The author talks about different ways of computing at a very small scale. These techniques although are not to be employed in same kind computing, have three common characteristics: non silicon, basic elements having already been physically implemented and ultra small scale (miniaturization). Different computing techniques are discussed, some of which focus on special applications and the others aimed to solve computationally difficult problems. Nano scale computing such as carbon nano tubes, DNA computing, organic computing, quantum computing and some special computing techniques like optical (high speed), nano fluidics and chaotic computing are discussed briefly. The author strongly feels that these various forms of computing, aimed at different domains of applications, which are currently under research and development stage might become very significant computing techniques in future, just like the present day technologies which themselves were once bizarre and were never expected to be practical.

Some of these techniques are going to introduce new ways of computing in some domains while some of them introduce computing itself in other domains (inside the human body for diagnosis). Computationally difficult problems and those requiring large memories and years of execution time, might take only hours to execute with the new computing ways (optical). Mass production of the elements such as nano tubes and polymers (organic computing) can greatly cut down the production cost [0], so it might be possible for every family to have a computer in the near future (just like cell phones now). With the reduced power consumption in these small scale technologies, we might be able to go mobile almost all the time. DNA computing and bio compatible computing (Organic) might open new doors in disease diagnosis (such as cancer diagnosis) and its intelligent, perfect treatment [2]. Although the speed of DNA computing is very less, the problems that might not fit into present day computing systems might be solved with this technique, as a hot tub sized vat full of DNA at laboratory concentrations can hold 100,000 billion times that of a gigabyte disk [3] and the effective speed can be achieved with executing the program in parallel. With quantum computing, new ways of security system may evolve, making it easier for banking, defense fields [4]. Using a chaotic based computing system and their nature of assuming infinite number of behaviors, a single generic system can be used to perform variety of computations [6].

In spite of these advantages that above techniques of computing provide, they are not widely used at present. There is still a lot of research required to overcome the hurdles, some of which are discussed below. 1) Assembly of tiny components and orientation of for example carbon nano tubes which can change the type of the material (semi conductor or metallic. 2) DNA computing is very slow. We can take advantage of DNA computing by processing in parallel. But the transmission of data is one of the biggest problems of the current research in that area. One more problem is, DNA breaks into water after sometime of operation. 3) Reliability is the main problem in many of the new types of computing. In quantum computing decoherence is one such problem. In DNA computing, if the output of a circuit is ‘1’, then it yields ‘1’ only for some time and changes eventually [3]. 4) Any type of computing is a shear waste if we cannot measure its output. In quantum computing this is a very big problem because the measuring devices are classical (very big, not at atomic level) not quantum, thus spoiling the coherence (it fixes the value i.e. spoils the wave function) [5]. 5) Cascadability is one of the important problems in new technologies especially in optical systems [0].

References:

1. <http://www.eng.auburn.edu/~agrawvd/COURSE/E6270_Fall07/READ/ft_gateway1.cfm.pdf>
2. <http://www.peterindia.net/DNAComputingArticle.html>
3. <http://sysbio.harvard.edu/csb/benenson/index_files/nature_science_update.htm>
4. <http://library.thinkquest.org/3037/dna.htm>
5. <http://www.physorg.com/news123944900.html>
6. <http://www.scienceagogo.com/news/quantum_measurement.shtml>
7. <http://gtresearchnews.gatech.edu/newsrelease/DYNAMIC.html>