

ENVIRONMENTAL MICROBIOLOGY

HISTORICAL PERSPECTIVE

- # Many serious events in 1970'S highlighted the need for better understanding EM such as:
- a) Emergence of a serious new waterborne food borne pathogens that posed a threat for human & animal health.
 - b) an increase in waste disposal leading to contamination of surface water & ground water supplies with organic & inorganic chemicals.
 - c) The development of new technologies in detection & identification of micro-organisms such as PCR.
 - d- discovery of the resistant to antibiological agents(antiseptics & antibiotics).
 - e- Recently discovered techniques that have a significant effect on human health such decrease of cholera and typhoid fever by applying filtration and use of disinfectants.

ENVIRONMENTAL MICROBIOLOGY

OBJECTIVES

1- DEFINE THE MOST HAZARDOUS ORGANISMS & UNDERSTANDING THEIR DISTRIBUTION , TRANSFORMATION AND ANY DISEASE THEY MAY CAUSE IN HUMAN OR ANIMAL BODY.

2- Describing some well known micro-organisms in air, water, & soil with special emphasis on their impact on their health hazard.

3- Study the wastewater treatment and disinfection processes.

4- INTERACTION & DISTRIBUTION OF MICRO-ORGANISMS WITIN WATER & SOIL TO FOLLOW THE BIODEGRADATION PROCESSES.

4- USE OUR UNDERSTANDING THE WAYS OF MICRO-ORGANISMS IN THE ENVIRONMENT TO IMPROVE THE LIFE IN OUR SOCIETY.

ENVIRONMENTAL MICROBIOLOGY & CHEMICAL POLLUTION

*The Chemical pollution has a direct and accumulative impact on human health. What ,Micro-organisms can do ?

- a) Biodegradation and /or detoxification •
- b) assessment & detection for accumulative •
mutagens, terratogens and/ or carcinogens
- c) resistance to antibiotics , disinfectants and •
insecticides or pesticides.

THE POSSIBLE HEALTH HAZARDS of The Chemical Pollutants

1- Potential mutagenicity

Mutagenesis is itself known precursor of carcinogenicity, terratogenicity and hundreds of genetic diseases.

2- Their Mutagenicity may affect the products out put and /or change some of their phenotypes.

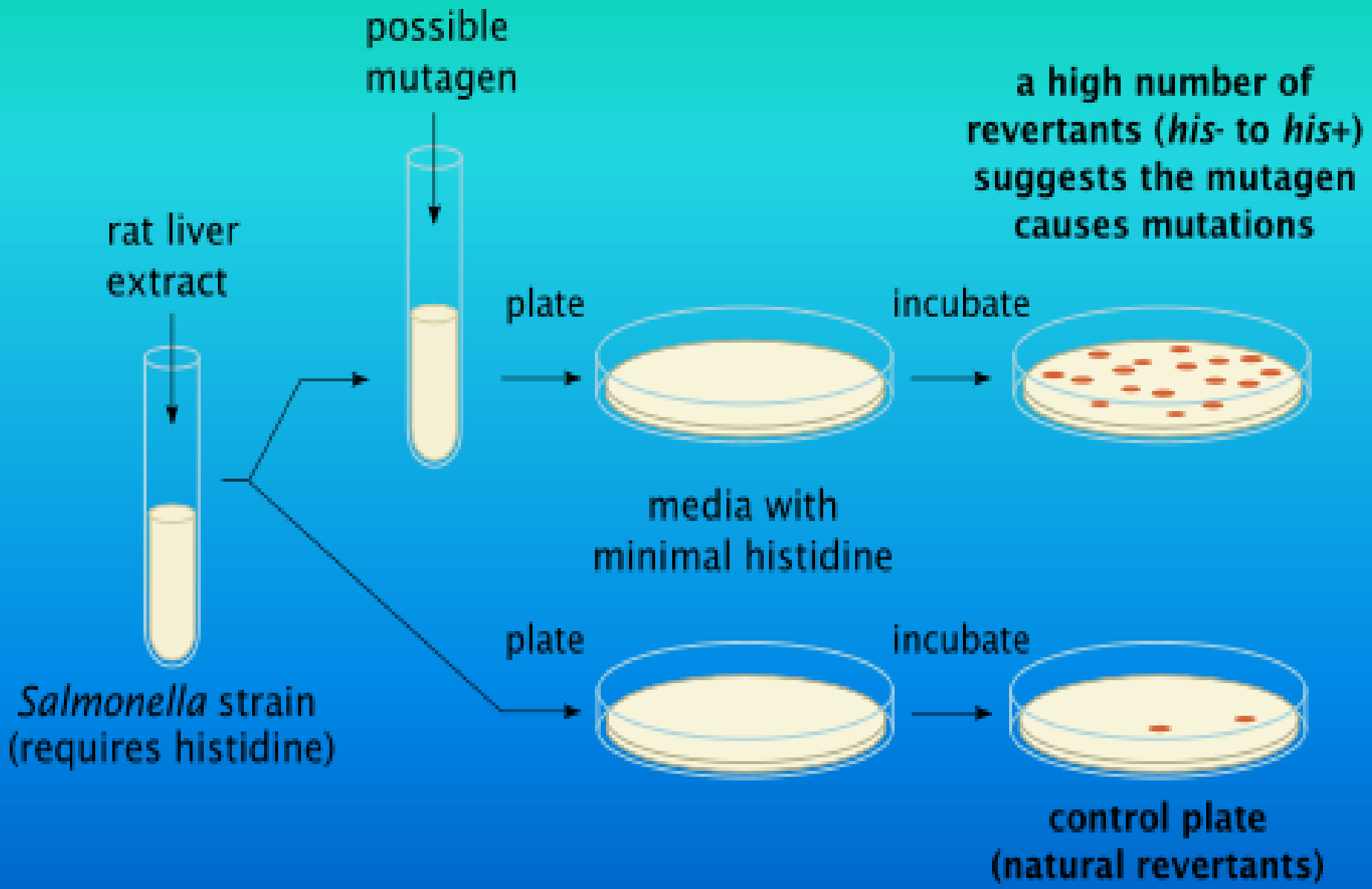
THE USE MICRO-ORGANISMS IN ASSESMENT OF MUTAGENS and/or ENVIRONMENTAL CARCINOGEN

a- Short-Term Bacterial Bioassays
(Ames Test & Fluctuation Test)

B- Yeast *Saccharomyces cerevisiae*

c- Chromated exchange-test

d- The micronucleus test (in vivo sh

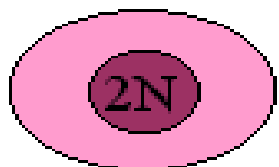


GENOTOXICITY: MICRONUCLEUS TEST

A micronucleus (MN) is formed during the metaphase/anaphase transition of mitosis (cell division). It may arise from a whole lagging chromosome (aneugenic event leading to chromosome loss) or an acentric chromosome fragment detaching from a chromosome after breakage (clastogenic event) which do not integrate in the daughter nuclei.

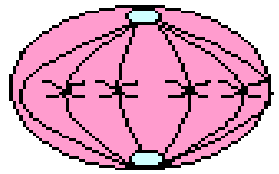
Scoring of micronuclei can be performed relatively easily and on different cell types relevant for human biomonitoring: lymphocytes, fibroblasts and exfoliated epithelial cells, without extra in vitro cultivation step. MN observed in exfoliated cells are not induced when the cells are at the epithelial surface, but when they are in the basal layer.

Mutagen :
aneugen or clastogen

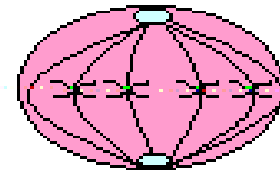


mitosis

Giemsa
staining

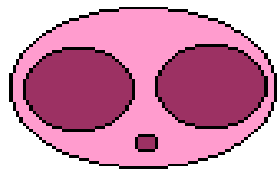


metaphase

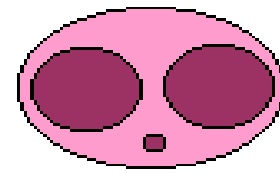


Fluorescence
staining

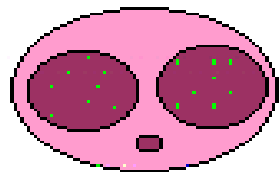
+ cytochalasin B



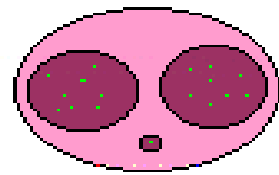
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FISH: probing with
pancentromeric
probe



Chromosome breakage
MN centromere -



Chromosome loss
MN centromere +

Environmental Problem 1

In November & December, 2011 Al-Hussein & Maternity Hospitals recorded 18% mortality rate among the patients who have done different surgical operations after only 2-3 weeks period after operations.



Cross Infections in the Environment Hospital

* Screening for the predominant antibiotic resistant bacteria in the: ■

1- Operation Rooms (floors, beds , air & aircondition systems) , ■
2- ICU ,3- Surgical Wards, 4- Surgical tools , 5- Nursing Equipments , 6- Nursing(especially anesthetic) & Medical staff ...etc

** Testing the efficiency of antiseptic / disinfectant agents that are routinely used ■

(concentrations used(MIC) , ways of treatment, frequency of application). ■

Conclusions in a clear report to the hospital staff showing the routes of transmission (from hospital staff to patient & from patient to patient or direct from surgical tools & equipments to patient or from hospital ventilation system). ■

Application of the control measures ■

Case Reporting

Case reporting provides epidemiologist with an approximation of the prevalence of a disease and its incidence. This information helps officials decide whether or not to investigate a given disease.

If an epidemiological study shows that a large enough segment of population is affected by a disease an attempt is then made to isolate and identify its causative agent . Identification of the causative agent provides valuable information regarding the reservoir for the disease, where control measures can be applied to stop disease from spreading .

Nosocomial (Hospital Acquired) Infections

Nosocomial infection acquired as result of a hospital & nursing homes stay. In Iraq, 10-20% may acquire some type of nosocomial infection. It is estimated that more than 20,000 people die of nosocomial infections each year. ■

Nosocomial infection can be related to the following factors: ■

- 1- Microorganisms ■
- 2- the compromised status of patient & ■
- 3- the chain of transmission in the hospital. ■

Control of Nosocomial Infections

The general measuring control aimed to: ■
- reduce the number of pathogens by using aseptic techniques, careful handling of contaminated materials, insisting on frequent hand washing, educating hospital

Personnel about basic infection control measures and using isolation rooms and wards. ■


- continuous inspection for respirators & humidifiers to stop spreading of airborne pathogens. ■

Control of Nosocomial Infections (cont.)

- The materials used for bandages and intubation should be of single use disposable or sterilized before use. ■
- Physicians can help improve patients resistance to infection by prescribing antibiotics only when necessary. ■
- you must act as epidemiologist (an individual who studies disease in populations) ■



MRSA POLLUTION IN KARBALA HOSPITALS



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Table 1 The over all distribution of MRSA from three hospitals in Kerbala City

Collection Sites	Total No. of collected samples	Total No. of MRSA	Percentages
Equipments	271	32	12%
Patients	244	44	18%
Nursing staff	122	22	18%
Total	637	98	15.4%

Table 2 The distribution of MRSA in three hospitals of Kerbala City

Hospital Name	Collection Site	Total Number of Samples	Number of Isolated MRSA	Percentage
Maternity Hospital	Equipments	40	9	22%
	Patients	85	16	18%
	Nursing Staff	22	7	32%
Al-Hussein General Hospital	Equipments	131	12	9%
	Patients	78	14	18%
	Nursing Staff	34	6	17.5%
Pediatrics Hospital	Equipments	100	11	11%
	Patients	81	14	17%
	Nursing Staff	66	9	13.5%
Average	----- -	637	98	15.4%

Table 3 Exposure of MSSA to different sub-lethal doses of antiseptics /disinfectants in Karbala hospitals, AL-Husseiny, Maternity and Paediatrics Hospitals

Antiseptic/ Disinfectant	MIC (mg /ml.)	Sub-lethal Concen- tration (mg/ml.)	No. of MSSA Exposed	No. of MRSA Detected ± SD **	Percentage
Formaldehyde (37%)*	24.5	12.25	420 ±95	289±84	68%
Alcoholic Iodine (2%)*-	1.2	0.6	1211 + 159	884 ± 181	72%
Hixsatan (4%)*	40.0	20.0	126 + 50	64± 11	50%
Iodine (10%)*	12.5	6.25	286 + 50	233 ± 25	81%
Ethyl alcohol (99%)*	24.5	12,25	1250+ 130	714 ± 67	57%
Chlorine (6%)*	1.5	0.75	230 ± 21	157 ± 19	68%

*The actual used concentrations in distinction methods in the screened hospitals.

** SD: Standard Deviation

Case Report2

In Chimalia Agricultural Area (North of Kerbala City): 5 gas gangreen , 7 Tetanus cases , 3 & 12 dog bites were reported to Health Authority of the Health Directorate in Kerbala Province. ■

If you are in charge of the CENTRE DISEASE CONTROL(CDC) What you MUST DO? ■



Soil Pathogens