

## New technologies for ultrasonic cleaning

Presenter: T G Leighton

Mengyang Zhu, Craig Dolder  
Institute of Sound and Vibration Research, , Faculty of Engineering & the Environment

Thomas Secker, William Keevil, Rodolphe Hervé, Sandra Wilks

Centre for Biological Sciences, Faculty of Natural & Environmental Sciences (Institute for Life Sciences)

Geraldine Clough

Faculty of Medicine, Institute of Developmental Sciences

Peter Birkin, Doug Offin, George Attard

School of Chemistry, Faculty of Natural & Environmental Sciences

Paul Stoodley, Liam Goodes, Terry Harvey, Nicola Symonds, Maria Salta

National Centre for Advanced Tribology, Faculty of Engineering and the Environment,

Bhaskar Somani

University Hospital Southampton NHS Foundation Trust (Urology)

Robert P. Howlin,

University Hospital Southampton NHS Foundation Trust  
National Institute for Health Research Southampton Respiratory,

David Voegeli, Mandy Fader, Jacqui Prieto

Faculty of Health Sciences

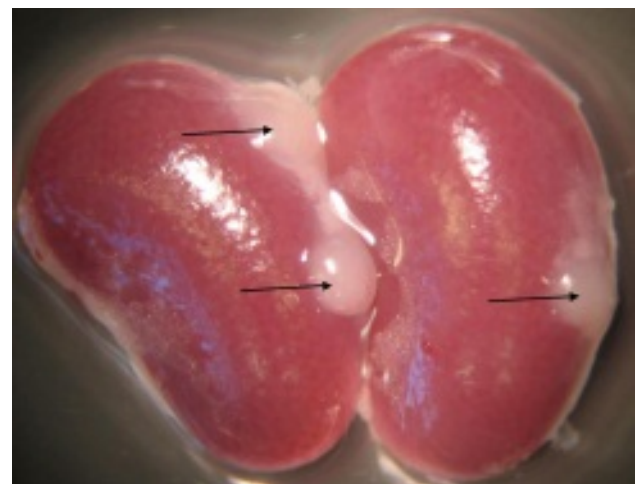
Jon Dawson, Richard Oreffo

Faculty of Medicine, Centre for Human Development, Stem Cells and Regeneration

# Cleaning baths and pressure washers:

Size, soup,

spray, shred





# Ultrawave

Precision ultrasonic cleaning equipment

Ultrasonic Cleaning

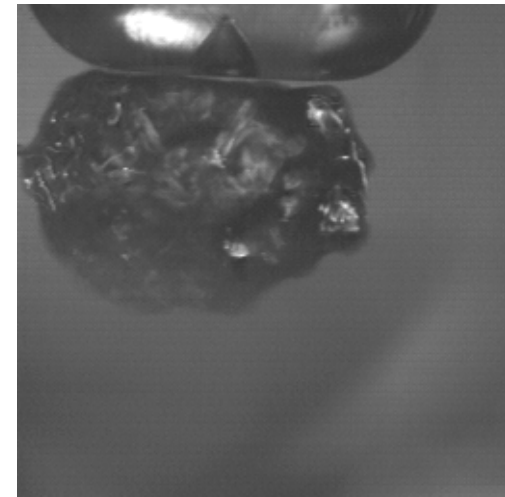
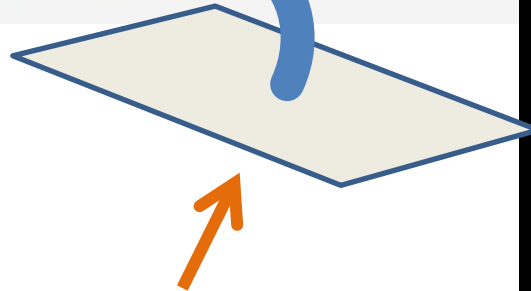
Ultrasonic Applications

News and Special Offers

HOME » NEWS AND SPECIAL OFFERS » STARSTREAM - 1000 TIMES MORE EFFECTIVE THAN WATER

## StarStream - 1000 Times More Effective Than Water

### The World's First Portable Ultrasonic cleaning Nozzle.



Photron

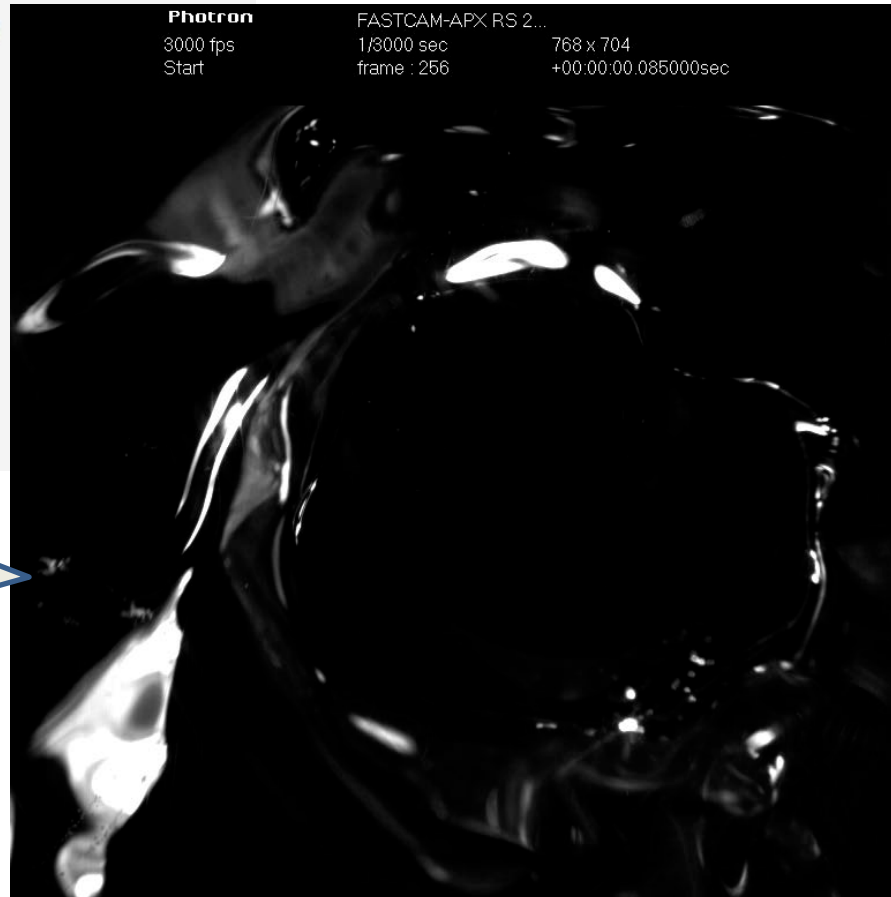
3000 fps  
Start

FASTCAM-APX RS 2...

1/3000 sec  
frame : 256

768 x 704

+00:00:00.085000sec







# Ultrawave

Precision ultrasonic cleaning equipment

Ultrasonic Cleaning

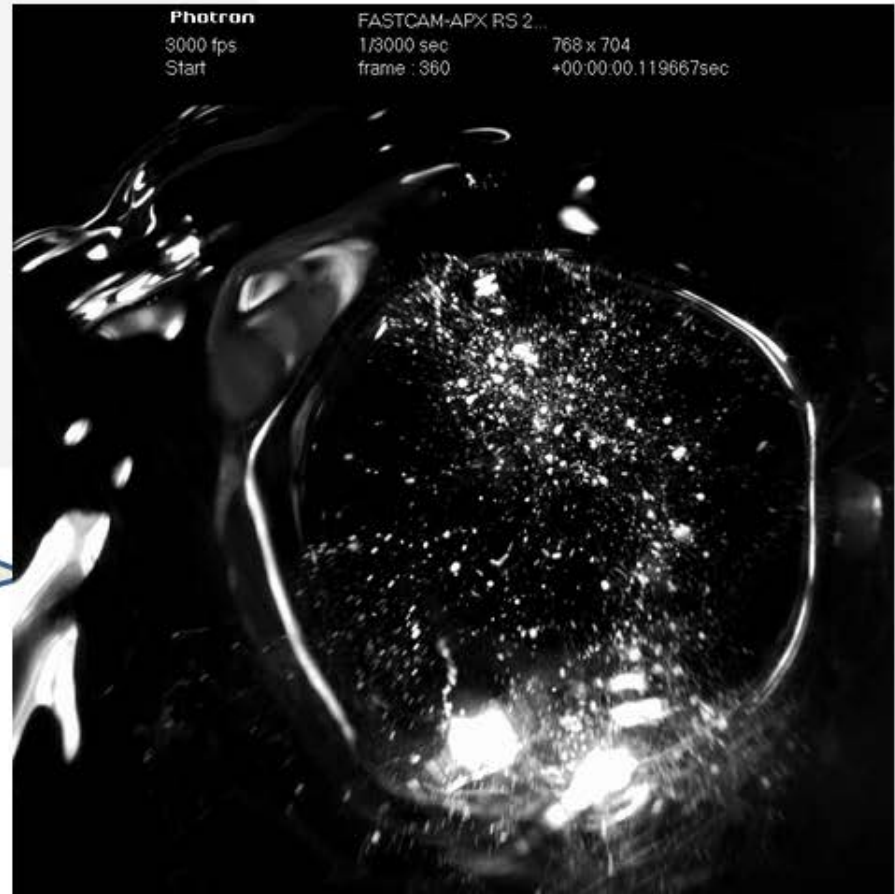
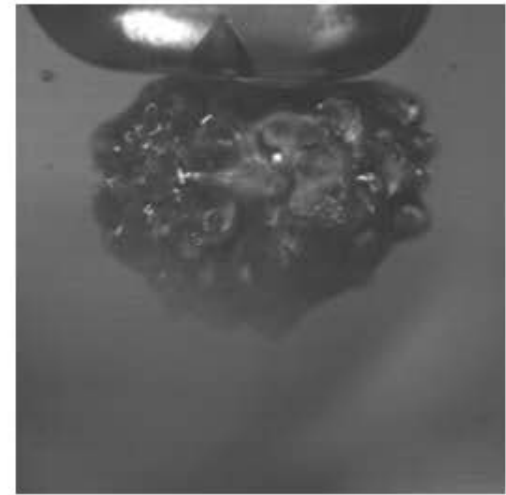
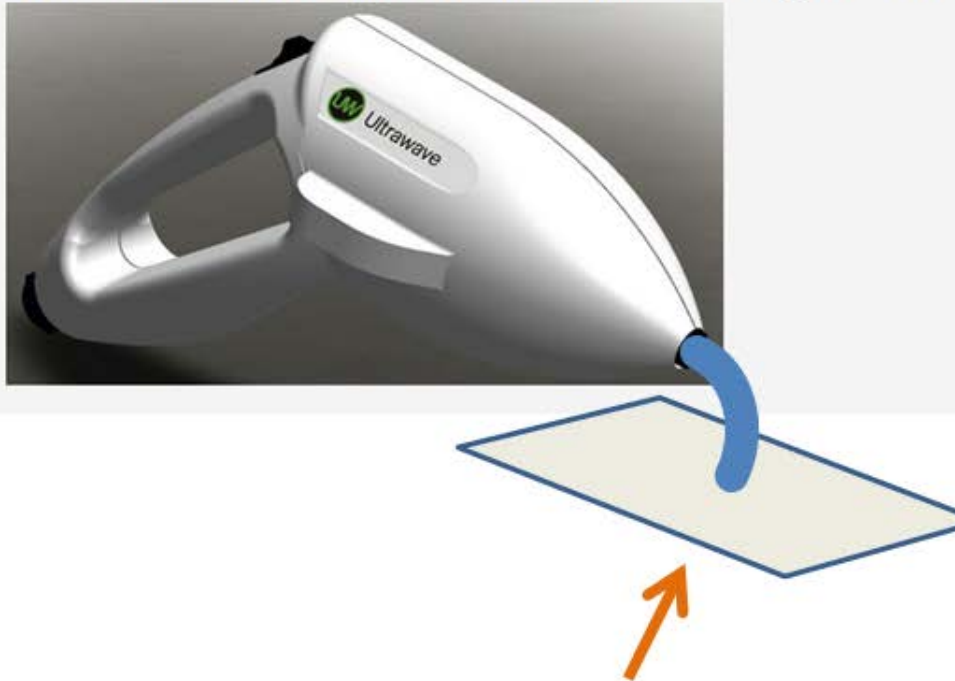
Ultrasonic Applications

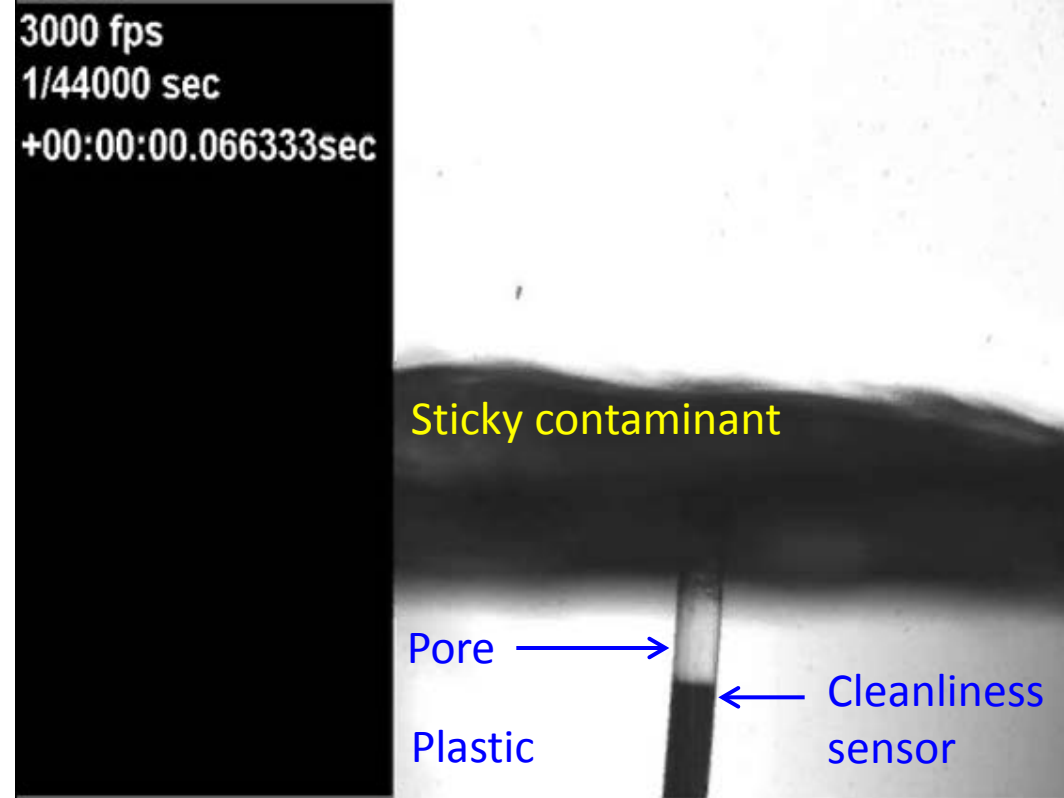
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## StarStream - 1000 Times More Effective Than Water

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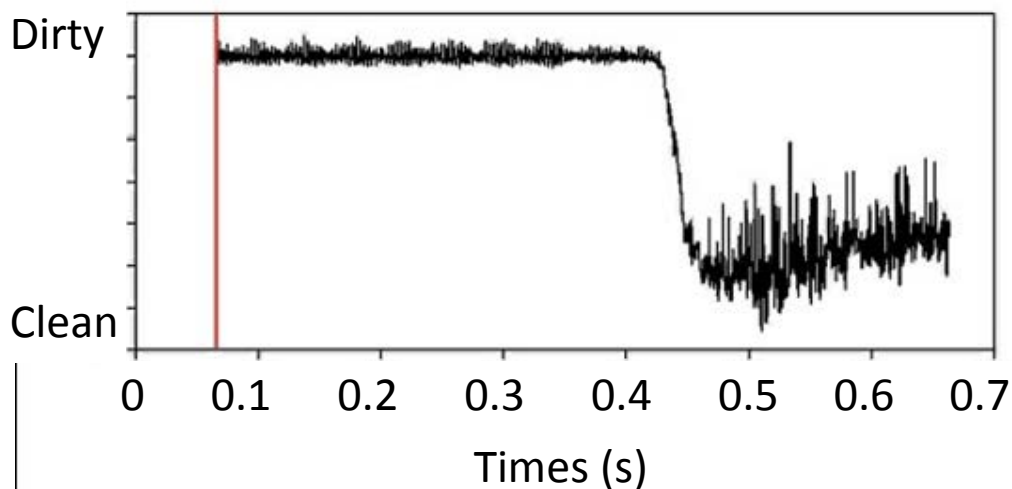


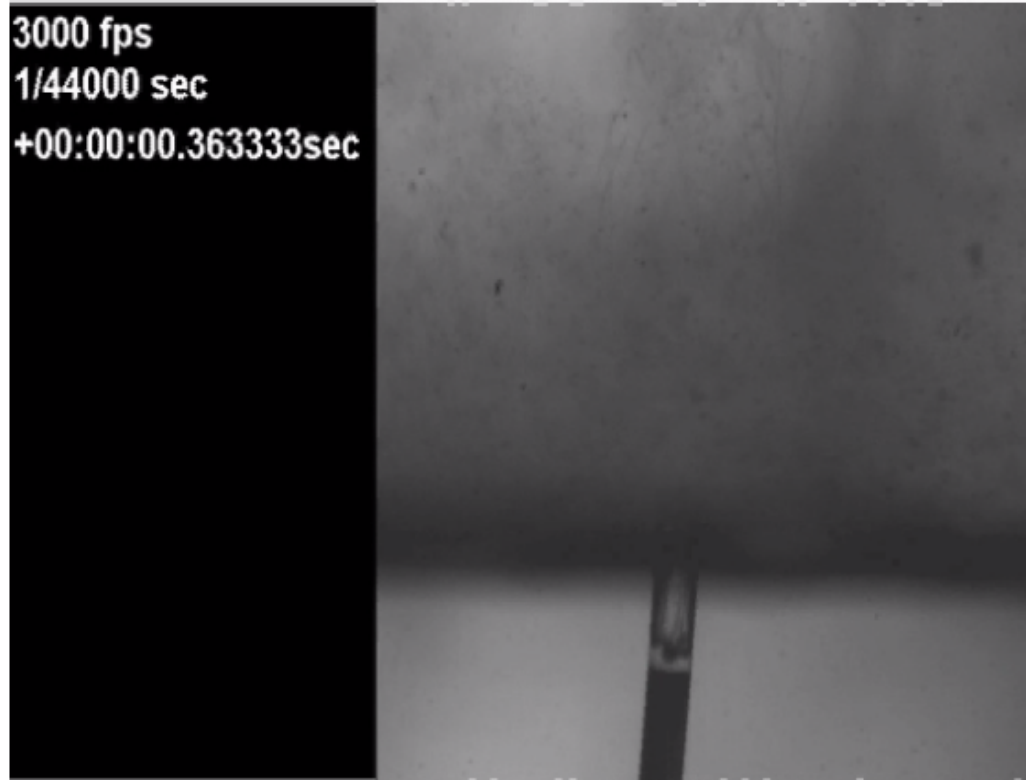


**Cleans with cold water  
without additives**

**or**

**Helps additives and  
hot water penetrate  
crevices**

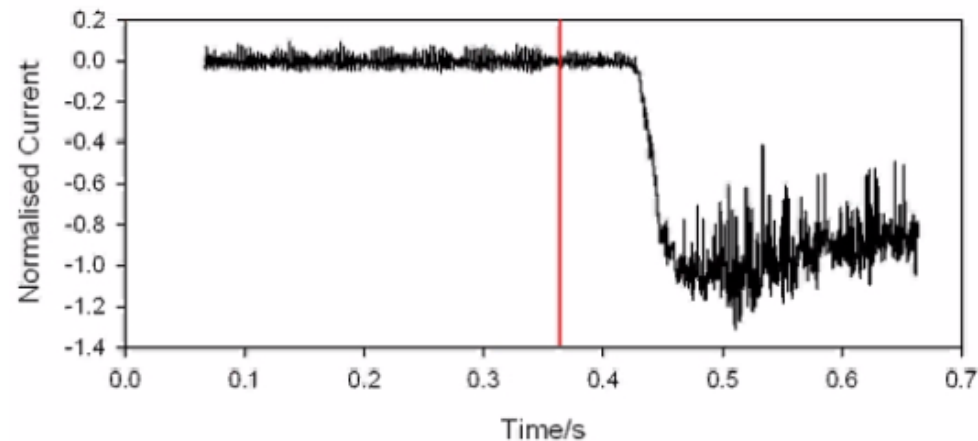




**Cleans with cold water  
without additives**

**or**

**Helps additives and  
hot water penetrate  
crevices**



StarStream ON (cold water, no additives)





The Centre for Disease Control recommends hands be washed for 20 s in warm soapy water.



In the UK the average wash is for 6s, often in cold water.

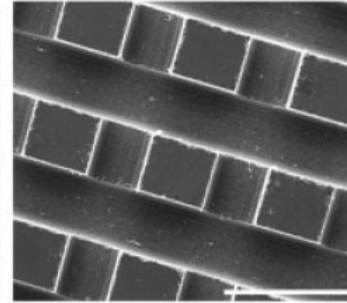
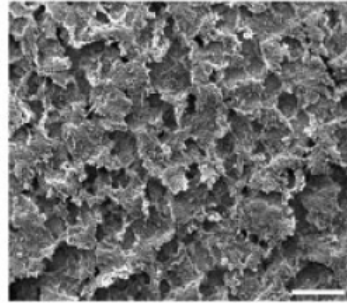
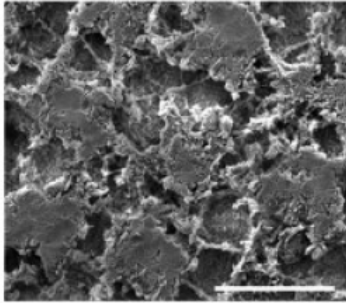


Before...

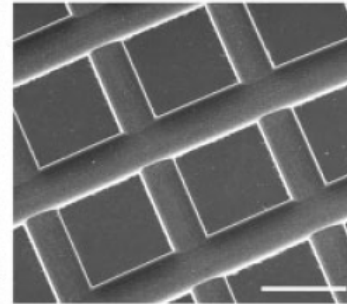
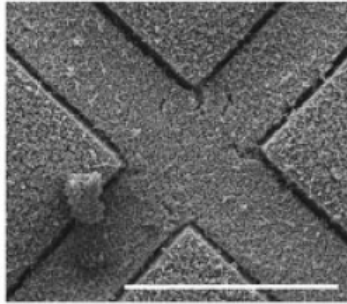
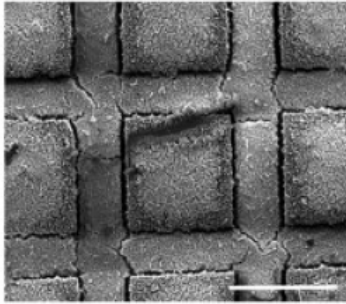
Water wash...

StarStream (cold water and no additives)

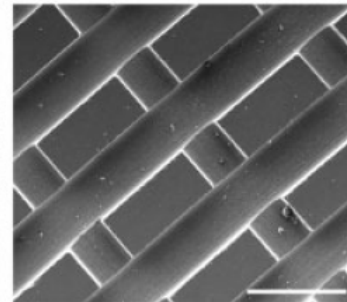
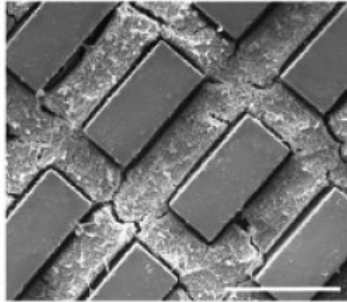
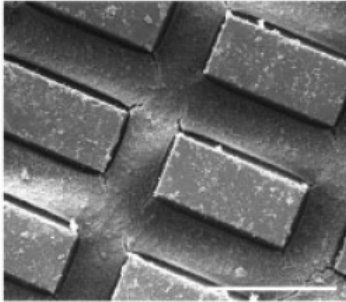
*S. mutans*



*A. naeslundii*



*S. oralis*



*S. mutans*



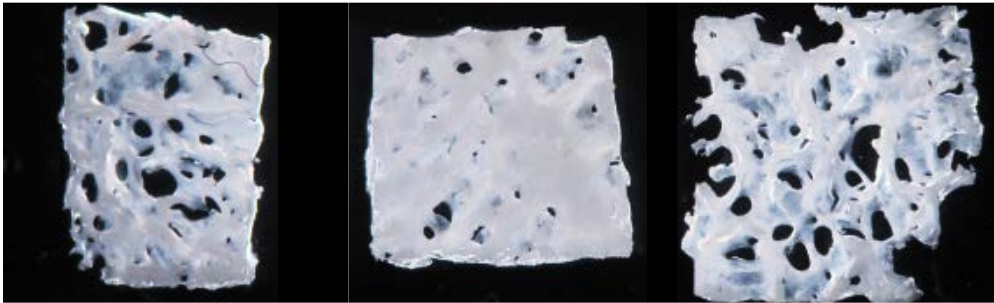
Scale bar=500 microns

(Rob Howlin and Paul Stoodley)

# Grafting bone between people for reconstructive surgery



No wash



1 week  
 $H_2O_2$



20 min  
 $H_2O_2$



(Jon Dawson &  
Richard Oreffo)



# Basil leaf

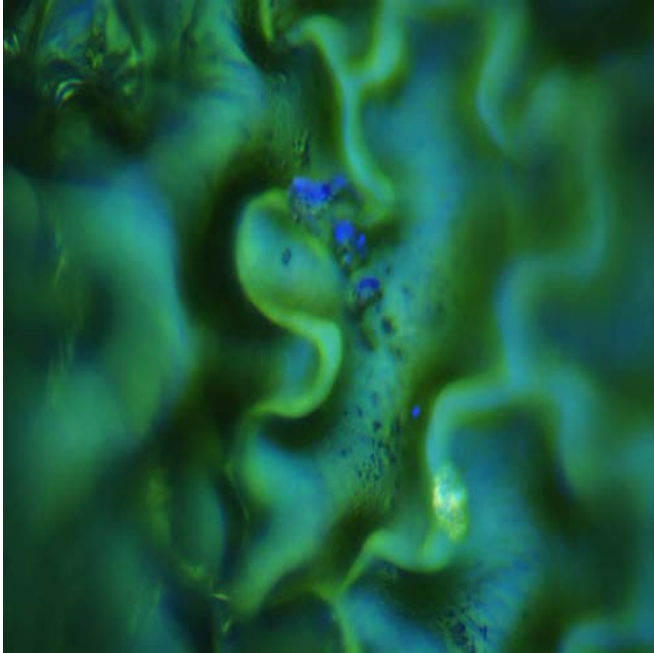


Basil Leaf imaged with Episcopic Differential Interference contrast (EDIC) microscopy and DAPI labelled endogenous bacteria (Tom Secker and Bill Keevil)

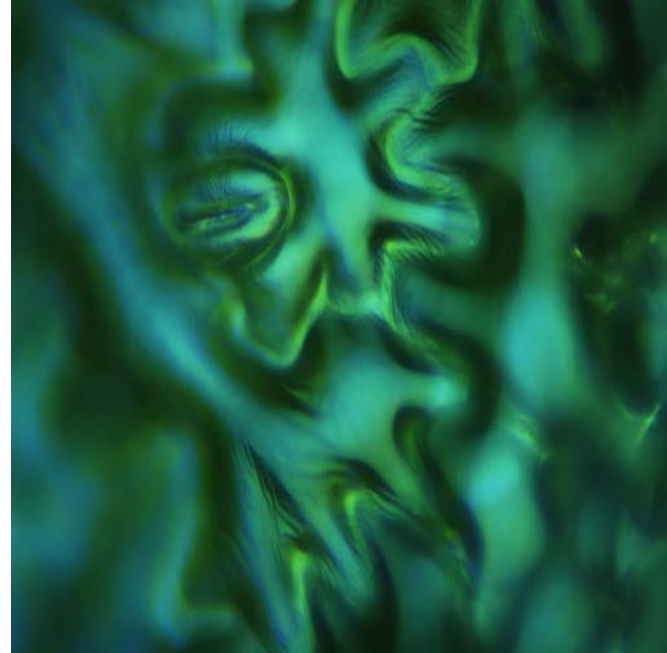


# Basil leaf

Control



Post StarStream



Basil Leaf imaged with Episcopic Differential Interference contrast (EDIC) microscopy and DAPI labelled endogenous bacteria (Tom Secker and Bill Keevil)

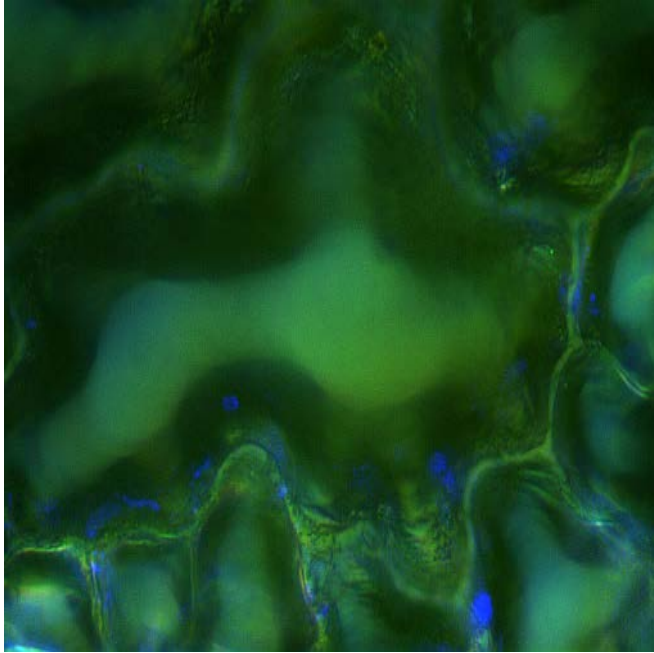
# Rocket leaf



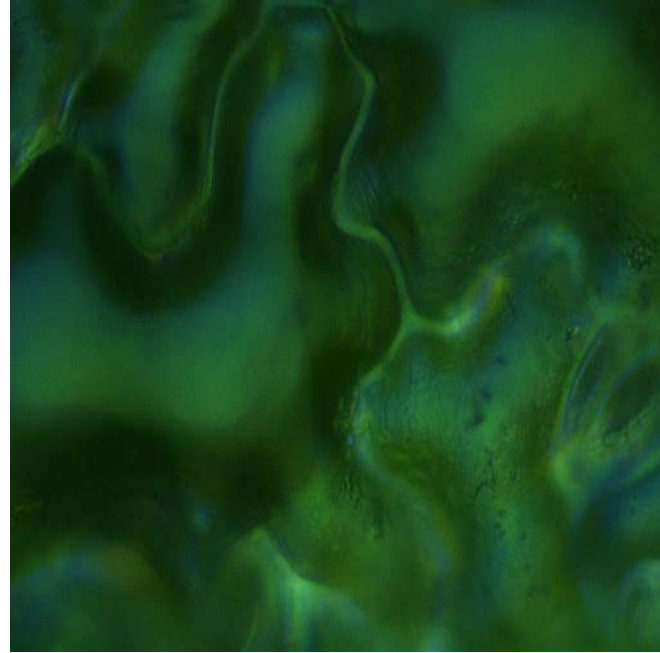
Rocket Leaf imaged with EDIC and DAPI labelled endogenous bacteria (Tom Secker and Bill Keevil)

# Rocket leaf

Control

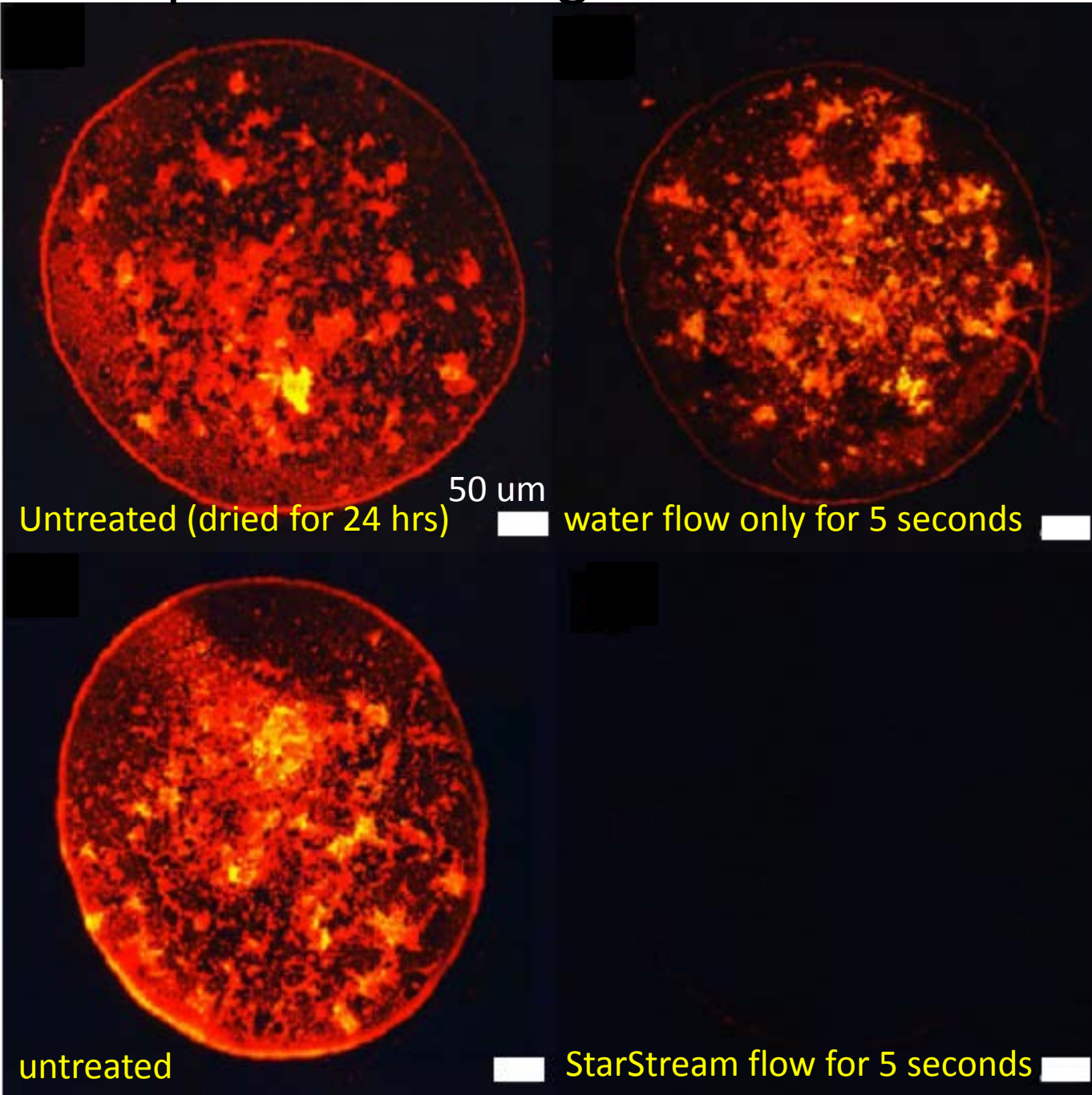


Post StarStream





# Brain protein on surgical steel



Untreated (dried for 24 hrs)

50 um

water flow only for 5 seconds

untreated

StarStream flow for 5 seconds

SYPRO Ruby  
stained protein  
on surgical  
steel

(Tom Secker, Rod  
Hervé, Bill Keevil)

Cold water, no additives...



For clean run-off



Because bleach ruins food



With 'water of opportunity

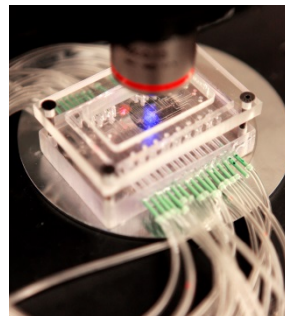


For casual hand washers

or ... with dilute chemicals



Because water is heavy



Diagnosis or kill



A fundamental challenge that puts nothing else into the environment ?





## References

- [The acoustic bubble: Oceanic bubble acoustics and ultrasonic cleaning](http://dx.doi.org/10.1121/2.0000121) Leighton, T.G. 2015 POMA **24**, 070006 (2015); <http://dx.doi.org/10.1121/2.0000121>
- [An activated fluid stream – new techniques for cold water cleaning](https://doi.org/10.1016/j.ultsonch.2015.10.001) - Birkin, P.R., Offin, D.G. and Leighton, T.G. 2015 Ultrasonics Sonochemistry :1-24 doi:[10.1016/j.ultsonch.2015.10.001](https://doi.org/10.1016/j.ultsonch.2015.10.001)
- [Electrochemical ‘bubble swarm’ enhancement of ultrasonic surface cleaning](https://doi.org/10.1039/c5cp02933c) - Birkin, P.R., Offin, D.G., Vian, C.J.B. and Leighton, T.G. 2015 Physical Chemistry Chemical Physics **17**, (33) :21709-21715 doi:[10.1039/c5cp02933c](https://doi.org/10.1039/c5cp02933c)PMID:[26234563](https://pubmed.ncbi.nlm.nih.gov/26234563/)
- [Removal of dental biofilms with an ultrasonically-activated water stream](https://doi.org/10.1177/0022034515589284) - Howlin, R.P., Fabbri, S., Offin, D.G., Symonds, N., Kiang, K.S., Knee, R.J., Yoganantham, D.C., Webb, J.S., Birkin, P.R., Leighton, T.G. and Stoodley, P. 2015 Journal of Dental Research **94**, (9) :1303-1309 doi:[10.1177/0022034515589284](https://doi.org/10.1177/0022034515589284)PMID:[26056055](https://pubmed.ncbi.nlm.nih.gov/26056055/)
- [Cold water cleaning of brain proteins, biofilm and bone - harnessing an ultrasonically activated stream](https://doi.org/10.1039/C5CP02406D) - Birkin, P.R., Offin, D.G., Vian, C.J.B., Howlin, R.P., Dawson, J.L., Secker, T.L., Hervé, R., Stoodley, P., Oreffo, R.O.C., Keevil, C.W. and Leighton, T.G. 2015 Physical Chemistry Chemical Physics **17**, (32) :20574-20579 doi:[10.1039/C5CP02406D](https://doi.org/10.1039/C5CP02406D)PMID:[26200694](https://pubmed.ncbi.nlm.nih.gov/26200694/)
- [A new approach to ultrasonic cleaning](https://doi.org/10.1121/1.4799209) - Leighton, T.G., Birkin, P. and Offin, D. International Congress on Acoustics, Montreal, Canada (2 - 7 Jun 2013) Proceedings of Meetings on Acoustics **19** doi:[10.1121/1.4799209](https://doi.org/10.1121/1.4799209)
- [Innovation to impact in a time of recession](https://doi.org/10.1142/S0218396X11004298) - Leighton, Timothy G. 2011 Journal of Computational Acoustics **19**, (1) :1-25 doi:[10.1142/S0218396X11004298](https://doi.org/10.1142/S0218396X11004298)