WHY CLEANING, DISINFECTING and THE PROBLEM WITH BIOFILMS

Veterinary specialist on poultry production and hygienic aquaculture questions

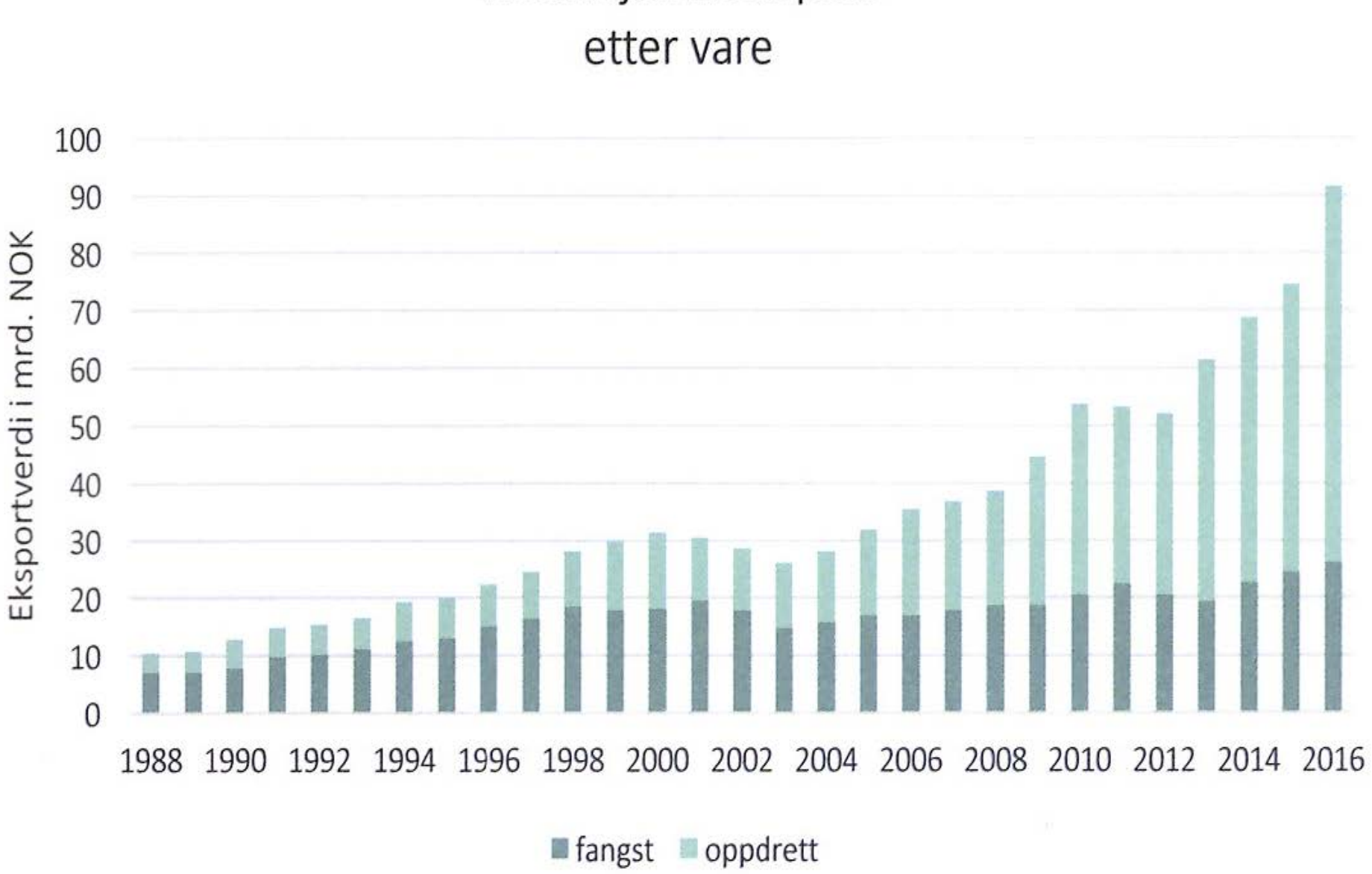
Dr.med.vet Gerhard Schaller

Agronor AS

Strandbúnaður 2018, Grand Hótel Reykjavík, 19.-20. mars







eksport av sjømat har vokst betydelig de siste tiårene - både målt i antall tonn og i verdi.
rtverdien nærmer seg 100 milliarder kroner. Kilde: Norges sjømatråd.

BACKGROUND

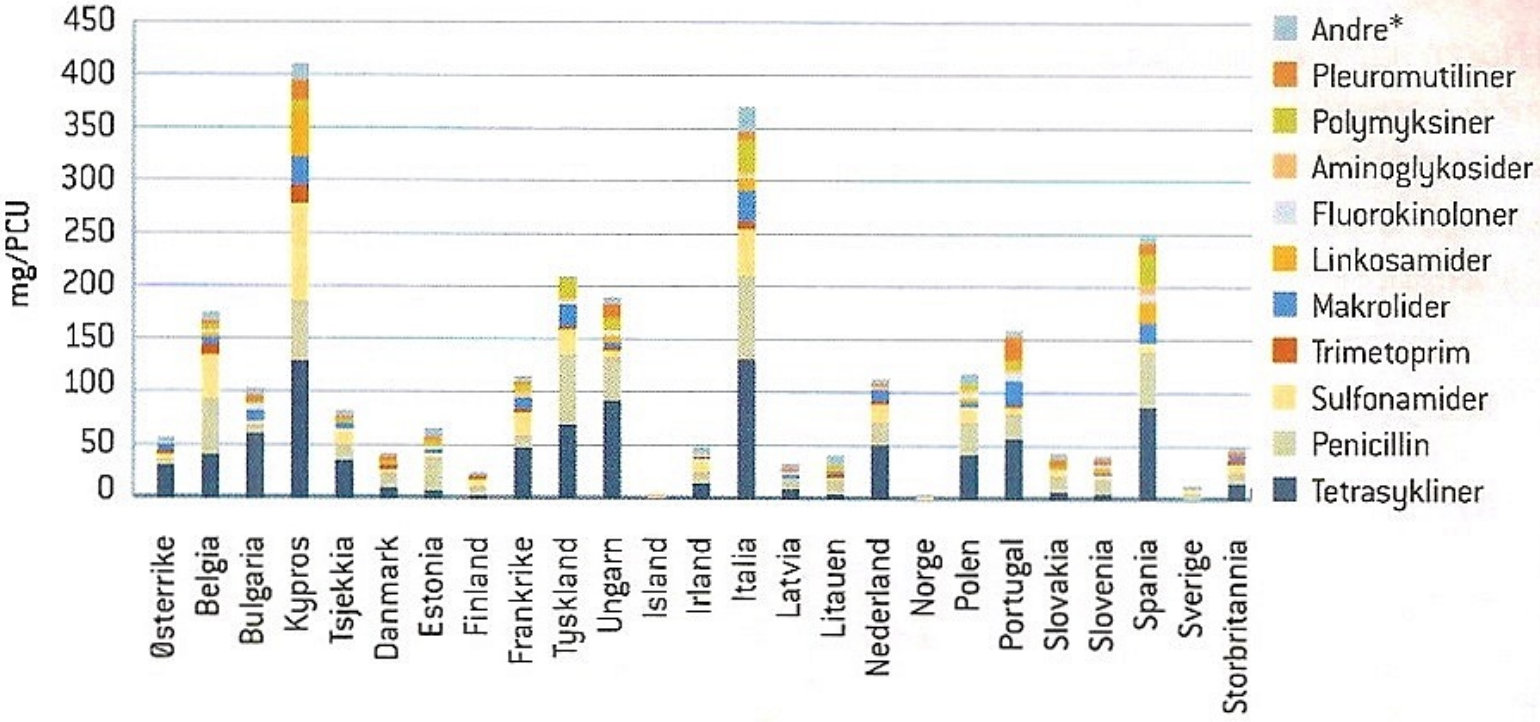
Treatment in poultry production units is problematic. The single animal is small, also in value– and all animals in the group may not be ill. This is similar in fish growing as well!

This is why in poultry attention very early was turned towards prevention of disease, with:

- **Cleaning and disinfection between insets**
- **Isolation of units from other groups, persons, transport etc**
- **Developement of vaccines**
- **Profylaktic medication (coccidiostats)**
- **Adapted management systems (wirefloors, cages)**
- **Spesific pathogen free (SPF) breeders (mykoplasma, leucosis)**

In large group operations the need for treatment is to be a situation of lost preventive possibilities.

The first line of defence is a good hygiene (cleaning and disinfection) with good control procedures.



Figur 3. Salg av antibiotika brukt til matproduserende dyr, inkludert hest, i 19 europeiske land i 2011
Kilde: Sales of veterinary antimicrobial agents in 25 EU/EEA countries in 2011 Third ESVAC report, 15.october 2013", figur 9 side 28. European Medicines Agency (EMC/236501/2013). Veterinary Medicines Division.
*Andre omfatter amfenikoler, cefalosporiner, andre kinoloner og andre antibakterielle midler.

Isolation of operations in the environment and carriers

- One age area = epidemiological unit with groups of the same origin, and the same finishing time!
- Safe distance to other groups
- Control of feedboats, serviceboats, wellboats or tanktrucks
- Control of visitors, entrance showers, sluices, equipment, traffic of all kinds.
- Regionalisation of groups of premises

Cleaning and disinfection

- Disinfection without previous cleaning will usually be without any meaning.
- The cleaning/washing removes more than 90 % of dirt and infectious matters.
- Disinfection should take most of the rest.
- Resting/fallow period should take even more.
- And then we hope that the internal resistance mechanisms of the body will be able to handle whatever is left -----

  without any disease outbreak!!

What do we want to remove before we disinfect?

Rests of feed / of decomposed animals

Manure - Fats

Mineral precipitations

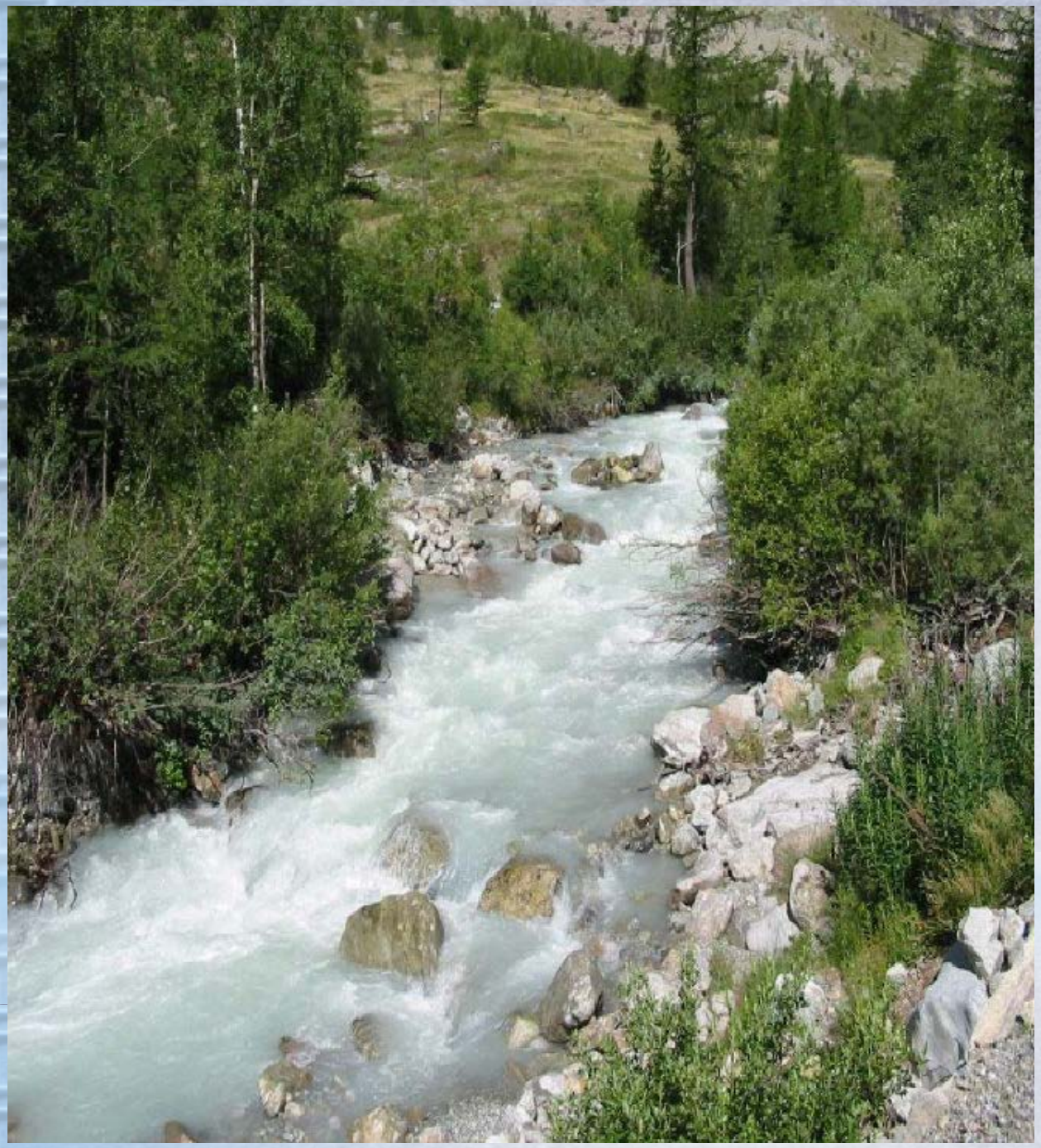
Vegetative growth
In humid corners, cracs, fissures,
in tubes, circulatory systems - growths.

---------- and biofilm

HVA ER BIOFILM?



- **Costerton et al.(1978): Biofilm e**
  is the dominant « lifeform » in natural ecosystems
- Costerton (2007) :“A biofilm is a multicellular community composed of prokaryotic and/or eukaryotic cells embedded in a matrix composed, at least partially, of material synthesised by the sessile cells in the community”



- Biofilms can be found everywhere.
- The biofilm is natures way to ensure variety.
- They serve a biological purpose, but at times it is a nuisance when bacterial numbers should be kept low and under control

Sulfur wells with biofilm



Yellowstone National Park

Biofilm at historical spots





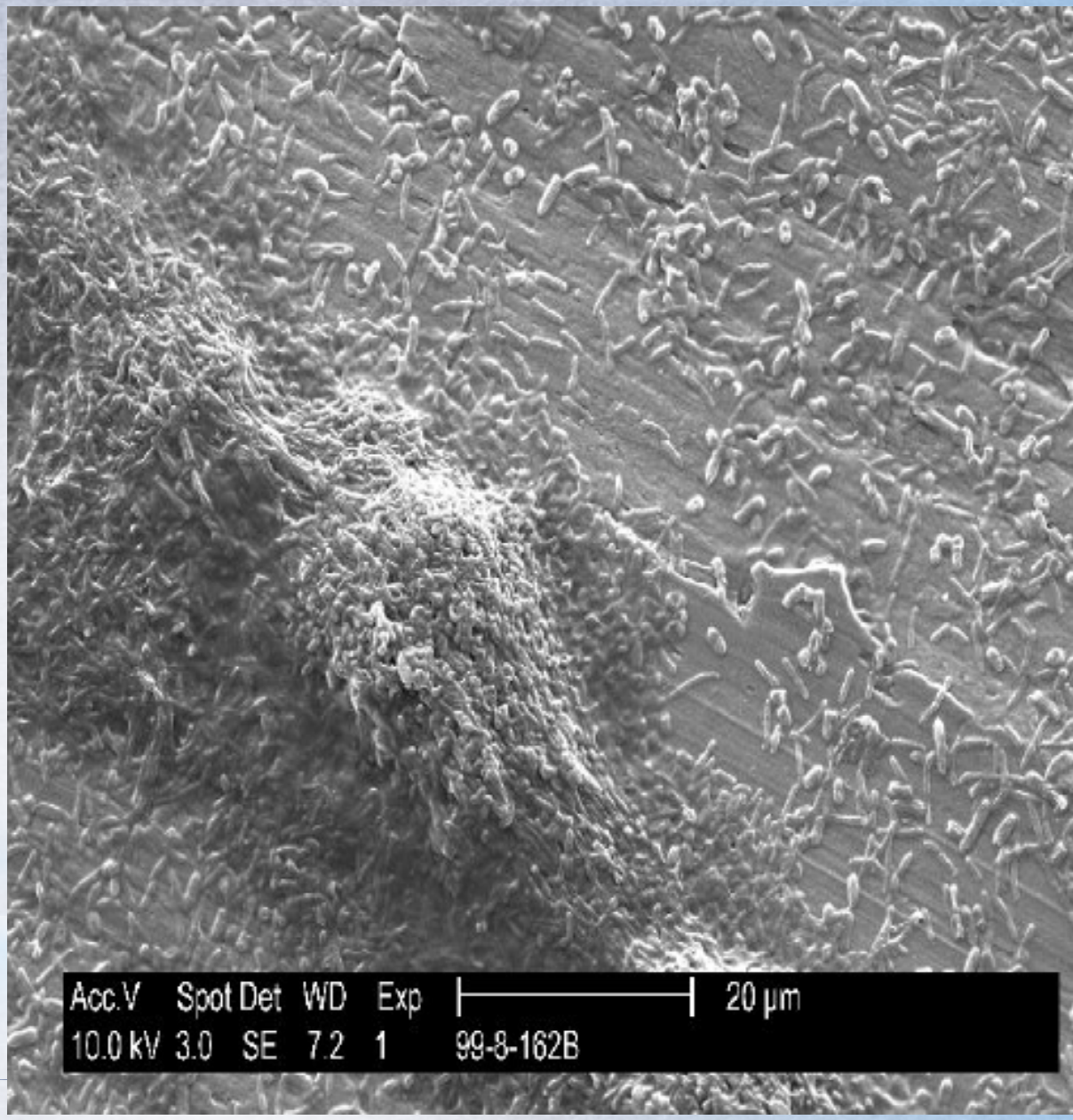
Biofilm m.m. i rør



Biofilm i vannrør





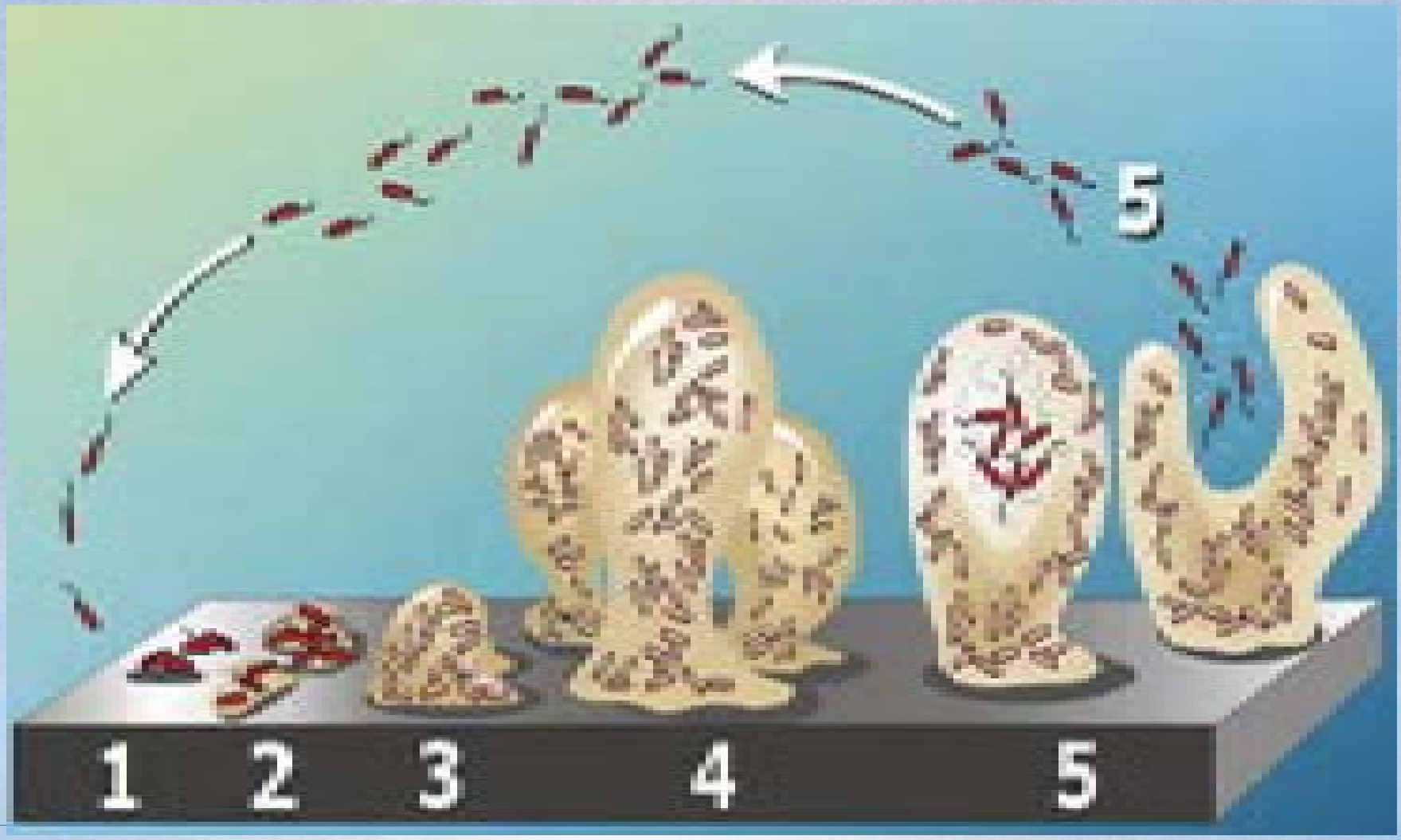


Biofilmkomponenter

Cells – alive and dead – various kinds encapsulated in a matrix that contains:

- **Materials sytheticised by bacteria like:**
- **Exo-polysaccarides,**
- **DNA from dead cells**
- **Proteines, f.ex. sulfated glycoproteins**
- **Materialer from the environment – mineral components**
- **Other organisms like algae and protozoae.**

BIOFILMDANNELSE



Stoodley P et al. Annu Rev Microbiol. 2002;56:187-209

Biofilmens vanskelige sider

- **Biofilm can give asylum to all the bacteria we fight hygienically, and can later feed these back into the environment.**

- It gives a high resistance against various kinds of stress/stressors (also cleaning!!).
- Points of importance to us:
  - **A physically tough organic matrix**
  - **Strengthened with mineral components and corrotion products. Which results in:**
  - **Resistance against disinfectants**
  - **Resistance against antibiotics, antimycotics Resistance against immunological substances**

Biofilm in industrial systems

SYSTEM	EFFECT
Heat exchangers, cooling towers, rubbers, ventilation systems o.l.	Infections, f.eks. Legionella Energy loss (lessened heat excange as well as liquid transport friction).
Drinking water pipes	Contamination, corrosion
Food production plants	Contamination
Paper production	Product quality
Skips outsides	Increased friction, infection
Osmotic membranes	Lowered permeability
Oil pipelines	Corrosion
Swimming pools	Contamination
Toilets	Negative estetics and more
Sinuses	Persisting inflammations
Implantates	Bakterial complications

The conclusion probably is that a biofilm with all the complicating factors is your most problematic cleaning job,
especially as all tube systems or pipelines are areas with good growth and survival potential for a biofilm.

The steps in cleaning and disinfection therefore has to be:

- Physical/mecanical action to remove the biofilm eg. With scrapes, brushes, pressure washers, and moles for pipes of various kinds
- Chemical processing with acidic or basic detergents, emulgators, surfactants etc.
- Disinfection to neutralise as much as possible of what might be left of infectious agents.
- Down time – Quarantine period

Godkjenningsordningen for desinfeksjonsmidler ligger under Legemiddelverket. (Medicinal authority)

”Forskriften om rengjøring og desinfeksjon av akvakulturanlegg mv” endret med hjemmel i lov av 19 desember 2003 nr 124 om matproduksjon og mattrygghet forskriftens § 7.

AGRONOR products for aquaculture are testet in Norway,

Veterinærinstituttet i Oslo og Trondheim tested bacteria.

***Aeromonas salmonicida* subsp. *salmonicida* ATCC 14174**

***Yersinia ruckeri* ATCC 29473**

***Staphylococcus aureus* ATCC 6538**

***Carnobacterium piscicola* NCIMB 2264**

Virus is tested at the University in Bergen

Infeksiøs pancreasnecrosis (IPN-virus – stamme N1)

Spesifics: Within 30 min, test at + 4oC, test also in saltwater

Recognized by every branch of food production

Long time experience shows that in animal production, growing, slaughteries and other further production, it is important that the general bacterial level is kept as low as possible, while at the same time unwanted bacteria, fungi, virus protozoae and other parasites are under control.


Hidden Depths

Poultry experience

-Flocks without disease signs still use energy to fight infections that might stay subclinical.

-Keeping parasites/bacteria/fungi m.v. at a low level improves DG and FCR.

-Controlling feed consumption together with growth data is a prerequisition to measuring such improvements.

-Feed consumption is close to 70 % of the production costs



Important points when washing

Give the detergent time to work!

A water temperature of 30-40°C in combination with a good geldetergent is high enough to dissolve fish fats. After soaking / action time you wash clean with a 15° flat nozzle, and have a short one ready for the difficult areas

A working pressure of 80 to 150 bar is good for preserving surfaces, equipment and the person that does the job.




ALT FISKE FORBUDT
NÆRMERE ENN 100 METER
ALL FERDSEL FORBUDT
NÆRMERE ENN 20 METER






FÆRØY





DOKKSETTING



CLEANING - AND DISINFEKTION PLAN – WELL BOATS

AT WHAT TIME : MINIMUM 1 X WEEKLY, AT CHANGE OF LOCALITY, BEFORE SPLITTING/SORTING, AT 1. TIME SMOLT TRANSPORT AND LOCALITY CHANGES + OUTSIDE SLIP CLEANING IN ADDITION

WORK AREA	HOW	DETERGENT	ACTION TIME	DISINFECT with	ACTION TIME
Hatches, walls, bottom, perforated covers, grilles	Cover the surfaces with detergent foam. Wash with high pressure 60-80kg, Max. watertemp. 25-35°C	3-5 x with DM CID-S 2-3 % 1 x med Tornax-S 1-5 %	15-20 min. Rinse Maximum 15 min. Must not dry! Rinse	VIROCID 1,5 % KICKSTART 1 %	30 min., Rinse 30 min., rinse.
Circulatory system, pipes, tanks, pumps and valves	Calculate the least volume the system needs to function properly	DM CID 1-2 %	Sirkulate the washwater minimum 15 min. Rinse with a large volum of water	VIROCID 1 % KICKSTART 1 %	Sirculate the solution 2 hours, Rinse the system Sirculate 30 min., Rinse the system.
Sorting equipment and other removable details	Apply on outside surfaces with foaming equipment. Wash w. pressure 60-80kg, Max. watertemp. 25-35°C For sirculation non foaming	3-5 x med DM CID-S 2-3 % 1 x med Tornax-S 1-5 %	15-20 min. Rinse Maksimum 15 min. Must not dry! Rinse	VIROCID 1,5 % KICKSTART 1 %	30 min., rinse 30 min., rinse.
Fish transport tubes with pumps, tanks m.v.	Apply on outside surfaces with foaming equipment. Wash w. pressure 60-80kg, Max. watertemp. 25-35°C For sirculation non foaming	DM CID-S 2-3% DM CID 0,5-1 %	Minimum 15 min. Rinse Sirculate solution in pump, pipes & tanks Rinse the system well	KICKSTART 1%	30 min., rinse the system
Cleared deck from stern to aft	Apply detergent with a foam lance Wash with high pressure 60-80 kg Max. temperature 25-35 °C	3-5 x med DM CID-S 2-3 % 1 x med Tornax-S 1-5 %	15-20 min. Rinse Maximum 15 min. Must not dry! Rinse	VIROCID 1,5 % KICKSTART 1 %	30 min., rinse 30 min., rinse.

AGRONOR AS

Disinfection and cleaning products

G.Schaller/Agronor AS/feb 2005

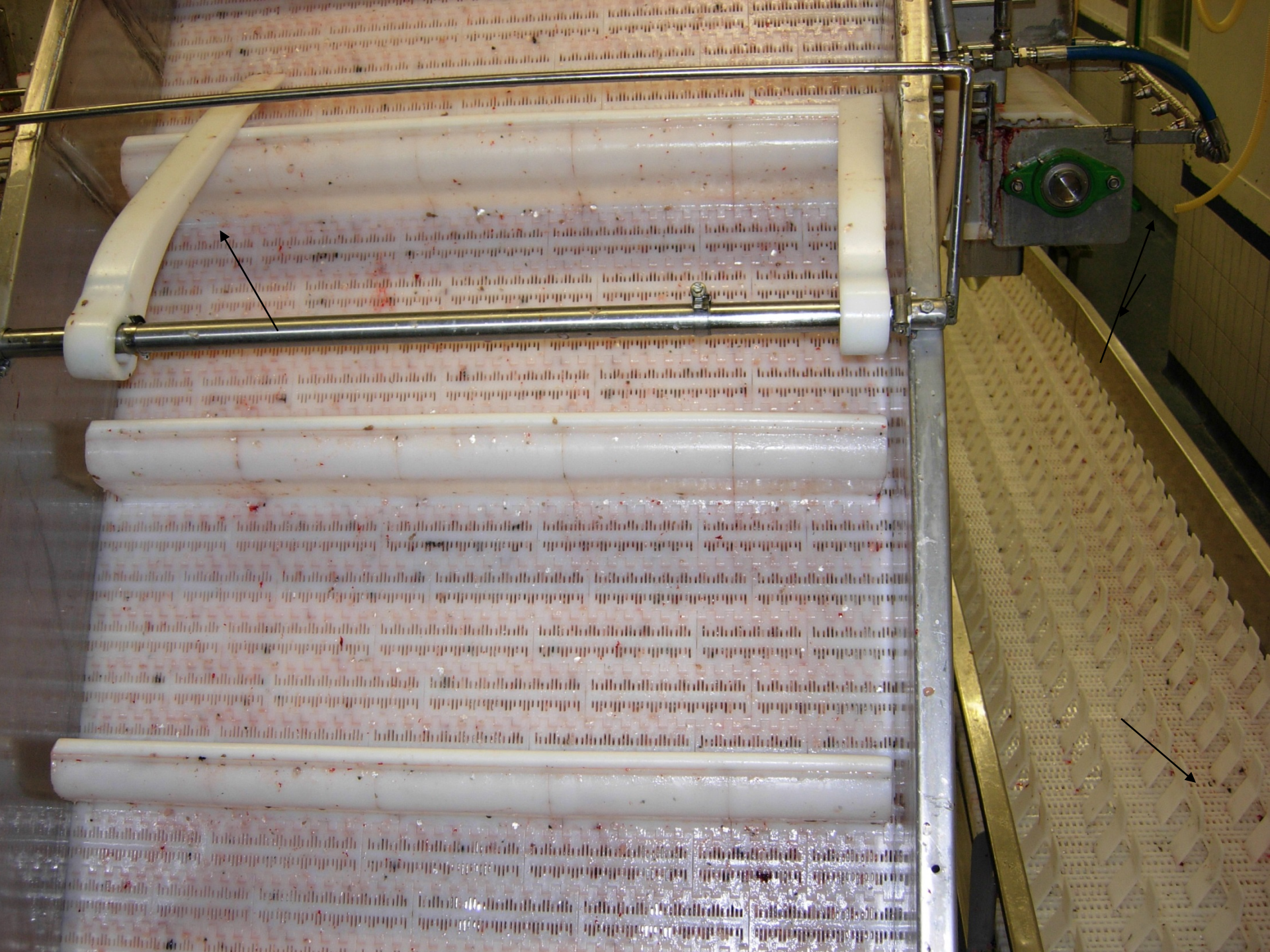
Disinfection without previous cleaning is without or insufficient effect.

- Tornax attacks iron and concrete, but cleans aluminium surfaces. Good pretreatment before painting of steel hulls on slip. 5% takes rust stains
- VIROCID is neutral and can dry on treated surfaces without harm
- KICKSTART (Org.acids og oxygen) is corrosive, but with a fast decomposition.
- The disinfection dosages given are for +4°C and in seawater. Higher temperatures can justify lover dosage or less action time.

Follow the directions of use – think safety and environment

Fiskeslakteri







Resultat:

Behov for ennå bedre rengjøring

Biogel, DM CID-S, DM CID, Alcalu S

Generell desinfeksjon

Virocid

Rensing og desinfeksjon av vannsystemet

KickStart

Målrettet desinfeksjon mot parasitter

H_2O_2, Neopredisan, varmtvannsbad o.a.?



ETSENDE

Natriumhypokloritt

INNEHOLDER:

NaOCL	10–15%
Ekvivalent mengde	10–15%
NaOH	0–15%

ADVARSEL:

Etsende: Bruk verneutstyr. Ved kontakt med syre utvikles giftig gass. Unngå kontakt med øynene.
Får man stoffet i øynene, skyll straks grundig med store mengder vann og kontakt lege.
Får man stoffet på huden, vask straks med store mengder vann.
Må ikke blandes med syrer.
Oppbevares utilgjengelig for barn!

Produsent: Borregaard Ltd. AS.
Distributør: Halfdan L. Solberg, Bergen, tlf. 55 39 44 00.

Simple control – Surface cleaning

- Foaming as visual control application
- Finger control, slimy and other feelings
-
- Surface evaluation, concrete/wood eg.
- State of joints and cracks
- Entrance rooms, feedstore, locks
- Inngoing - outgoing ventilation ducts, openings and fans







Control types- disinfection - total bacterial count indicators

- **Traditional bacteriologi–swabbing etc.**
- **Petri dish variants**
- **Sausage disc method (10 cm^2)**
- **Hygikult eg.**
- **ATP-meters (Adenosin triphosphate), (accepted in HACCP-systems = Hazard Analysis Critical Control Point)**
- **UV- lights/lamps**

HSE during cleaning - disinfecting

Highpressure - washing and disinfection creates aerosoles (airborne droplets) that can move deep into your lungs. Outside this might not be so critical!

Inside – use respiratory protection as a whole or halfway face mask equipped with filters A2, P2/3, or higher ! !

This can go well for a time without protection, but then you get older + you smoke + you are exposed to organic, chemical or mineral dusts ----------

Read directions of use!




SUNDSFJORD





Salmonlice – our big problem

We are trying to decimate numbers by:

-Using insecticides (already a lost case)

-Skirts to prevent ready larvae reaching fish

- Treating infested fish with H_2O_2

- Adding parasitic cohabitants (Wrasses eg.)
  They can transmit other diseases

-Laser recognition programmes

-Thermic treatment of salmon at +32 C,(80%?)

--------- and more variants!



Caligidae


HAUGE AQUA


HAUGE AQUA

Finally - politically

- Cleaning and disinfection is part of the insurance that has to be payed in connection with any kind of food production.
- Authorities can prescribe usage of acknowledged substances along with controlled working procedures in connection with notifiable diseases, and og tasks of general official interest.
- The implementation and correct use of the substances is however the responsibility of the producer/owner.
- Customers can demand access to protocols and routines in this area.

Controlquestions

- What is the biggest problem with hygiene work? Psychology boost of staff doing hygiene duty close to the fish!!!!!!!
- Cost relation between labour and chemistry.
- Sammenlign kostnad på desinfeksjonsmidler.
- Do we only try to prevent disease outbreaks?
- Er HMS mest for gamle folk over 40?
- What do economists know about hygiene?
- Er media våre hjelpere i hygienearbeidet?
- Hva er Mattilsynets oppgaver i vårt arbeide?
- Can wellboats transfer infectious agents?
- Should we be loyal to the job or to the nation?
- Why use foaming equipment with the high pressure cleaner?

Vi må vel satse på kortreist mat!



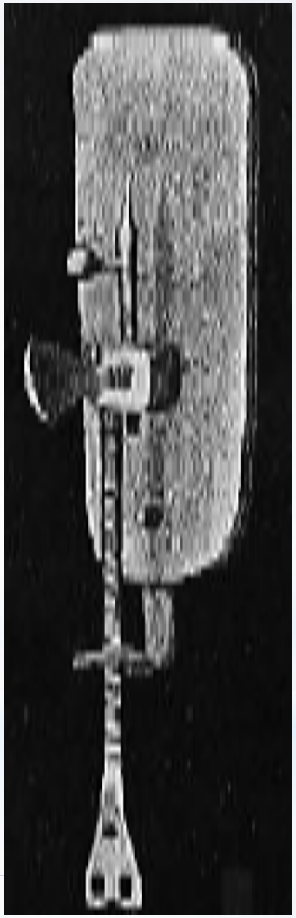
Nye markeder?

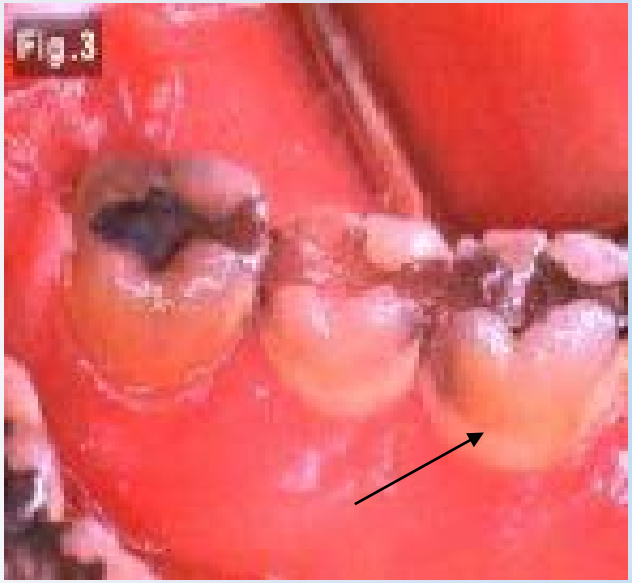


Antonie van Leeuwenhoek (1632-1723)

Betraktet bioflm på tannhalsene med sitt enkle mikroskop







Han så bare de største encellede levevesene (f.eks. Paramecium)