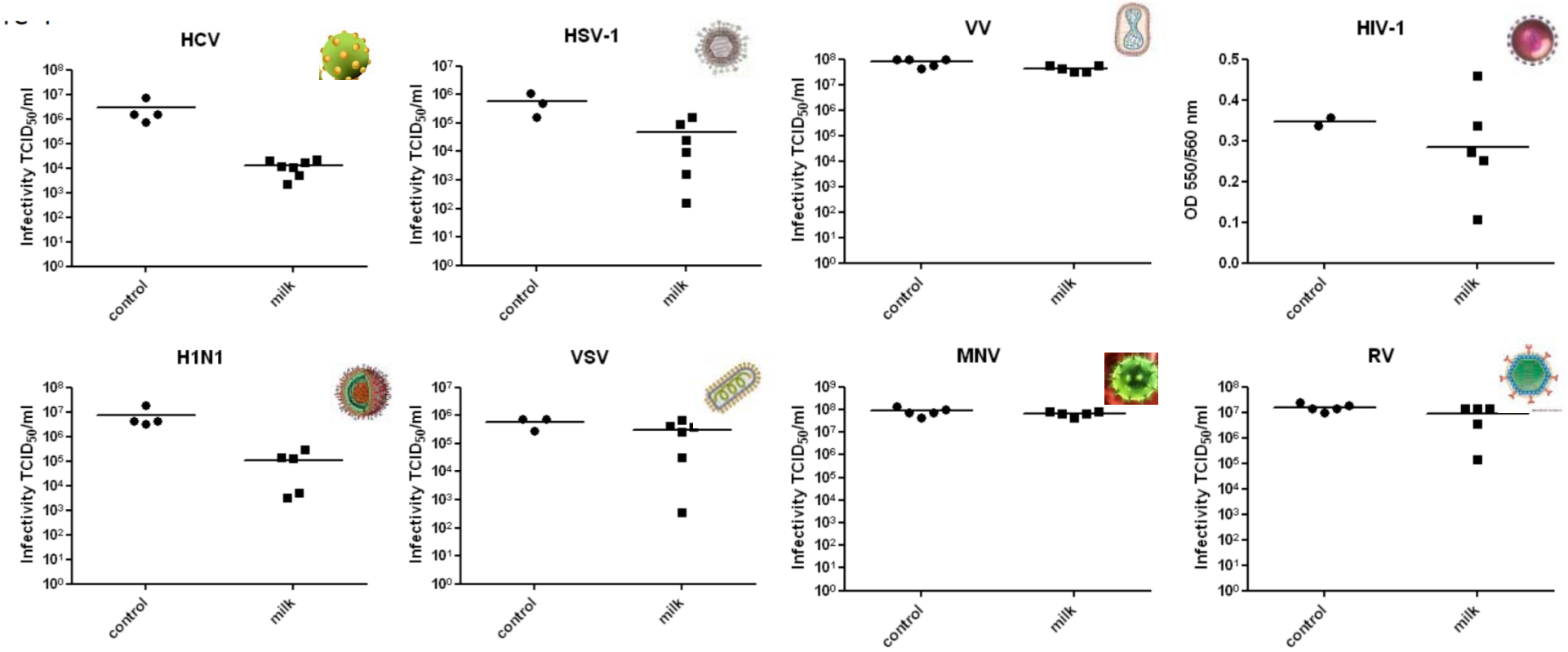


Fatty acid		Conc. [mg/ml]	RF	SD
Butyric acid	4:0	10	- 0.17	± 0.53
Caproic acid	6:0	10	≥ 3.71	-
Caprylic acid	8:0	10	≥ 3.71	-
Capric acid	10:0	5	≥ 3.71	-
Lauric acid	12:0	5	≥ 3.71	-
Myristic acid	14:0	20	0.96	± 0.71
Palmitic acid	16:0	20	0.58	± 0.18
Stearic acid	18:0	20	1.08	± 0.18
Palmitoleic acid	16:1	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	-



Pfaender et al. Journal of Infectious Diseases 2013

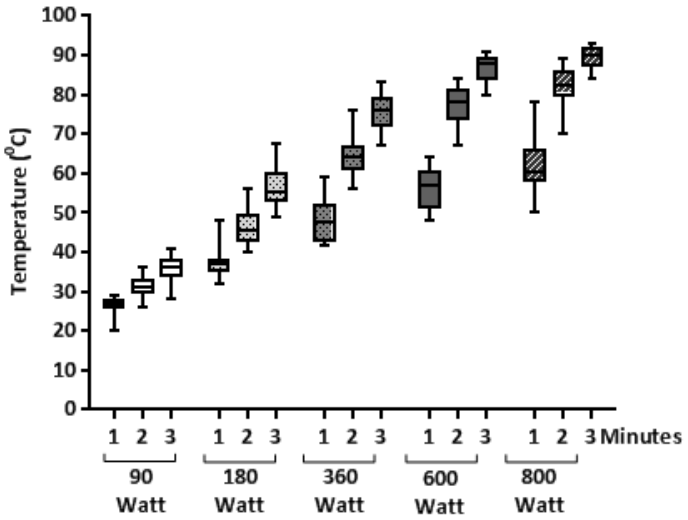
Inactivation of HCV in human mother's milk

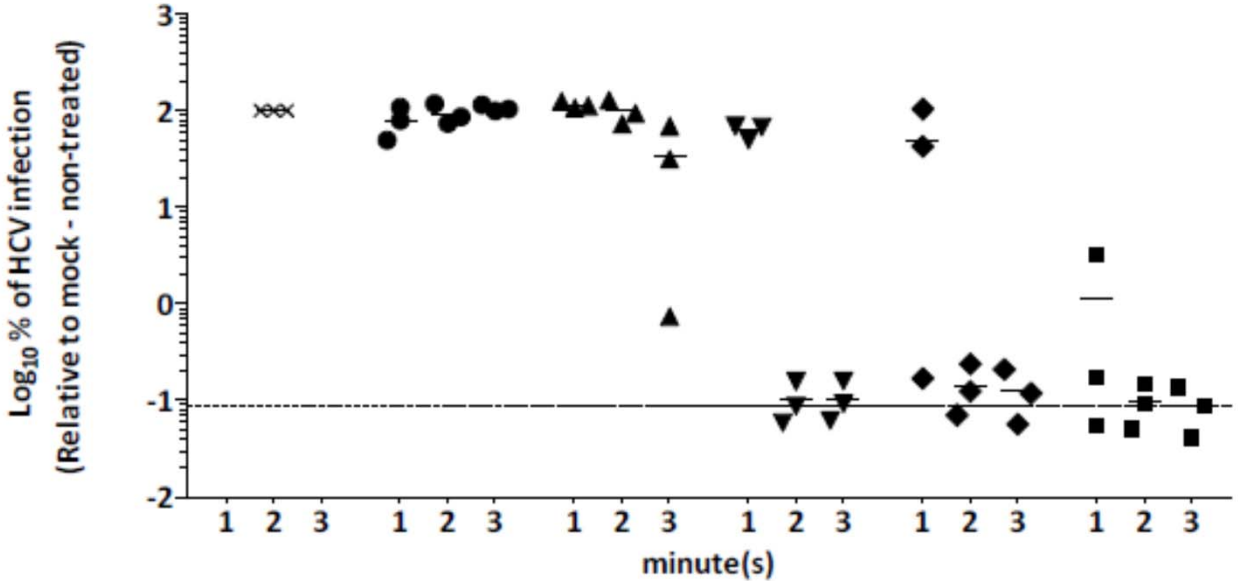


Pfaender et al. Journal of Infectious Diseases 2013

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

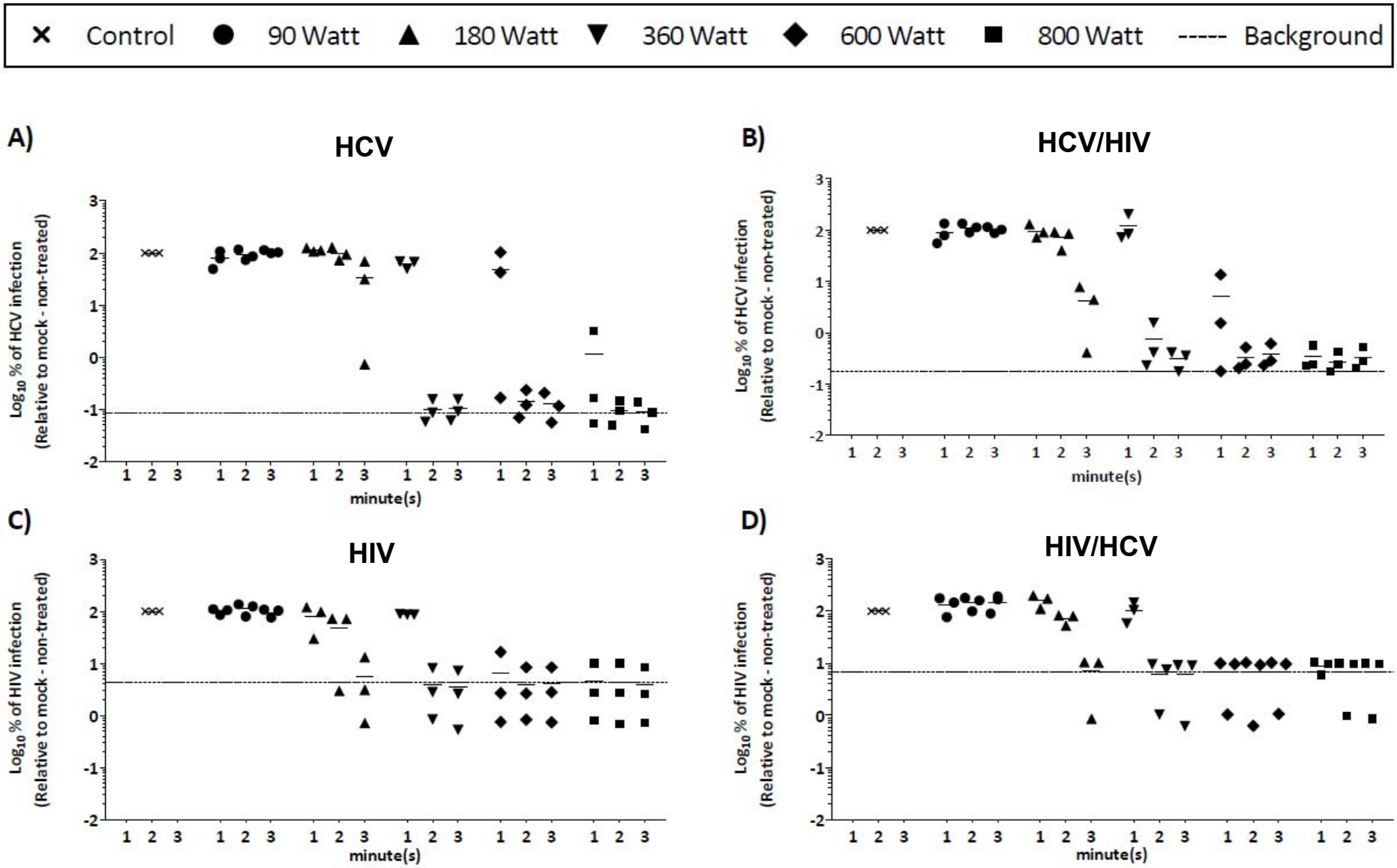
Inactivation of HCV and HIV by microwave!?



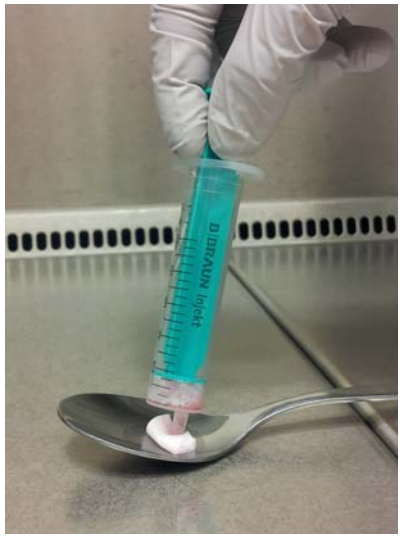


× Control ● 90 Watt ▲ 180 Watt ▼ 360 Watt ◆ 600 Watt ■ 800 Watt ----- Background

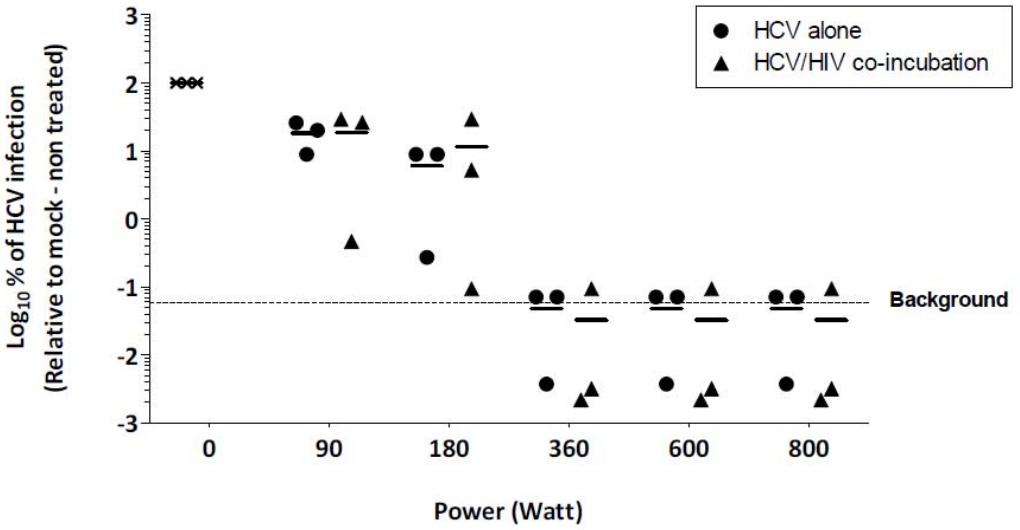
Inactivation of HCV and HIV by microwave



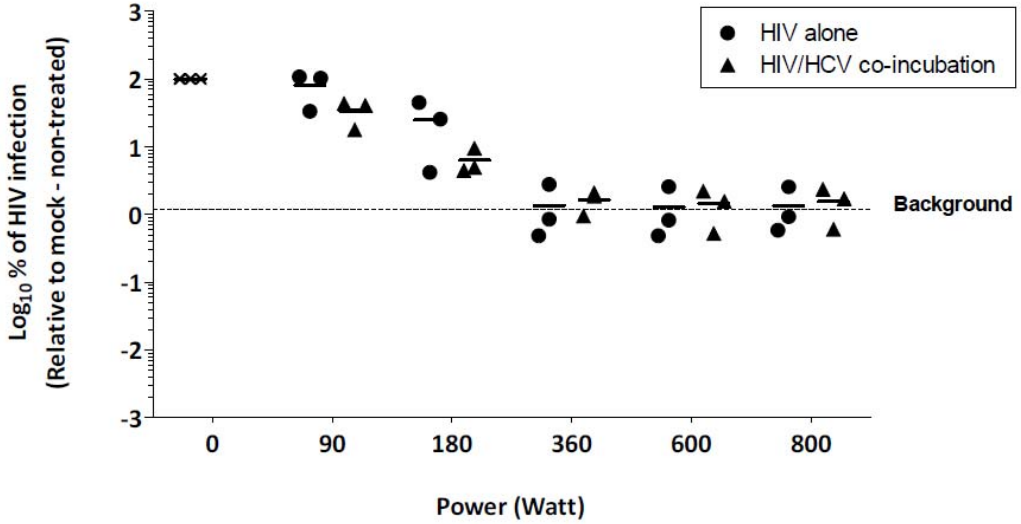
Inactivation of HCV and HIV by microwave



A)



B)



Acknowledgement

Twincore, Institute of Experimental Virology

Martina Friesland
Juliane Dörrbecker
Stephanie Pfänder
Aci Siddharta Anggakusuma
Daniel Todt
Michael Engelmann
Stephanie Walter
Svenja Drave
Martinea Friesland

Christine Goffinet
Thomas Pietschmann
Brill & Partner
German Red Cross

HELMHOLTZ CENTRE FOR INFECTION RESEARCH

MHH Medizinische Hochschule Hannover