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losus. This could experimentally be confirmed. With fascioliasis patients it is almost a rule, that anti-*Fasciola hepatica* antibodies react with antigens from *D. viteae* and *E. granulosus*, and with lower extinction values and much less often also with antigens from *T. canis* and *S. mansoni*. This contrasts the extremly high specificity (98%) of the *F. hepatica* total worm extract antigens present on the plastic surface. This antigen is the most specific antigen in our multi-antigen ELISA plate. One exception, however, has to be mentioned. Sera from paragonimiasis patients show the same reaction pattern as sera from fascioliasis patients. Sera from clonorchiasis patients generally do not crossreact with antigens from *F. hepatica* or if so, only in the borderline range (cf. fig.).

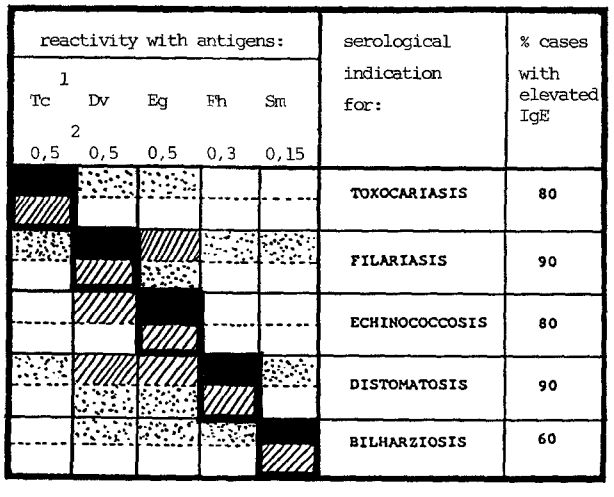
4. The sensitivity and specificity of the antigens from *Schistosoma mansoni* is high for patients with *S. mansoni* infections (about 90%). The sensitivity with patients having urinary schistosomiasis drops to about 60%, as also experienced by other authors. The simoultaneous use of antigens from *S. mansoni* and *S. haematobium* can improve the reliability of the schistosomiasis serodiagnosis with ELISA.

The multi-antigen ELISA has been proved in our laboratory to be a very valuable screening system for patients with unexplained blood eosinophilia and negative results in stool examinations. All ELISA-reactive sera are further analyzed with the indirect fluorescent antibody test (IFAT), which is more specific but less sensitive. In addition, abnormal fluorescence with a certain antigen can confirm the suspicion of crossreaction in ELISA with the corresponding soluble antigen. We found the appreciation of fluorescence of specific anatomical structure to be quite important in order to properly interpret the results. This potency of IFAT is still under investigation.

Since the serum concentration if IgE antibodies are often raised with helminth infections, we include in our helminth screening ELISA a semiquantitative IgE determination (using a monoclonal anti-IgE catching antibody from Hybritech). Values between 200 and 2000 kU/l are recorded as positive, and values over 1000 kU/l are recorded as strong positive. Patients with elevated IgE values can be further examined for specific IgE against antigens from various helminths by the Radio Allergo Sorbent Test (RAST), which proved to be more specific than ELISA or IFAT.

Using a sensitive multi-antigen ELISA as a screening procedure allows a routine serodiagnostic laboratory to become more efficient. More expensive and time consuming methods are the only applied to confirm results on a reduced number of samples, for which sufficient time will be available for labor and more careful evaluation. The overall impact is a more cost-effective service and a higher quality report for the clinician.

Typical reaction patterns of sera from different helminthiasis patients and various helminthic antigens;
sera moderate (▨) or strongly (■) positive for homologous antigens are contained within the darker borders.



1) Antigens: Tc = *T. canis, in vitro* derived metabolic antigens from larvae II; Dv = *D. viteae*, total worm extract; Eg = *E. granulosus*, antigens from hydatide fluid of bovine lung cysts; Fh = *F. hepatica*, total worm extract; Sm = *S. mansoni*, total worm extract.
2) Positive threshold value for the different antigens (extinction values at E_{492nm}; equals upper limit of normal population values).

⩾ 4× positive threshold = ■

2–4× positive threshold = ▨

1–2× positive threshold = ⁘
cut off = □

Round Table Discussions

Discharge to the environment of viruses in wastewater and sludge

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The many varieties and forms of viruses which may occur in nature were described, and the main types illustrated. Almost all living things are associated with specific viruses, including hosts as diverse as mankind and bacteria. Under suitable circumstances, any virus which exists within the catchment of a sewage works may eventually find its way into the sewage. The number of different types which may therefore be present is potentially very large, though many derive from hosts other than man and, due to the host specificity typical of viruses, the vast majority pose no problem to human health. However, some viruses from plant or animal sources distributed through contaminated sewage can be of agricultural (and therefore of commercial) importance.

The problems which face us in human health arise mainly from a large and diverse group known as the human enteric viruses. These are excreted in very large numbers by infected persons and are universally present in sewage. They show a marked ability to survive for long periods and can resist extremes of pH, the effect of organic solvents and bile salts. Conversely they are relatively sensitive to high temperatures and dessication. Infection takes place when the virus is ingested, possibly in food or water. The main route of transmission however is probably directly from person to person either by the oral-oral route or the fecal-oral route. The minimum infective dose is believed to be as little as one virus particle.

Over 114 different human enteric viruses have been isolated to date and have been implicated in a range of human disease. The group contains the polio and hepatitis A viruses, together with rotavirus (a major cause of infant diarrhoea in developing countries) and norwalk virus which is frequently implicated in outbreaks of idiopathic vomiting and diarrhoea. Both hepatitis A and norwalk viruses still cause problems in Europe.

The factors influencing the numbers and types of viruses in sewage were considered. They were shown to depend partly on the composition of the community from which the sewage derived with special regard to the age, level of health, economic status and general hygiene. It also is related to the composition of sewage, with water from industrical sources having a low virus content.

The treatment of sewage was examined. This process is important because it is the point at which the majority of viruses are released into the environment. Once dispersed a variety of routes exist by which they can return to the community and establish a cycle of infection. These include the contamination of drinking water, crops, shellfish and waters used for recreation. The treatment processes were shown to be capable of producing a range of products both liquid and solid with varying levels of virus contamination. In general viruses tend to associate with the solids and are therefore predominantly found in the sludges. All the treatment processes tended to reduce the numbers of viruses but, with very few exceptions, none removed them entirely. The importance of designing treatment systems with desirable pathogen control characteristics – plug flow rather than fully mixed, for example – was emphasized.

Data were presented on the concentrations of viruses found in a range of sludges and effluents; these were mainly a reflection upon the degree of treatment to which the material had been subjected. The results of a year long study at a treatment works near London were illustrated. These works, processing mainly domestic sewage by the activated sludge method, reduced virus numbers by approximately 99% which was considered to be good by comparison with other published results.

The types and concentration of viruses found in the River Thames over a period of several years were also shown. These viruses which are largely attributable to contamination by treated sewage effluents present a problem when the water is processed to produce drinking water. These findings were interpreted in terms of the epidemic state of the community, the influence of polio vaccination programmes, the ability of the viruses to survive in the environment and the limitations of viral analysis methodology. Successive waves of infection in the community were reflected in the virus content of the river. Amongst the various factors affecting survival temperature was found to be the most important with viruses being adversely affected by high temperatures.

The influence of temperature and time on survival were shown to be significant in a wide variety of treatment processes ranging from sludge digestion, pasteurization and composting to long term storage of lagooning. This theme was expanded to embrace the many other pathogens which may occur in sewage including such resistant organisms as ascaris and taenia.

The presentation concluded with the suggestion that sewage should be regarded as a resource rather than a nuisance. Dried sewage sludge, for instance, contains some 20% fat and 50% protein plus significant quantities of fertilizers such as phosphate and nitrate. The assured destruction of pathogens including viruses will remove one of the major factors inhibiting its re-use.

Environmental contamination with Salmonellae by the spred of animal waste and sewage sludge

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Sewage sludge, used as a fertilizer in agriculture, is a main source for the pollution of the environment with Salmonellae. Among 370 samples of unsanitized sludge from 207 different sewage disposal plants in Switzerland, Salmonellae were detected in 339 samples (97%). All samples investigated from 199 plants proved to be positive with an average pf 780 Salmonellae per liter.

On the contrary, we were able to isolate Salmonellae only in 7 cases (1.3%) out of 555 samples of slurry from different cattle herds. In 55 farms, however, where the slurry was mixed up with sewage sludge, the percentage of Salmonellae recovery increased to 38.2%.

Among 100 samples of slurry from different pig fattening stations, we could isolate Salmonellae in 23.0% and in addition, the examination of 208 fecal samples from poultry herds revealed the presence of Salmonellae in 51 specimens (24.5%). The spread of animal wastes from intensive fattening plants of pigs and poultry has therefore the same importance for the environmental contamination by Salmonellae as the spread of sewage sludge.

Carotenoids from plankton and purple sulphur bacteria in lake sediments as indicators of changes in the environment

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The vast increase in the influx of phosphorus into our lakes during this century has led to a series of well-known phenomena associated with eutrophication, thereby altering a sector of our environment in a spectacular manner.

The primary effect, an increase in the production of plankton, has resulted in part of the pigments produced by biomass aggregating on lake beds, particularly carotenes, carotenoids, chlorophylls and phaeophytine. Alcohol and acetone mixed in a ratio of 1:1 release these coloring matters from bore samples. The amount of crude carotenoids can be determined almost exactly by photometry, measuring at 665 and 450 nm. The carotenes and carotenoids are separated by gradual development of the sediment extracts on silica gel thin layer plates, using hexane-acetone-propanol-2-mixtures. Their presence is not only proof of their conservation in lake sediment but also enables a qualitative and quantitative reconstruction of earlier plankton biocenosis according to order, family and sometimes also genus of the various algae.

The behavior of the dreaded *Oscillatoria rubescens* (so-called Burgundian blood) in Swiss lakes is manifested by