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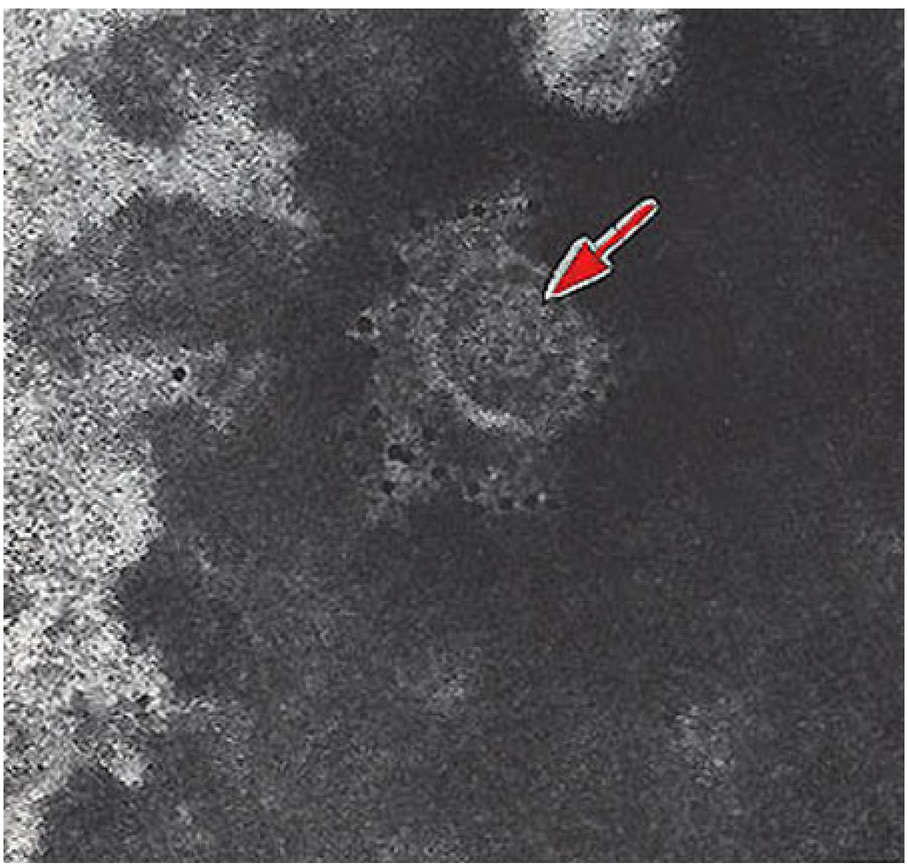
Anatomy of the Hepatitis C Virus

The structure of the hepatitis C virus is like that of most complex viruses - a core of genetic material (RNA), surrounded by a protective shell of protein, and further encased in a lipid (fatty) envelope of celluar material. However, the fact that the genetic information of the virus is stored in RNA, not DNA, has important consequences in the life cycle of the virus, and gives hepatitis C its dangerous ability to mutate.

All organisms, with the exception of the RNA viruses, store their permanent information in DNA, using RNA only as a temporary messenger for information. DNA is quite a stable molecule, not particularly reactive with other molecules, and the processes which reproduce it make very few mistakes in the process of copying the molecule (between one in 1 million and 1 in 10 million). Most of these mistakes are normally corrected even when they do occur. This makes DNA an ideal format for the storage of information, for mutations (errors) only rarely occur, and most are not significant.

RNA, by contrast, is a quite reactive molecule, capable of reacting even with itself under the correct conditions. It also makes frequent mistakes during copying - averaging one mistake per 10,000 nucleotides each time it is copied. These properties make RNA very poorly suited for the storage of information.

However, these very propeties make RNA ideal for the storage of viral information. Once the immune system has learned to recognize an infecting virus and create antibodies against it (developed an immunity), it can quickly destroy it, so the virus can no longer use that host for reproduction. In order to reinfect a host - it must first change its nature enough that the immune system will no longer recognize it - in other



Hepatitis C virus. Structure of the viral capsid is clearly visible words, it must mutate.

The unstable nature of the RNA molecule provides this mutagenic factor, allowing the Hepatitis C virus to develop new genetic variations of itself. As discussed earlier, the mutated forms are frequently different enough from their ancestors that the immune system cannot recognize them, so if the immune system begins to succeed against one variation, the mutant strains quickly take over and become new, predominant strains. Because each surviving virus reproduces itself thousands of times, mutations in the RNA sequence occur frequently, allowing it to evolve faster than any other type of living organism. This evolution is known as antigenic drift. Mutations occur randomly across the entire length of the viral RNA, and so of course most are not beneficial, producing viruses which lack a needed protein or are otherwise disadvantaged. However, because of the enormous number of offspring produced by each virus, even a high

rate of mutation does not threaten the survival of the virus - and when advantageous mutations do occur, they are rapidly selected for and reproduced.

Hepatitis C, as an RNA virus, has a powerful reproductive strategy. Because it stores its information in a "sense" strand of RNA, the viral RNA itself can be directly read by the host cell's ribosomes, functioning like the normal mRNA present in the cell. The virus thus needs no special abilities of its own - it uses the cell's own ribosomes to produce everything it needs for its takeover of the cell's processes and reproduction. This means hepatitis C requires only a small amount of RNA to encode its core information, and thus has lots of room for genetic variation within the non-essential portions of its RNA. This also gives it fewer common characteristics that can be readily identified by the immune system - or, for that matter, exploited by scientists working to create a treatment.