

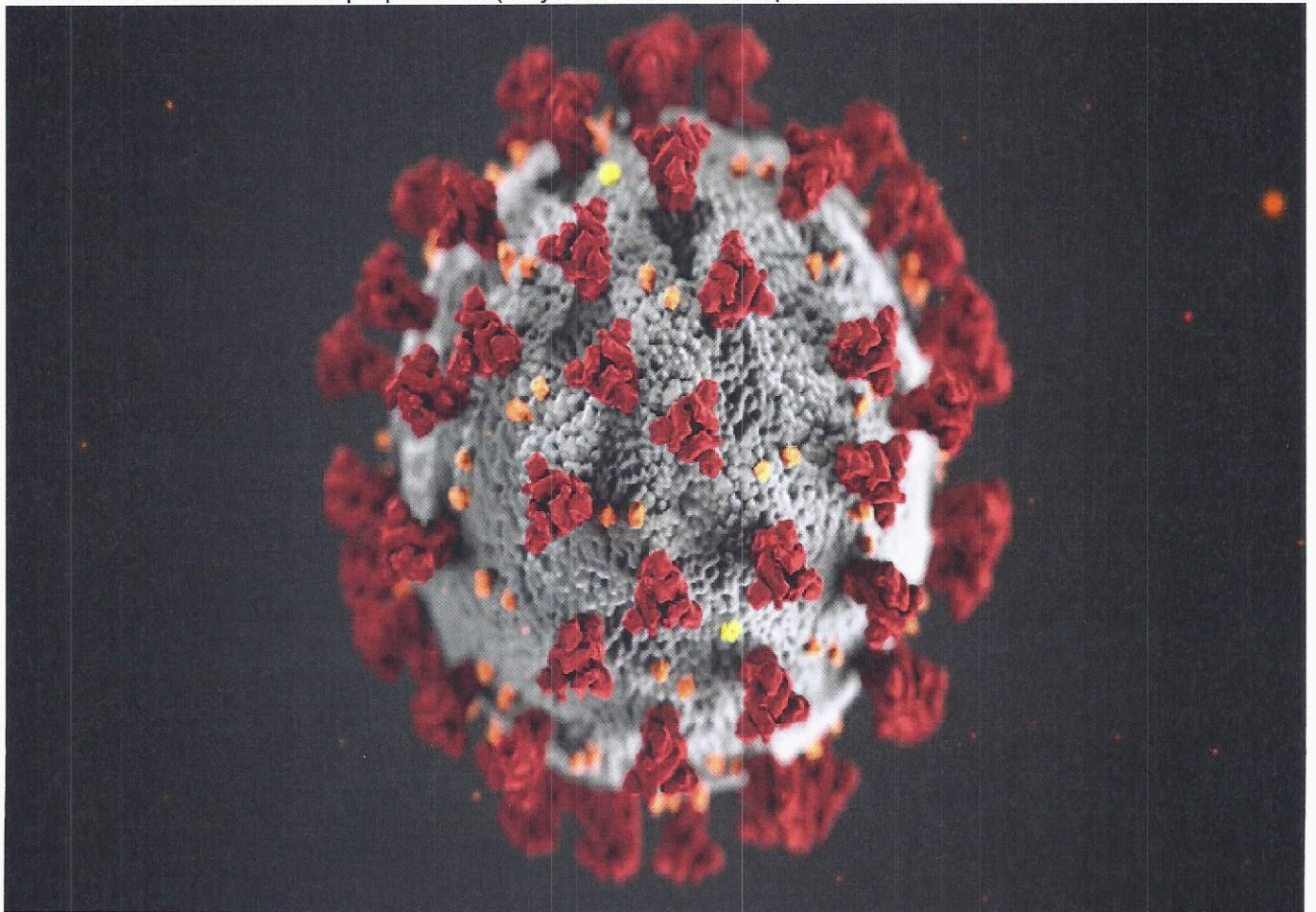
# Covid19 Through The Eyes of a Fish Pathologist!

By: DR Gerald Bassleer Fish Pathologist  
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**As an active fish doctor in the aquarium fish world, many people have asked my opinion about this new viral infection. After 6 months' of studying reports & scientific publications & data I was able to start collecting enough information about Covid-19 (Corona virus or SARS-Cov-2) that would help my "fish community" learn more about this disease(i.e. in relation to the viral KHV in Koi) and to understand what we can do in order to prevent or adapt to it.**

Since 2020, our whole world has had to deal with an epidemic viral infection called Covid-19 (a Corona virus, SARS-Cov-2). I will not go into detail when, or where, or why it all started, since we do not know all the proper facts (maybe

we will never know, like with many of our fish diseases) but the real purpose of this article is about prevention & adaptation (like we do with our fish care) without going into details with complicated scientific facts!





Our focus will be on the diagram of disease and interrelation of the host (fish or mankind), the pathogen (virus or other) and the stress factors!

### The Host

Fish or mankind usually finds a way to survive in the world with the many millions of pathogens around us. Since the first day that we are born, we (fish & mankind) all have an innate immune system, an automatic self-defense system against pathogens! During our lives we develop an adaptive immune system, due to contact with viruses (many 1000+ we must deal with). Through this our defense system develops a way to fight off the 'intruders' and learns to adapt. Here a vaccination stimulates the defense system to develop antibodies to fight off a virus.

For our Koi we have a vaccination against the Herpesvirus KHV (Koi Herpes Virus CyHV-3) that is given by some Koi-breeders in Israel! Other breeders in Israel, Japan, Taiwan, Europe, etc. raise their Koi in bio-secure facilities (no vaccination) to prevent infection and the spreading of diseases, such as KHV. In the trade, the seller usually recommends that it is good practice not to mix vaccinated Koi with non-vaccinated Koi. Fish that have been sick may develop an adaptive immunity.

Wild fish usually have a better immune system due to their daily contact with pathogens, while tank raised fish that are kept in enclosed, sometimes very hygienic environments, may have a poorly developed immune system due to the lack of contact with pathogens. With regards to Covid-19, when we, mankind, are in good shape, living in a good and safe environment, enjoying a good food supply, avoiding negative stress, having good contact with nature, playing outside and keeping pets, avoiding too much



Above: Koi with KHV  
Pic supplied by DR Bassleer

hygienic control measures, etc. our immune system will do very well to handle the intruders, microbes, pathogens... or a virus! Therefore children with a well developed innate immune system can handle the viral infection Covid-19 very well, as well as many (99.5%) people who have already developed a good adapted immunity. Who suffers most? A small % of the population who become really sick. These are people that deal with serious health problems (diabetes, heart disease, obesities,

cancer patients, asthma, smokers, hypertension, cardio-vascular problems, etc.) with a poor immune system (many elderly people have a poorly functioning immune system). A poor working immune system cannot be activated by a vaccine as the flu-vaccine teaches us.

### Pathogens

We know that bacteria, fungi, parasites or viruses are part of our everyday lives. Our aquarium fish deal also deal with it in nature, with different seasons potentially





Above: Koi showing signs of KHV in the gills during a post mortem

having differing impacts. Tank raised fish must deal with pathogens in breeding facilities, mostly depending on mankind's biosecurity control measures which determine the condition of fish. An important aspect is the quantity or volume of pathogens that can be introduced to each other. When there are a very small numbers of pathogens, there is a smaller risk of transferring the disease. We see that daily in our aquaria, our fish always tend to carry some sort of pathogen which do not seem to have an effect due to their immune/defense systems working very well. When we introduce new fish into our aquaria that are not showing any obvious disease, we have a minimal chance of our 'old' fish community becoming infected and sick...unless our 'old' fish community has developed a poor defense system and so may become susceptible and diseased!

When we introduce a new fish into our aquarium, that has a serious infection (like Koi with KHV or with Skin flukes or ICH), we have a larger risk that our healthy fish can become infected, especially in crowded conditions. Hence professional aquarists normally employ good quarantine & biosecurity practices, to

determine if any pathogens exist as well as avoid the spreading of pathogens by isolating the aquarium/fish with a disease!

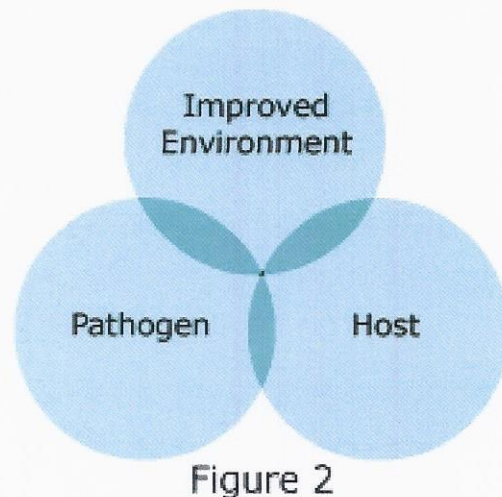
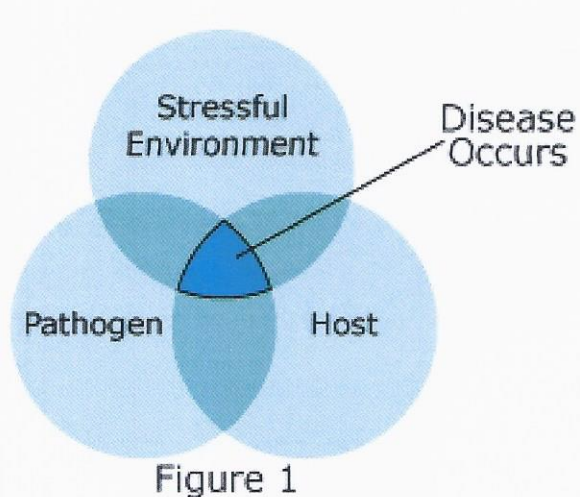
The same counts for mankind and Covid-19. Small amounts of viral particles have shown to have a very limited effect on healthy people that have a good functioning immune system, or a system that has adapted. We have learned that the contact with large number of viral particles during large social gatherings in particular (poor ventilated, dry, dusty, cool or heated) enclosed environments is a potential larger risk for those that are most susceptible.

#### **Environment & Stress**

In the daily practice in teaching fish health management by Dr. Bassleer, the aquarium fish industry is supported by good practices! This all takes into consideration creating a good environment for the fish (good filtration, optimizing water quality, enough oxygen, etc.) and avoiding stress (chemical like ammonia or nitrite; physical like fighting for food, aggression; good handling, netting; good feeding practices, etc.).

A poor environment can become a terrible stress

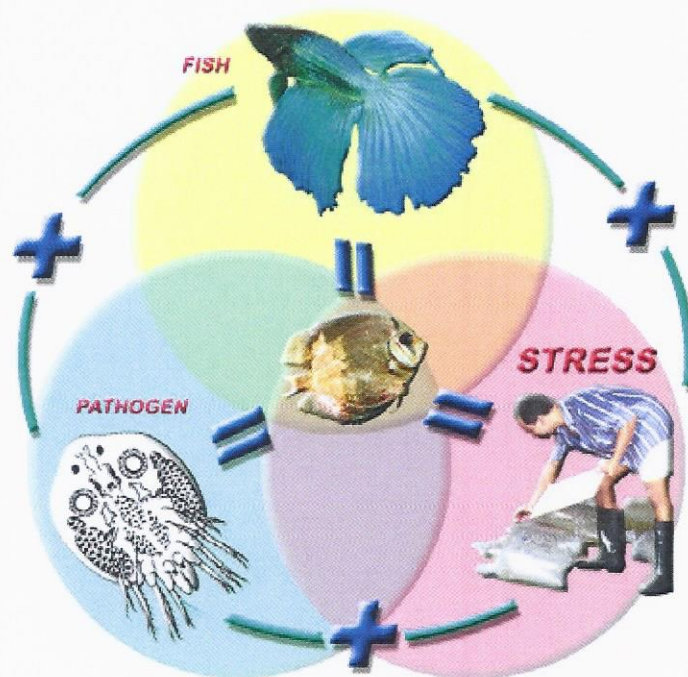




Above and below: A few diagrams showing how disease can start up as well as be prevented within the aquarium

for the fish and cause the fish to become weak and its immune system to fail!  
 Most of our fish become sick in our aquaria due to us keeping either too many fish together, too small or poorly managed filtration or lack of water changes and overfeeding. Usually we as hobbyists must be blamed for it due to us not taking the necessary adequate measures to keep the aquarium and its occupants in the best shape! The same goes for mankind. Living in a polluted environment, poor health care system, no adequate food supply or bad eating habits, living in crowded housing or rooms with poor ventilation (Note: Covid-19 loves cool, dry, dusty air, poor-ventilated, crowded rooms, so indoor activities are major source of super-spreading). Other reasons include being too hygienic so the immune system lacks good development as well as too much stress that weakens the immune system and so forth.

**ADAPTATION:** Why adapt? The virus Covid-19 will remain always part of our world (like influenza that is still around us although we have 80 years of vaccination). Dr. Bassler always recommends that 'prevention is better than



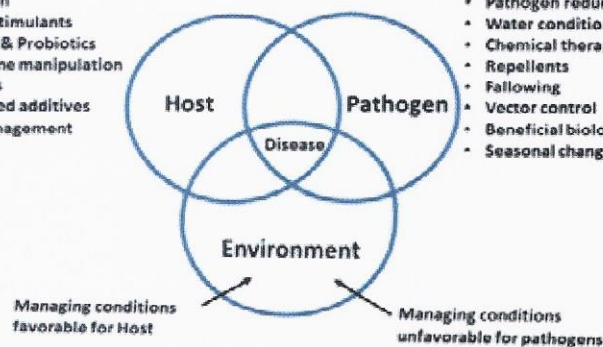
### Manipulating the disease triangle

#### Host Augmentation

- Genetic selection
- Vaccination
- Immuno-stimulants
- Prebiotics & Probiotics
- Microbiome manipulation
- Antibiotics
- Feed & Feed additives
- Stress management

#### Pathogen Control

- Biosecurity measures
- Pathogen reduction equipment
- Water conditioners
- Chemical therapeutics
- Repellents
- Fallowing
- Vector control
- Beneficial biologicals
- Seasonal changes to production





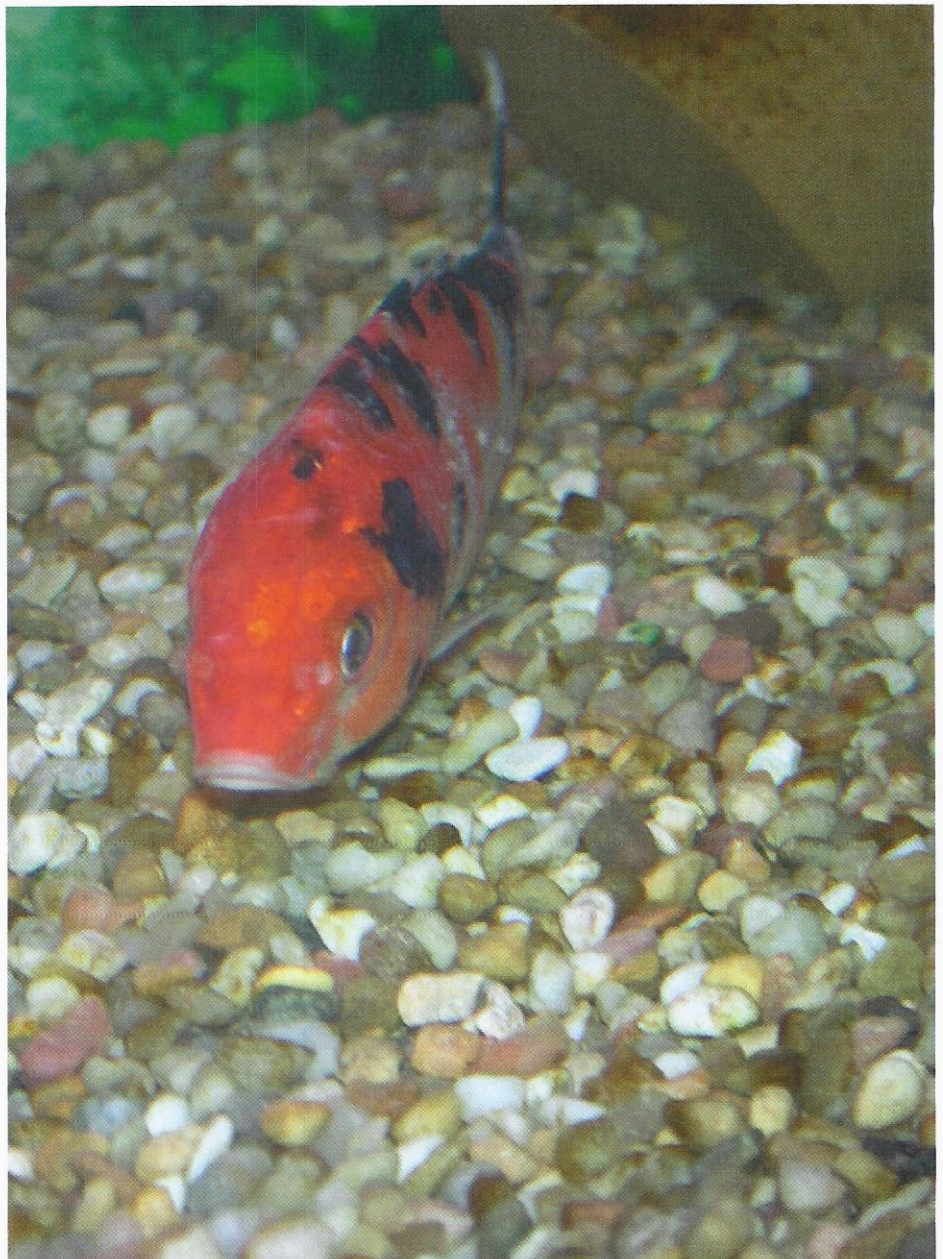
cure'.

A task we should perform daily is to check if our fish are doing well. When we have a sick fish, we try to detect the cause, we try then try to separate and treat.

Currently the best we can do is to stimulate the immune system and keep the body & mind in good shape. We should avoid risky environments and protect the 'risky' part of the population. Washing your hands (common practice for koi breeders) or proper disinfection as is practiced with fish nets. Fish-importers check with their Koi-suppliers if their fish are free of KHV and usually send several samples of fish to the laboratory for testing, a single swab unfortunately is often not enough to get a proper diagnosis. As a fish keeper, when our fish become sick, the first rule is to find the cause and to then determine the correct pathogen so an adequate treatment can be implemented. For KHV some disinfectants work well to avoid the spreading of this viral infection. KHV fortunately has an official eradication program. When a veterinarian has detected & tested a positive KHV-case, the whole pond will be destroyed, the supplier will also be contacted and checked! This prevents potential spread to another fish.

When we talk about Covid-19, several studies on face masks have been published. Level of safety can all depend on the kind of mask, how well it is the used, or in combination with other safety practices. Only professionals in health care are trained how to use masks effectively and they select the best mask that are specifically made to control a virus, certainly not those that we use daily. Many vaccines against Covid-19 have been studied and the future will tell us if they will be effective without any negative side effects or risks. In the coming years, many people will eventually develop an adaptive immunity, which is the best defense against viral infections.

The same counts for fish, they can also develop an immunity against KHV, White Spot Disease or ICH as well as many bacterial, viral and parasitic



Above: Another Koi showing signs of KHV  
Pic supplied by DR Bassleer

infections. (Bassleer; Defra; Hardy; Leung; Macintyre; Peeters; Singleton; WHO)

Detection and Quarantine in the early stages of a problem is the key to success. It is good practice for us to check the health of our fish in each aquarium daily within our fishrooms or petshops. When we see a problem, we would firstly check that all the environmental parameters are correct followed by use a microscope to examine the fish if one is available. In extreme cases it is best to send a test to a laboratory for a PCR-test.

If we do more testing for certain diseases we will tend to find more positive cases in our fish room even if the fish are not showing any disease due to the fact that they are being kept in good conditions and have an immune system that



works well. When we detect a serious infection in one aquarium, it does not mean we have to close the shop, we can still continue to sell the other healthy fish from other aquaria as we keep the *infected aquarium in quarantine!*

For Covid-19, testing helps to implement good bio-secure measures, keeping recently infected people in quarantine, bringing the sick ones to the hospital and avoid spreading & start treatment. People should be responsible to stay home when they are sick and avoid close contact. (Bassleer; Fulton; van Tussenbroek; Ventegodt; Wodarg; Zizi)

### **Environmental control**

What should we do when we keep fish? Make sure you avoid stress and provide a good filtration and proper water changes with a good feeding practice. Our goal is to obtain optimal water quality! For mankind and the many viral infections, we should improve ventilation in closed rooms, with lots of fresh air and higher humidity. Creating a healthy social environment and not unnecessarily causing stress by locking up healthy workers, families, children or elderly! (Dutch doctors & psychiatrists; Zizi;)

### **Food & immune system**

For animals & mankind, a good balanced diet

with pro and prebiotics helps to keep the body in good shape and as well as maintain a good functioning immune system. During my work as a fish doctor, I have learned that a imbalanced gut flora is a major cause of fish disease. This will be the same for us humans. It is the 'leaking gut' based on the same principle, a poor gut flora (microbiome) due to bad food habits, antibiotics, chemicals, stress, etc.! (Aelbrecht; Bassleer; Klatte)

### **Treatment**

For Koi with KHV there is actually no treatment but the application of a good disinfectant seems to prevent further spreading. Usually the Koi will die from secondary bacterial infections such as the disease Columnaris. When treating during the first stages, with proper antibiotics the fish could recover and survive the viral KHV with its adaptive immune system.

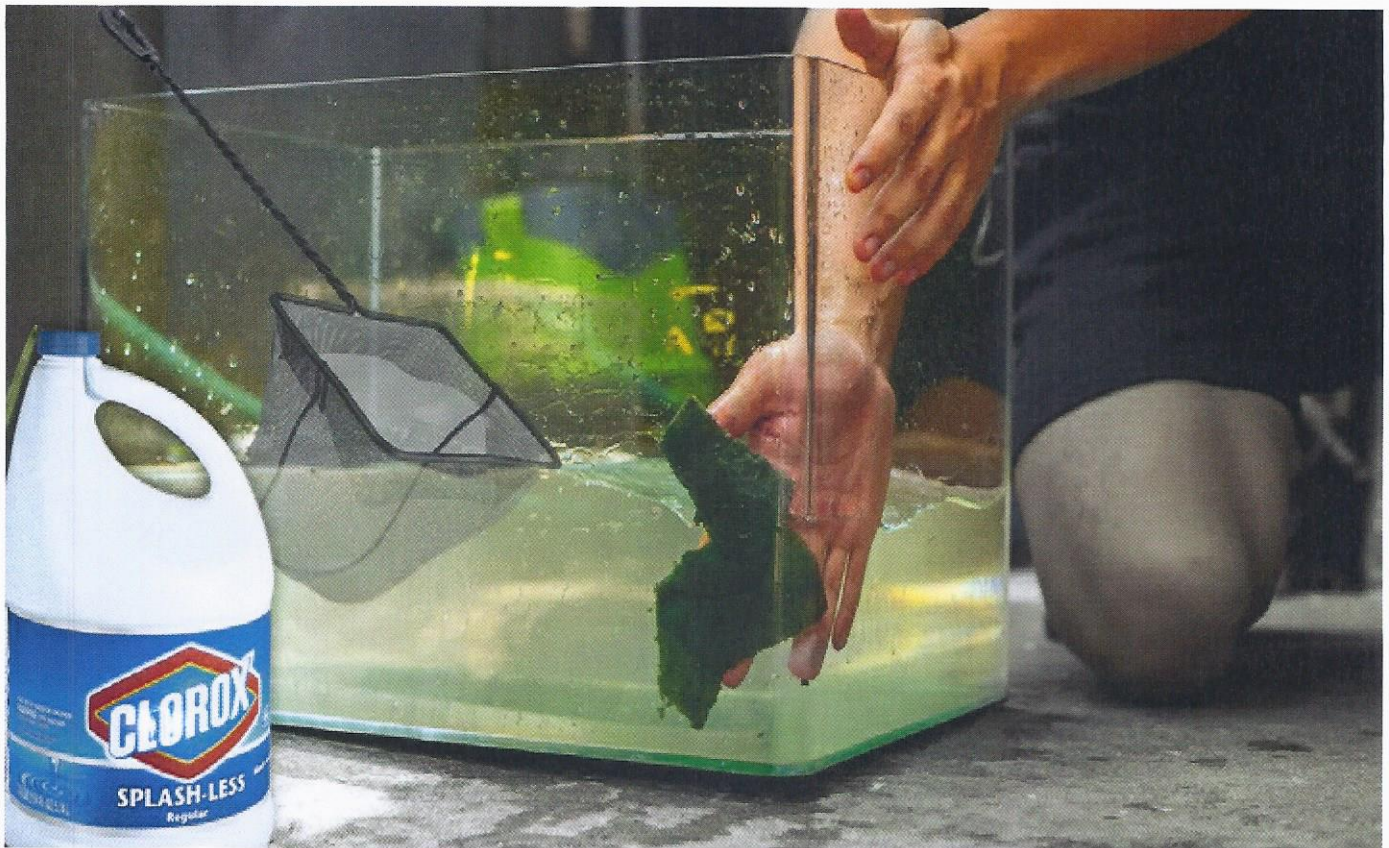
For Covid-19 there seems to be at least 10 different medications available that help to control but not kill the Corona-virus and help to control the secondary infections like pneumonia or sepsis.

Certainly, we will learn more in the coming years because "Science is Never Settled". (Klatte; Monforte; Zizi)

Below: Koi showing external lesions as a result of KHV.







Above: Proper disinfection of quarantine tanks and equipment is very important!  
Bleach is very commonly used within a disinfection protocol

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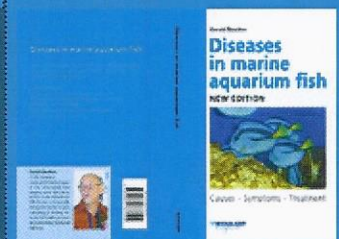
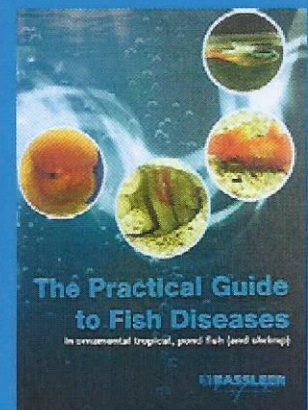
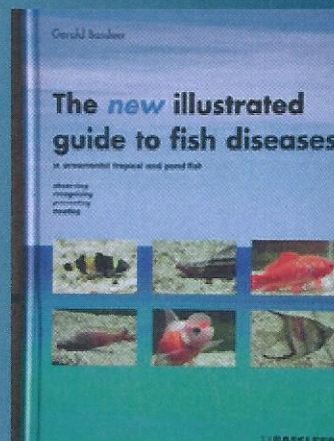
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