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Centre for Research on
Environmental Microbiology
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Centre de recherche en
microbiologie environnementale
Pour un futur plus sain

**PREVENTING THE ENVIRONMENTAL SPREAD OF
INFECTIONS: A CRITICAL LOOK AT CURRENT
PRACTICES AND FUTURE DIRECTIONS**

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OUTLINE

- **HOW IMPORTANT ARE MICROBIAL PATHOGENS?**
 - IS THEIR SIGNIFICANCE CHANGING?
- **DOES HYGIENE WORK IN DISEASE PREVENTION?**
 - IF YES, WHAT ROLE DO MICROBICIDES PLAY IN IT?
- **ARE MICROBICIDES USED IN HYGIENE & ENVIRONMENTAL CONTROL SAFE & EFFECTIVE?**
 - IF NO, ARE SAFER ALTERNATIVES AVAILABLE?
- **WHERE DO WE GO FROM HERE?**

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KEY TOPICS FOR THIS CONFERENCE

- **HYGIENE**
- **SUSTAINABILITY**
- **CLEANING STANDARDS**
- **INFECTION PREVENTION
& CONTROL**

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WHAT IS 'HYGIENE'?

- AVOIDANCE OF ALL THAT IS 'DIRTY'
- SCIENCE THAT DEALS WITH THE PROMOTION & PRESERVATION OF HEALTH
- ANY PRACTICE LEADING TO THE ABSENCE OF HARMFUL LEVELS OF GERMS

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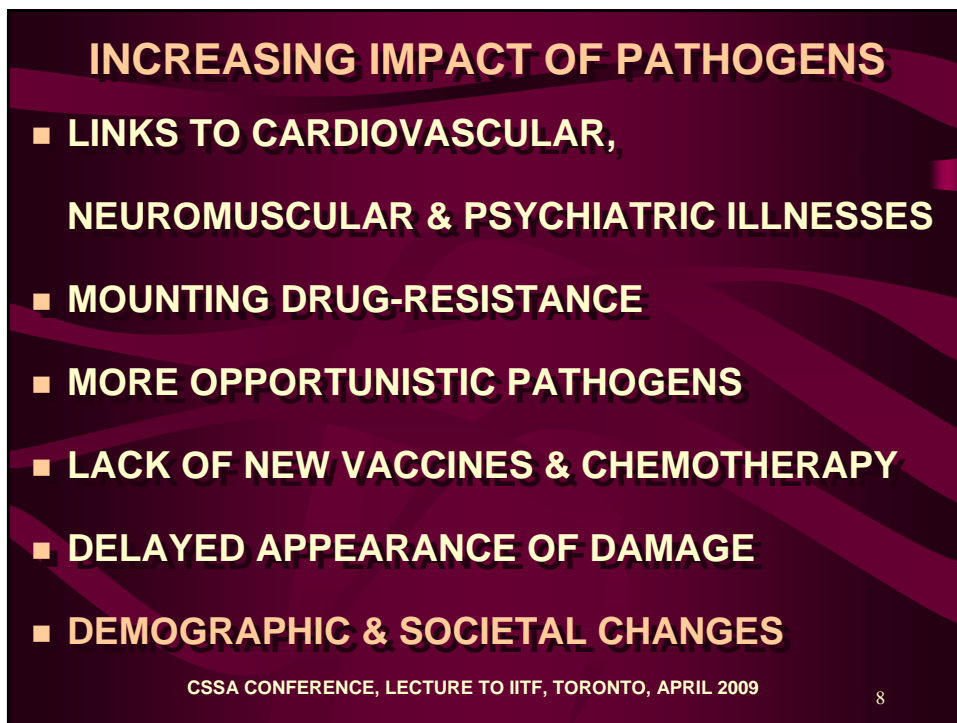
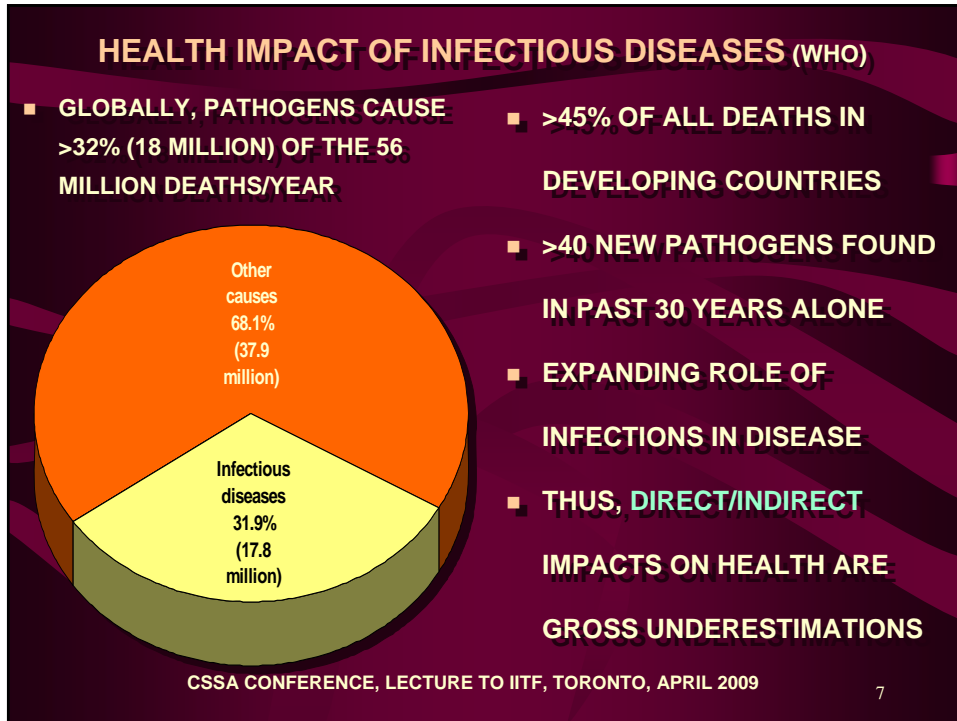
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ATTITUDES TOWARD 'HYGIENE'

- IN N. AMERICA, ATTITUDE CHANGE STARTED FOUR DECADES AGO DUE TO ADVENT OF VACCINES, DRUGS & MOLECULAR BIOLOGY
- IN EUROPE, 'HYGIENE' REMAINS ACTIVE & ITS STUDY A RESPECTED ENDEAVOR
- REVIVAL OF INTEREST GLOBALLY (LONDON SCHOOL OF HYG. & TROP. MED., STANIER INSTITUTE, INTERNATIONAL FORUM ON HOME HYGIENE, CREM, ETC.)
- BACKLASH - ARE WE GETTING TOO CLEAN?

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PATHOGENS IN THE ENVIRONMENT

- MOST CONVENTIONAL PATHOGENS GET INTO THE ENVIRONMENT FROM SYMPTOMATIC & ASYMPTOMATIC HOSTS
- 'ENVIRONMENTAL PATHOGENS' LIVE IN THE ENVIRONMENT, BUT CAN CAUSE DISEASE IN HUMANS; MANY ARE 'OPPORTUNISTIC PATHOGENS'
 - 'PERIKAIROTIC' (GREEK: *PERIBALLON* = ENVIRONMENT + *KAIROSKOPOS* = OPPORTUNIST) DEFINES ENVIRONMENT-BASED HUMAN PATHOGENS (SATTAR & SPRINGTHORPE, 2004)
 - IN GENERAL, 'PERIKAIROTS' DO NOT GIVE RISE TO SECONDARY HUMAN CASES (E.G., LEGIONNAIRE'S DISEASE)

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MODES OF PATHOGEN SPREAD IN NATURE

INFECTED HOST $\xrightarrow{\text{DIRECT HORIZONTAL SPREAD (PERSON-TO-PERSON SPREAD)}}$ SUSCEPTIBLE HOST

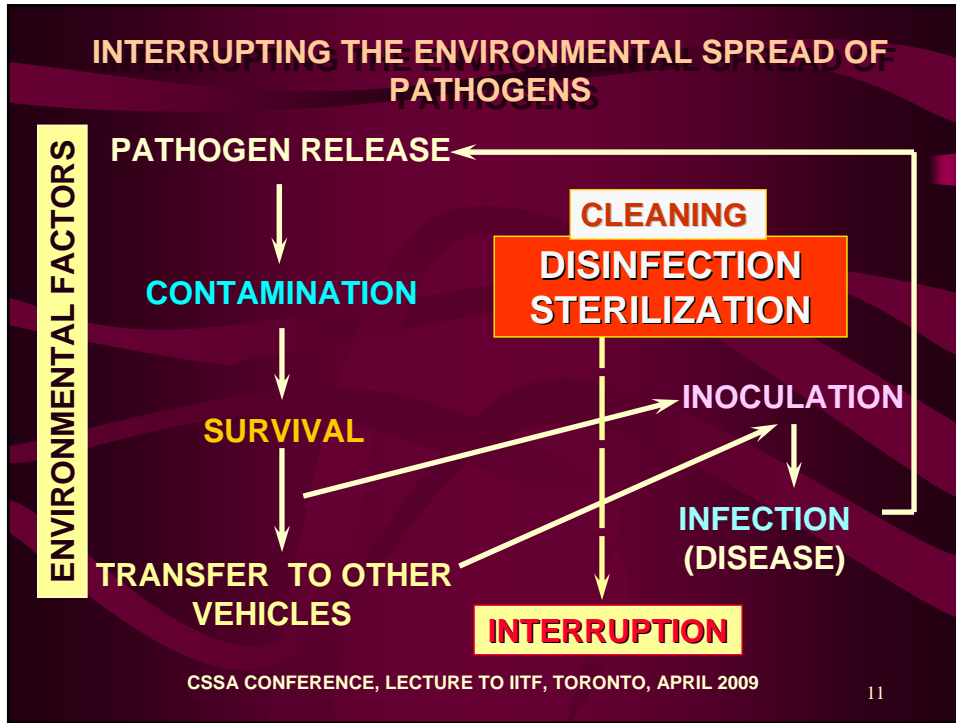
INFECTED HOST $\xrightarrow{\text{INDIRECT HORIZONTAL SPREAD (ENVIRONMENTAL OR VEHICULAR SPREAD)}}$ SUSCEPTIBLE HOST

VERTICAL

ENVIRONMENTAL SPREAD IS VIA VEHICLES SUCH AS WATER, FOOD, AIR, FOMITES, ENVIRONMENTAL SURFACES, MEDICAL DEVICES, INSECTS, HANDS, SOIL & WASTES

SUSCEPTIBLE HOST

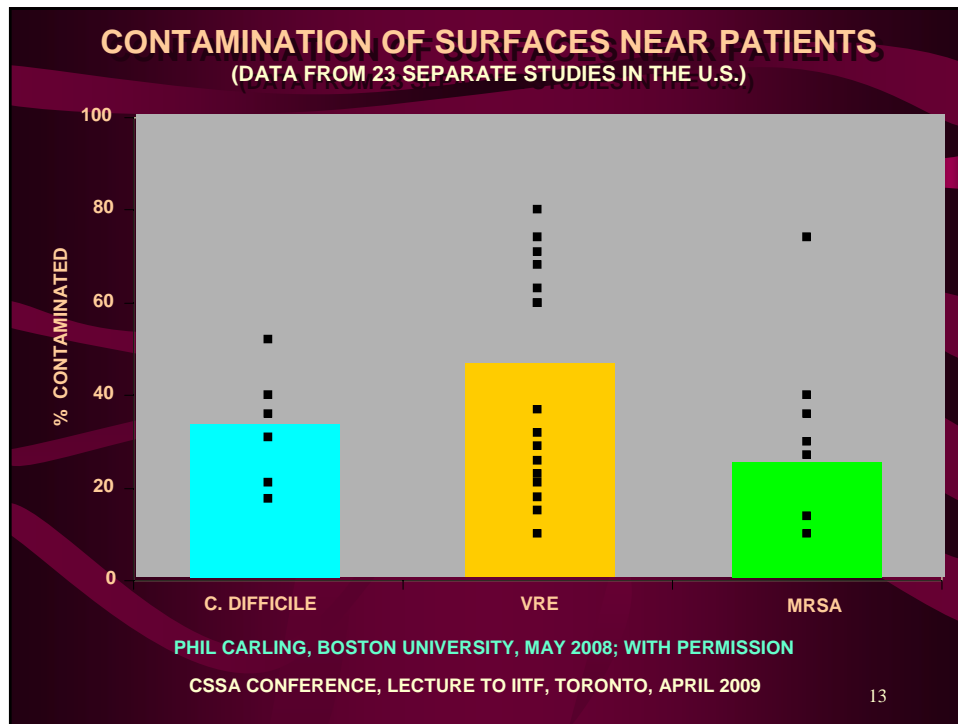
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CONTAMINATED SURFACES IN U.S. HOSPITALS

	VRE	MRSA	C. DIFFICILE
BED RAILS	+++++++	+	+++
BED TABLE	++++++	+	
DOOR KNOB	++	++	+
DOORS	+++	+	
CALL BUTTON	+++	+	++
CHAIR	+++	+	++
TRAY TABLE	+++	++	
TOILET SURFACE	+		++++
SINK SURFACE	+	+	+++
BEDPAN CLEANER			+

PHIL CARLING, BOSTON UNIVERSITY, MAY 2008; WITH PERMISSION
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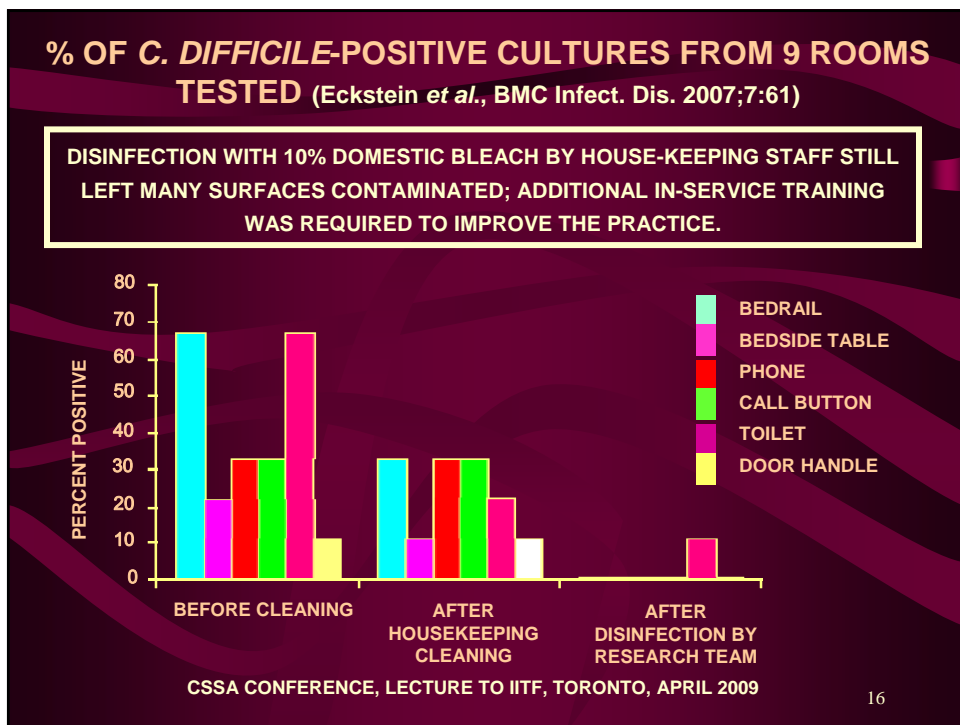


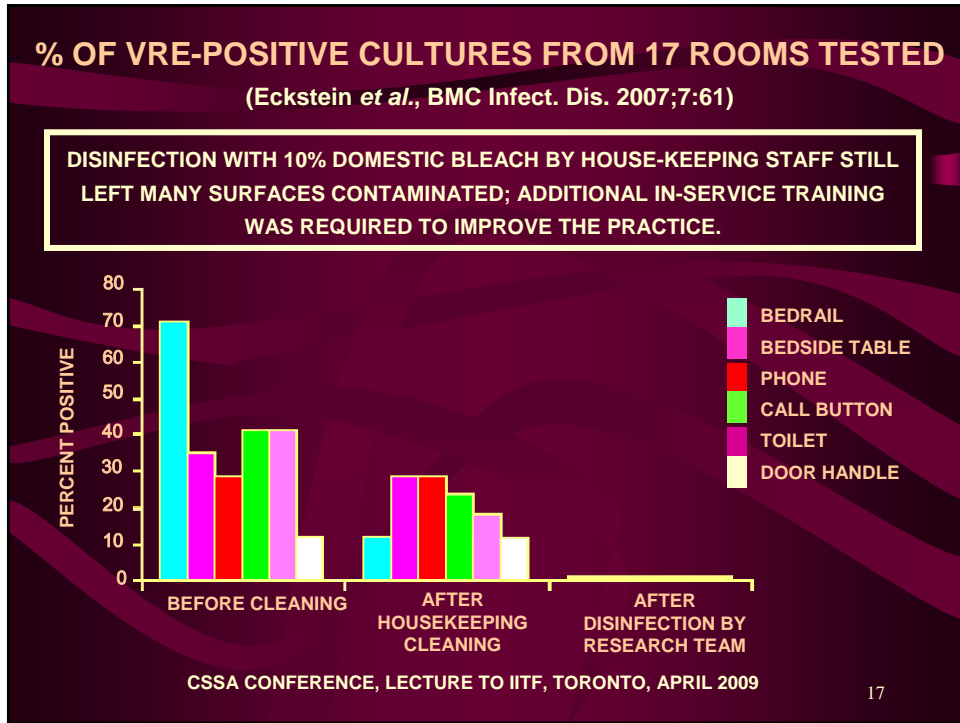
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- ### CLEANING
- CRUCIAL FOR SUCCESS OF STERILIZATION & DISINFECTION
 - ROUTINE CLEANING OFTEN NOT SATISFACTORY
 - HOW IS CLEANING MONITORED?
 - DIRECT OBSERVATION
 - SAMPLE ENVIRONMENTAL SURFACES & CULTURE FOR VIABLE ORGANISMS
 - ATP BIOLUMINESCENCE TOOL
 - FLUORESCENT MARKING TOOL (PHIL CARLING)
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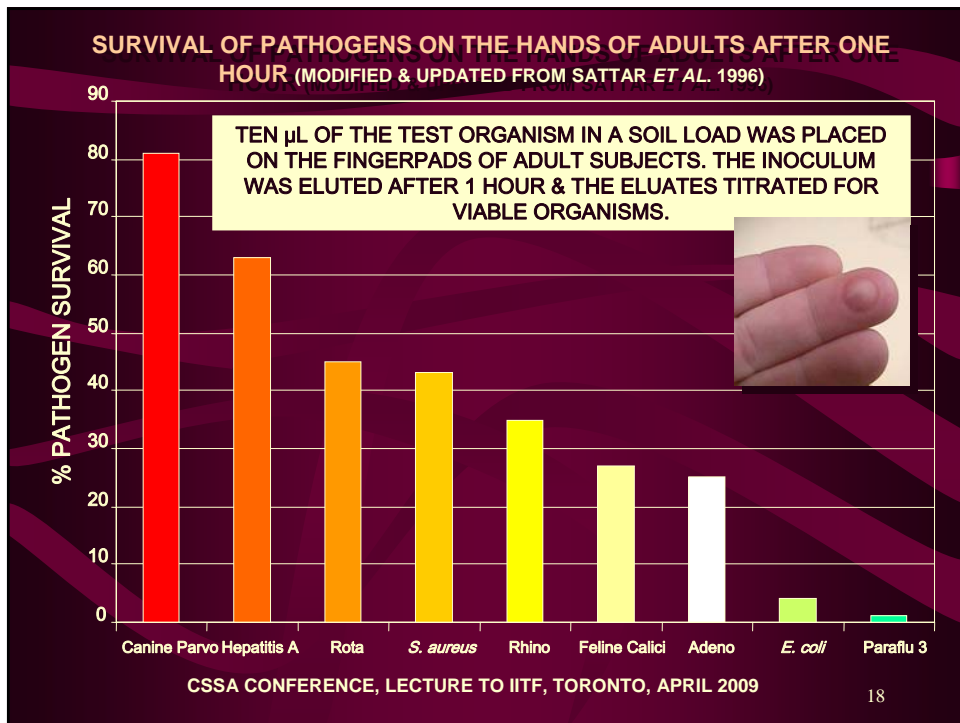
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ANTISEPTICS & DISINFECTANTS (MICROBICIDES)





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HAND HYGIENE

- **HAND HYGIENE CRUCIAL IN PREVENTING THE SPREAD OF MANY PATHOGENS**
 - LIMITED RELEVANCE IN INTERRUPTING DIRECT PERSON-TO-PERSON & AIRBORNE SPREAD
- **TESTING OF MICROBICIDAL ACTIVITY BASED ON:**
 - SUSPENSION TESTS & *IN VITRO* CARRIER TESTS
 - *IN VIVO* TESTS (WHOLE HAND & FINGERPAD OF ASTM)
 - *EX VIVO* TESTS (HUMAN OR ANIMAL SKIN)
- **PRODUCT REGISTRATION IN CANADA REQUIRES DATA FROM *IN VIVO* TESTS**
 - HEALTH CANADA'S GUIDELINES UNDER REVIEW
 - SOME HANDRUBS HAVE BEEN AWARDED A DIN
- **WHO'S GUIDELINES ON HAND HYGIENE ISSUED**

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THE ACTIVITY OF AN ALCOHOL-BASED HAND GEL AGAINST 3 NON-ENVELOPED VIRUSES

VIRUS TESTED	BASILINE CONTROL (PFU)	REDUCTION IN PFU WITH GEL	REDUCTION IN PFU WITH WATER	P VALUE
ADENOVIRUS TYPE 4	0.23 X 10 ⁵	>99.99%	85.0	0.0003
RHINOVIRUS TYPE 14	0.95 X 10 ⁵	≥99.90%	94.0	0.0004
ROTAVIRUS STRAIN WA	0.33 X 10 ⁵	99.99%	89.0	0.0003

FINGERPAD METHOD WITH 12 PANELISTS FOR EACH VIRUS. PLACED TEN µL OF VIRUS WITH SOIL LOAD ON EACH DIGIT & DRIED. EXPOSED TO 1 mL OF GEL CONTAINING 60% ETHANOL OR WATER WITH 200 PPM HARDNESS FOR 20 SECONDS. ELUATES PLAQUE ASSAYED & LOG₁₀ CALCULATED.

Sattar *et al.*, Infect. Control & Hosp. Epidemiol. 21: 516-519, 2000.

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WHAT IS THE FUTURE?

INCREASING SCRUTINY OF MICROBICIDES

- ANYTHING THAT CAN KILL MICROBES CAN BE POTENTIALLY HARMFUL TO OTHER LIFE FORMS!
- TOXICITY TO HUMANS & WORKPLACE SAFETY
- ECO-TOXICOLOGY IS ALSO A MOUNTING CONCERN
 - PERSISTENT CHEMICALS
 - GENDER-BENDER CHEMICALS
 - SUBLETHAL LEVELS IN WASTE STREAMS
 - 'CHEMBIOACTION' – DELETERIOUS OUTCOME OF COMBINED EFFECTS OF CHEMICALS & MICROBES
- ARE SAFER & BETTER ALTERNATIVES AVAILABLE?

METALS AS MICROBICIDES

- **SILVER-BASED FORMULATIONS**
 - SLOW RATE OF ACTIVITY
 - BACTERIOSTATIC RATHER THAN BACTERICIDAL
 - MAY NOT BE EFFECTIVE AGAINST VIRUSES
- **COPPER-BASED SURFACES**
 - COPPER & SEVERAL OF ITS ALLOYS RECENTLY REGISTERED AS MICROBICIDAL HARD SURFACES BY U.S. EPA
 - POTENTIAL SUBSTITUTE FOR STAINLESS STEEL & OTHER SURFACES IN HOSPITALS & OTHER SETTINGS
 - CLAIM ACTIVITY AGAINST BACTERIA, BACTERIAL SPORES & VIRUSES
 - CONTACT TIME ONE HOUR OR LONGER
 - COMPATIBILITY WITH OXIDIZER-BASED PRODUCTS REMAINS FURTHER TESTING

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TREATED ARTICLES

- **POROUS & NON-POROUS MATERIALS WITH MICROBICIDAL CHEMICALS BOUND TO THEM**
 - EXAMPLES ARE SILANES, HALOMINES & TRICLOSAN
- **TEST PROTOCOLS FOR CLAIMS OF ACTIVITY NEED REFINEMENTS**
- **POTENTIAL FOR MICROBIAL RESISTANCE & CROSS-RESISTANCE**
- **TOXICITY TO HUMANS FROM LONG-TERM EXPOSURE TO LOW LEVELS OF SUCH CHEMICALS ALSO UNKNOWN**
- **POTENTIAL AGAINST VIRUSES UNKNOWN**

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CONCLUDING REMARKS

- 'SOLUTIONS' CREATING MORE PROBLEMS
- WE ARE IN POST-ANTIBIOTIC ERA
- DISEASE PREVENTION THROUGH ENVIRONMENTAL CONTROL & HYGIENE IS MAKING A COMEBACK!!
- BETTER & SAFER MICROBICIDES NEEDED
- BETTER KNOWLEDGE OF DISEASE SPREAD?

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SUSTAINABILITY

- MEETING THE CURRENT NEEDS WITHOUT COMPROMISING *OUR SAFETY, SURVIVAL & PROSPERITY & THAT OF FUTURE GENERATIONS*

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FOOD FOR THOUGHT

**“THE QUESTION OF THE CENTURY
IS: HOW BEST CAN WE SHIFT TO A
CULTURE OF PERMANENCE, BOTH
FOR OURSELVES AND THE
BIOSPHERE THAT SUSTAINS US?”**

- E.O. WILSON IN *THE FUTURE OF LIFE* (2002)

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