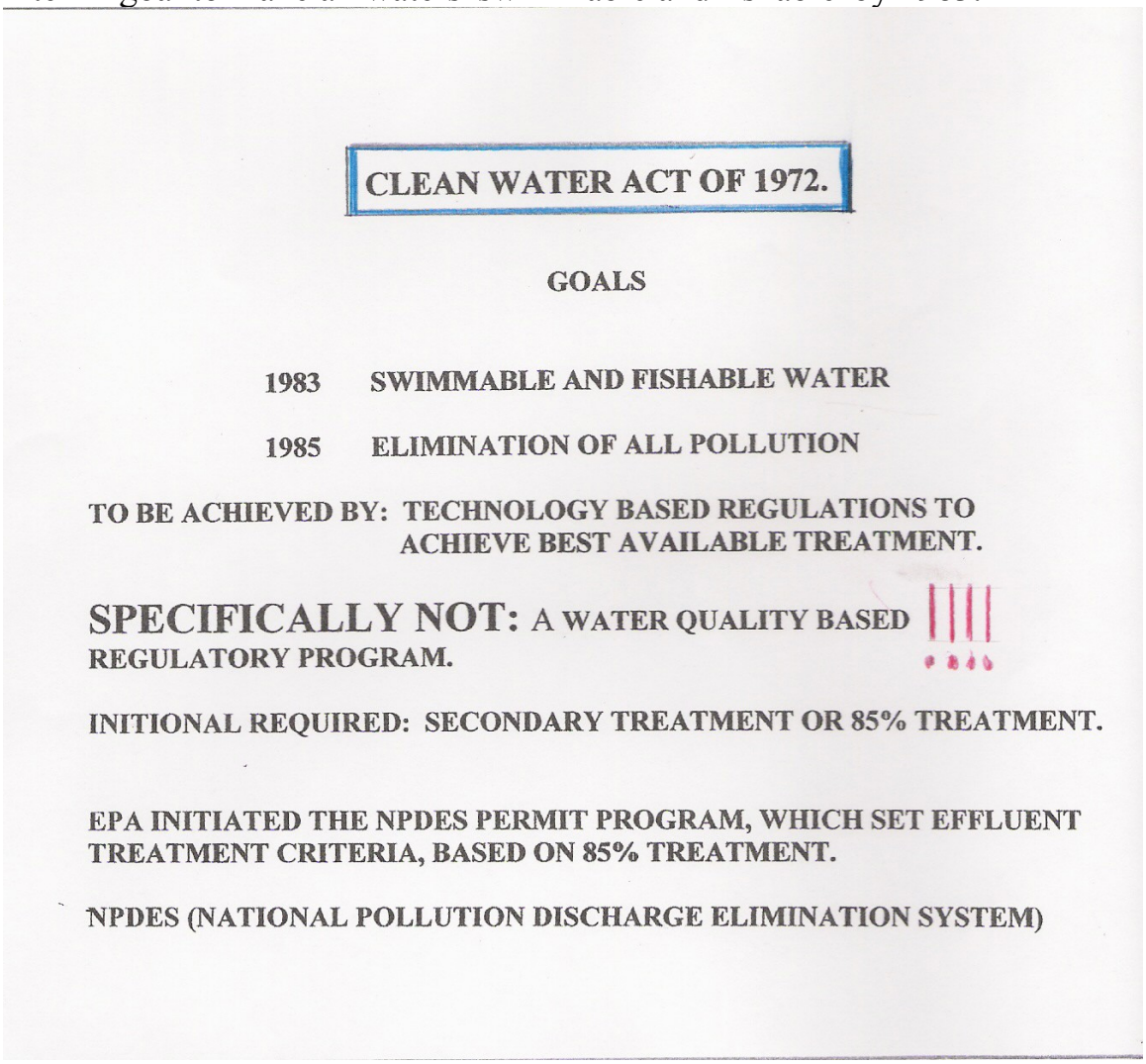
Background information of what went wrong when the EPA implemented the Clean Water Act.

Prior to 1972, each State had its own water pollution regulations and this created 'clean' and 'dirty' states. Industries in 'clean' states, who did not want to spent money to meet the higher treatment standards, simply moved to a 'dirty' state and when States lose employment, they will go to the federal government asking to prevent this.

This is what happened and resulted in Congress passing the Clean Water Act of 1972. An Act intended to set uniform national wastewater treatment standards. Its goal was to eliminate all water pollution by 1985 and as interim goal to make all waters 'swimmable and fishable' by 1983.



CLEAN WATER ACT OF 1972.

GOALS

1983 SWIMMABLE AND FISHABLE WATER

1985 ELIMINATION OF ALL POLLUTION

TO BE ACHIEVED BY: TECHNOLOGY BASED REGULATIONS TO ACHIEVE BEST AVAILABLE TREATMENT.

SPECIFICALLY NOT: A WATER QUALITY BASED REGULATORY PROGRAM.

INITIONAL REQUIRED: SECONDARY TREATMENT OR 85% TREATMENT.

EPA INITIATED THE NPDES PERMIT PROGRAM, WHICH SET EFFLUENT TREATMENT CRITERIA, BASED ON 85% TREATMENT.

NPDES (NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM)

The intend of the Act was clear, as Senator Muskie stated on the floor: "This Act simply means that we can not use our rivers any longer to treat our sewage."

Congress selected a 'technology-based' regulatory program, so that best available treatment would be required. Thereby specifically rejecting a 'water quality-based' program, whereby the treatment would be determined by the water quality of the receiving water body. Congress felt that this could be too easily manipulated by local governments.

Since 'elimination of all pollution' or 100% treatment, was not achievable at that time, Congress demanded 'secondary treatment of sewage, which Congress was told, represented 85% treatment, an acceptable first step towards the final goal of 100% treatment.

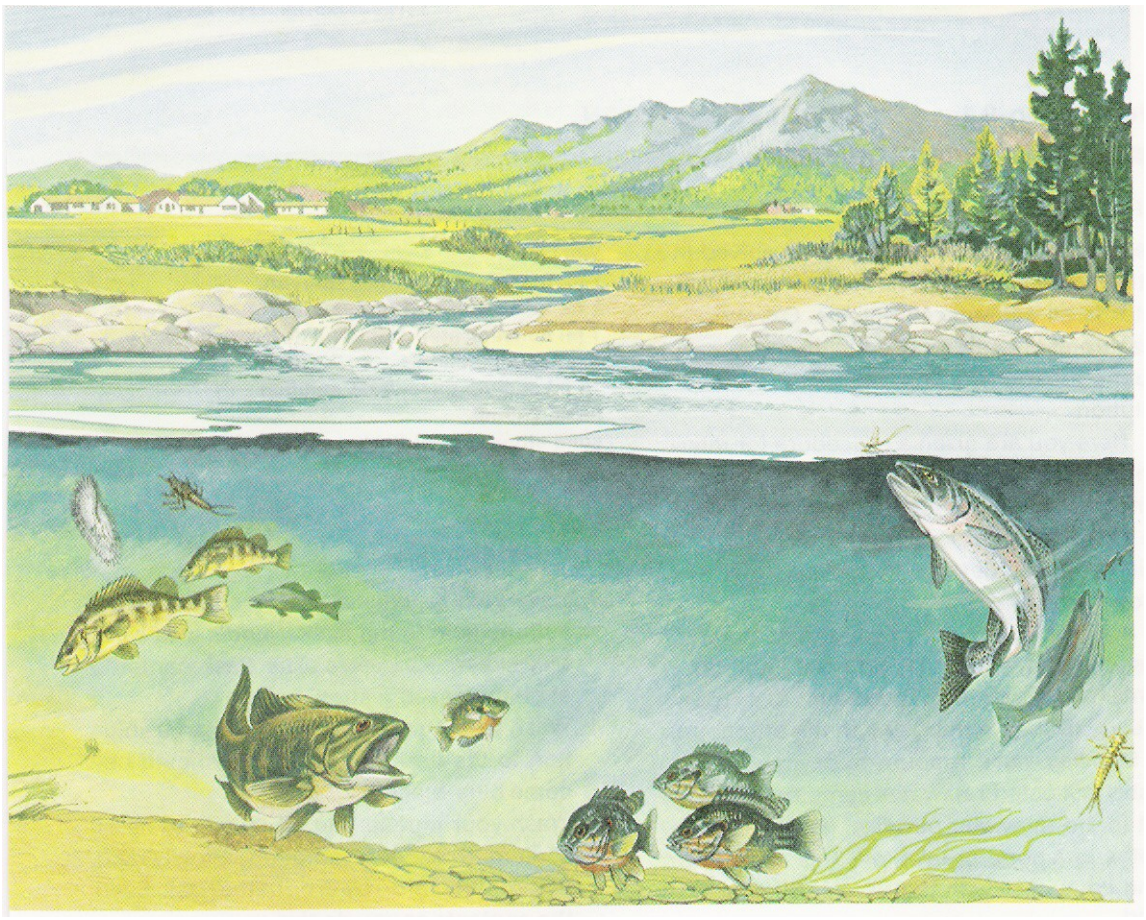
EPA was told to implement the Clean Water Act and initiated the NPDES (National Pollution Discharge Elimination System), a permit system, for anybody discharging wastewater into open waters.

EPA used this 85% treatment rule to set the permit treatment standards. But by using an essential pollution test incorrectly, EPA only addressed part (60%) of the pollution caused by carbonaceous (fecal) waste and ignored all the pollution caused by nitrogenous (urine and protein) waste. This was clearly inadequate to meet any of the goals of the CWA.

EPA acknowledged this mistake in 1983, but in stead of correcting this essential test, EPA allowed a different test, thereby lowering the goals of the Act and now officially ignoring part of the pollution caused by fecal waste and all the pollution caused by nitrogenous waste. All this was done without even informing Congress.

To understand what went wrong, one first has to know what sewage is, how it impacts open waters and how it can be 'treated'.

Before doing so, let me first explain some basic principles.



We live in a biosphere with plants and animals not only living on land, but also in water. In this biosphere all different forms of life, live in an ecosystem, in which several recycling processes occur. If we look at all these different forms of life, it seems very complicated, but actually it is not that bad, if you keep it simple. It is like the structures you built with LEGO blocks.

Life mainly has only four different blocks, called atoms and when they hook together, they become molecules. They are hydrogen, oxygen, nitrogen and carbon and since there are trillions of these blocks, they can form millions of different structures, called ORGANIC molecules.

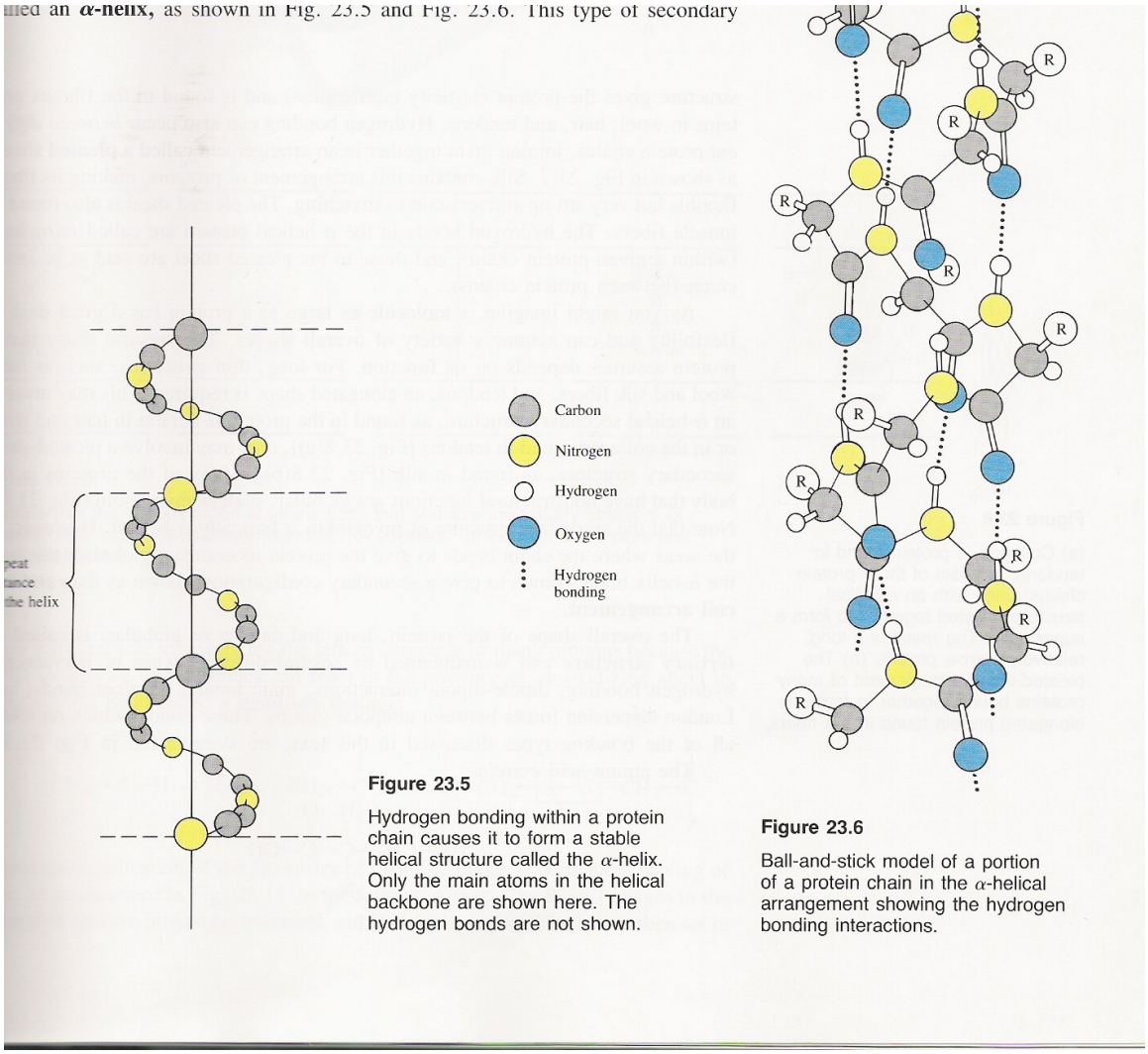


Figure 23.5

Hydrogen bonding within a protein chain causes it to form a stable helical structure called the α-helix. Only the main atoms in the helical backbone are shown here. The hydrogen bonds are not shown.

Figure 23.6

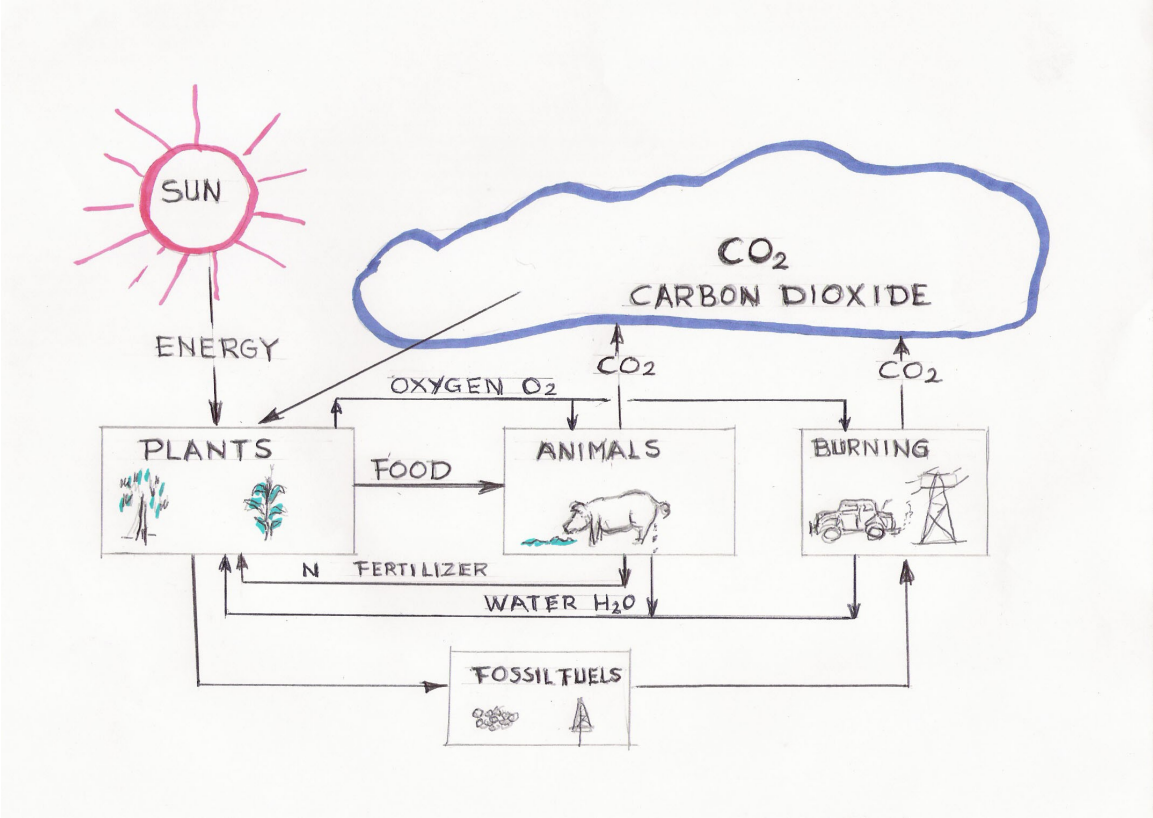
Ball-and-stick model of a portion of a protein chain in the α-helical arrangement showing the hydrogen bonding interactions.

A simple organic molecule is sugar. It only has six carbons, 6 oxygen and12 hydrogen atoms. Much more complex are protein molecules, which make up the cells of our bodies and who will have hundreds of carbon, hydrogen, oxygen and nitrogen atoms.

While molecules can break apart, the atoms in them never do and they are used over and over again, the same as is done with LEGO blocks.

In nature this is called an element cycle and the most famous and simplest ones, are the hydrogen, oxygen and carbon cycles. The nitrogen cycle is more complex and may be even more important than the carbon cycle.

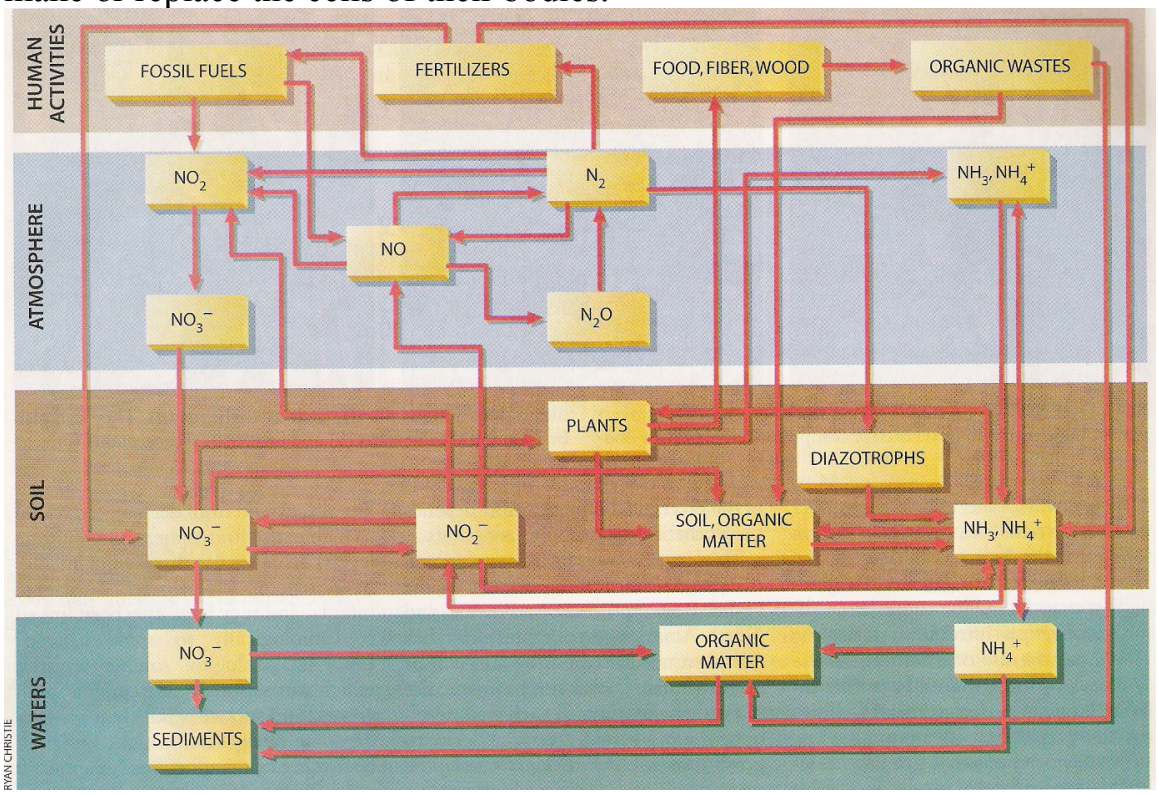
Life needs energy and the basic principle here is also easy to understand. It takes energy to put these atoms together to make a molecule and that energy is captured inside that molecule. It is released when that molecule is broken apart.



The carbon cycle shows how carbon dioxide from the air, together with the nitrogen and water in the soil, uses the energy of the sun to grow plants. Water molecules are split and hydrogen atoms used to make organic molecules, while oxygen gas is released into the air. These plants are either directly used by animals as food, or as what happened millions of years ago, they are stored as fossil fuel in the earth.

The energy stored in these organic molecules can be released by chemical or by biochemical oxidation, while both processes require oxygen. Releasing energy, by burning wood or fossil fuels, are examples of chemical oxidation and as the organic matter burns with the oxygen in the air, energy is released and this results in carbon dioxide and water.

The organic matter eaten by animals is not only used to release energy, by using biochemical oxidation, but it is also used to make new proteins to make or replace the cells of their bodies.



The nitrogen required for organic matter is called 'reactive nitrogen', as it is a single nitrogen atom. While nearly 80% of the air consists out of nitrogen gas, this form of nitrogen is not available, as the two atoms are extremely strongly bonded together. In Nature it takes special bacteria and lightning storms to break these nitrogen gas molecules apart to make 'reactive nitrogen'.

Nature itself can not provide enough 'reactive nitrogen' to grow food for the six billion people now living on Earth and it is synthetic fertilizer, that now provide about 30% of the reactive nitrogen to grow food.

All the element recycling processes follow the same principle, which basically breaks down the large molecules into much smaller ones and even individual atoms. When organic matter is used as food, these large molecules are broken down and absorbed by our bodies. What is not used ends up in our feces. The large molecules absorbed by our bodies are used to

produce energy by using biochemical oxidation. This requires oxygen and comes from the air we breathe. The result is also carbon dioxide and water.

The large organic molecules our bodies absorb also have reactive nitrogen and part of this nitrogen is used to make new cells, while the nitrogen not used by our bodies is filtered out by our kidneys and leaves my body when we urinate.

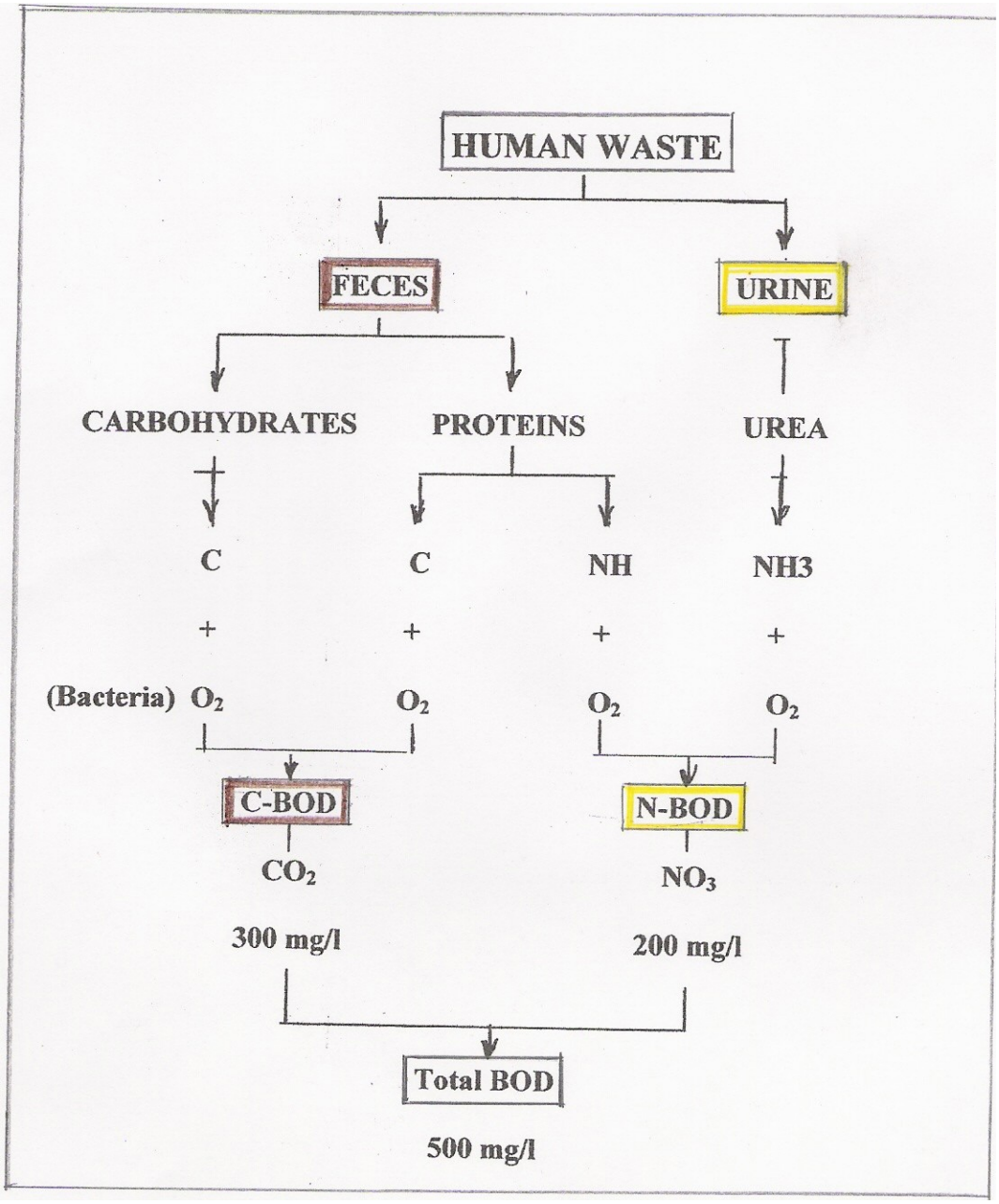
Feces and urine are our body's waste products, but they still have a food value for bacteria. One kind uses the feces as food, whiles a complete different kind, use the urine. They both use biochemical oxidation to release energy and both require oxygen.

So when we flush your toilet, our waste becomes sewage and when it is dumped into a river, bacteria will have a feast and consume a lot of oxygen dissolved in the water. This depletion of oxygen can cause fish to die.

The bacteria feeding on the urine also require oxygen and thus also contribute to this depletion of oxygen, but the urine itself and the waste

products of these bacteria, are fertilizers for new plant growths and in water mostly algae.

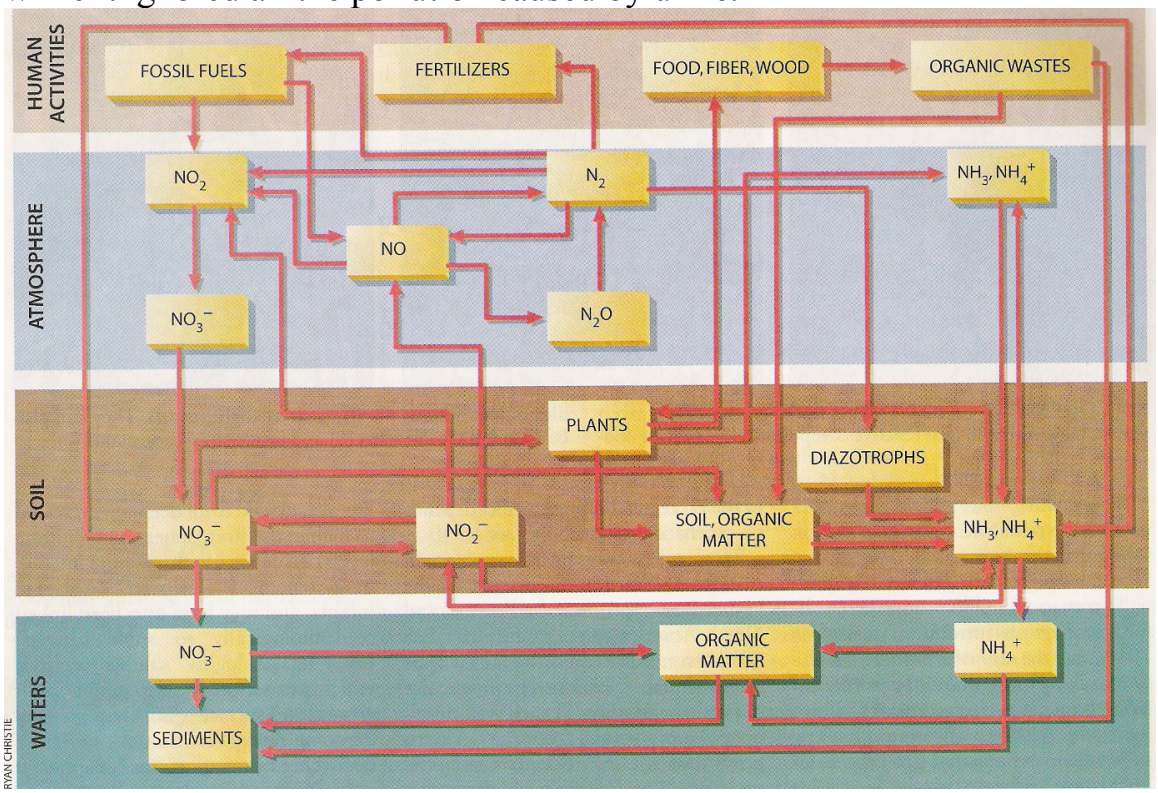
This algae growth does not happen at the location where the sewage is dumped into the river, but can happen much further down stream, as is the case of the dead zone in the Gulf of Mexico.



This picture shows what happens to the organic waste products making up sewage. Carbonaceous (fecal waste) causes an carbonaceous biochemical

oxygen demand and results in carbon dioxide and water, while our nitrogenous waste (urine and part of proteins) besides causing a nitrogenous biochemical oxygen demand, in all its forms (urea, ammonia, nitrates) can be used as a reactive nitrogen form to grow new plant cells.

When EPA set sewage treatment standards to implement the Clean Water Act, it used a test that measures this biochemical oxygen incorrect and as a consequence EPA only addressed most of the pollution caused by feces, while it ignored all the pollution caused by urine.



The incorrect use of this essential pollution test also has caused all types of other regulatory and engineering problems.

People do not like to talk about the nitrogen cycle in our biosphere, because it is complicated. It however is equal or even more important than the carbon cycle.

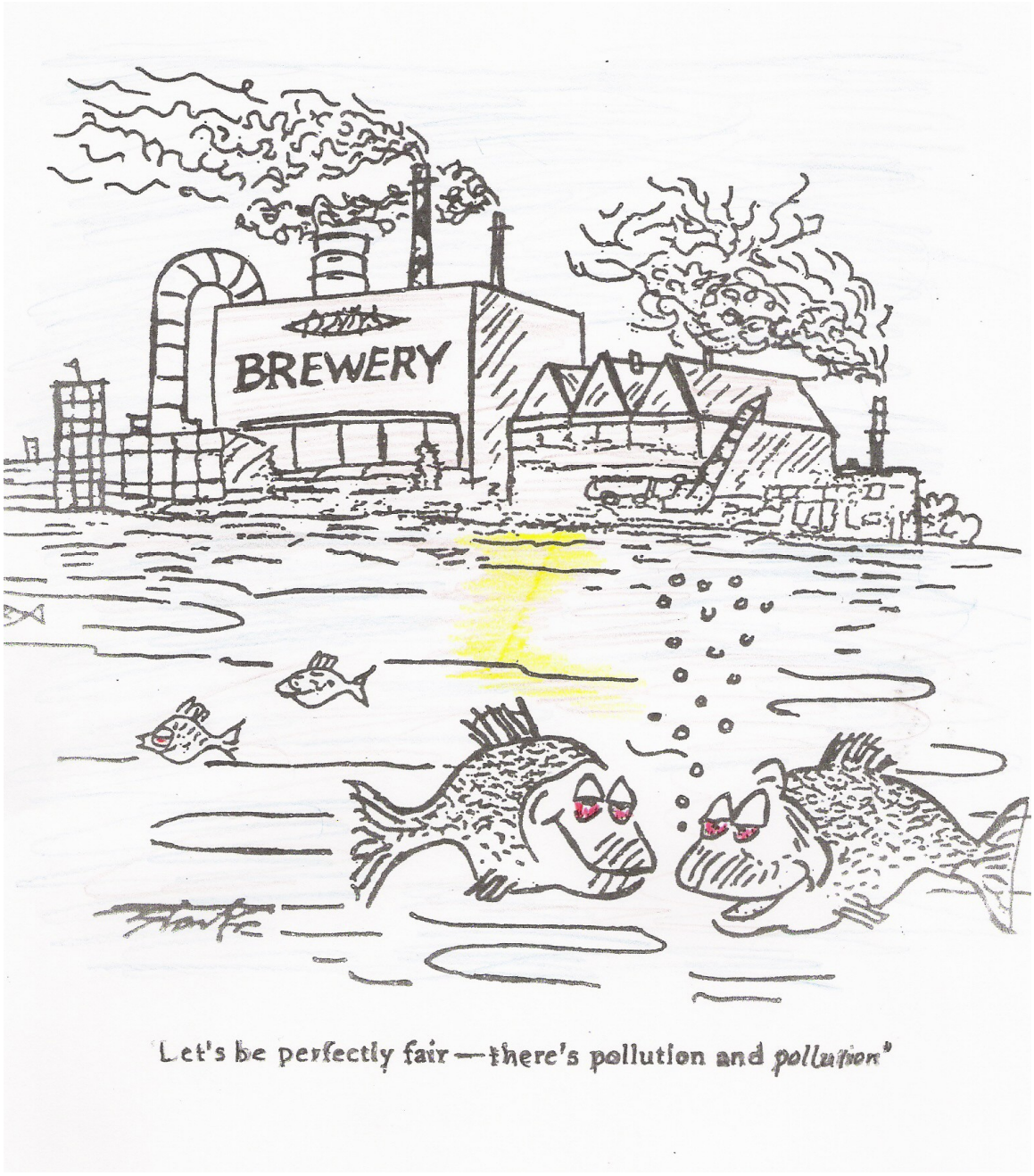
We all have heard about global warming, which is caused by an increase of carbon dioxide in the air as the result of the burning of fossil fuels, which, before they were taken out of the earth, were not part of the active carbon cycle.

BUT we have a similar increase of reactive nitrogen in the biosphere, as the result of man-made fertilizer and the burning of fossil fuel, causing nitrogen gas during combustion to become 'reactive nitrogen'.

This increase of 'reactive nitrogen' in the biosphere, not only causes global warming, as carbon dioxide does, it also creates Green Rain, which is rain water that has fertilizer in it. During the raining season this causes grasses and brush to grow fast, but during a drought, they become fuel for wild fires.

Fires used to be good for a forest, but now with the additional fuel, the big trees also catch fire and when trees loose their roots, it can cause land erosion and mud slides.

Of course we can not stop using man-made fertilizer, but we have to become much more careful how we use this fertilizer, as it, together with the reactive nitrogen from burning fossil fuels, will end up in our biosphere and where it will stimulate all types of life. Also life we do not like or life that does not like us, such as bacteria and viruses, that can make us sick.



Treating urine in our sewage will not solve all the problems, but would be a good step in the right direction.

Sewage treatment was developed more then a century ago, mainly to prevent odor problems. However, much better treatment, including the treatment of nitrogen, is not only possible, but actually would cost less than what we now pay for odor control plants.

With the present testing data it is impossible to evaluate the performance of sewage treatment plants, neither is it possible to evaluate the pollution loading on a receiving water body.

The limited proper test data on raw sewage also shows that there is a real possibility that sewage treatment plants are designed to treat the wrong waste. In spite of all this, there is a reluctance to correct this test procedure.

To summarize our present water pollution regulations: Standing on a bank of a river and holding in one hand a glass of city drinking water and in the other a can of coke, you can NOT throw the drinking water into the river, because it has chlorine in it and is toxic for fish, BUT you can throw about a third of your coke in the water. Or what you also can do is drink both, wait and then pee in the river.

If you do not believe me, you first should read the BOD test in the Technical PDF file and if you still have questions, you can always contact me.

AND when convinced, I urge you to contact your Congressmen and Senators in Washington and demand that they hold EPA accountable for not implementing the Clean Water Act as it was intended and promised to us.

CLEAN WATER ACT OF 1972.

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