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MESSAGE FROM NEIL B. GODICK

There is a trend developing in Russia: after much skepticism by companies in the world's developed economies the *R* in *BRIC* is being recognized for its science and technology.

Boeing, Intel, and Microsoft have had for several years huge Russian based engineering and development centers. The results from these centers have been technologically impressive and the economic savings substantial. Now, with Russia's engineers and scientists having a positive reputation and with there being cost cutting in many companies - the rush is on to *find* Russia. Companies working in Russia have told us they experience better technological results than they achieve in China and India while costs in Russia are the same or less.

The operating model for engineering and research in Russia is similar to other countries:

- A dedicated facility with dedicated employees working for a single company
- Contract research agreements either long term or project focused with universities, scientific institutes, and private businesses

The *risk* in Russia as elsewhere is finding the best qualified engineers and scientists and then managing them. These *risks* are magnified in Russia by the companies' lack of experience of working in Russia, cultural, language and legal differences, and the Russian engineers and scientists' lack of experience in working with businesses from developed counties.

We do not intend for these reports to solve any need our readers may have. We do intend to keep everyone current on technology developments in Russia. If you would like any additional information on any of the developments reported – send us a note.

Physics-Health Sciences

Employees of M.V. Lomonosov Moscow State University and OOO *Akademia Biosensorov* have developed a device they named «atomic scales». Together with an atomic-power microscope the device offers unique possibilities for studying phenomena at the molecular and cellular level.

- A thin rectangular silicon plate is placed into a solution drop. It serves as a cantilever whose surface is either gilt or simply activated by oxidizers – a mix of hydrogen peroxide with sulfuric acid.
- Protein molecules are adsorbed on the surface to form a densely packed one-molecule thick layer. The force of interaction between these molecules is capable of deforming the silicon plate; this is the sensitive part of the atomic scales.
- Upon laser illumination of the cantilever, the reflected laser beam will be displaced in relation to the reflection of unbent silicon plate. Using the size of this deviation, it is possible to find the surface tension force of the molecular layer and, mediately, their cohesion force in the layer and the bonding force between the layer and the surface.
- And finally, if one observes the process in time, it will be seen that the surface tension force of the protein layer (and thus its structure) changes in time.

Recently, by using this device and atomic force microscope, the scientists together with their colleagues from A.N. Frumkin Institute of Physical Chemistry and Electrochemistry, RAS have carried out a fascinating study. They studied the way protein molecules merge on a silicon surface to form long narrow strips – fibrils. They were able to quantify this process. The scientists hope that this approach will allow deeper insight into the processes that lead to neurodegenerative diseases including Alzheimer's disease. In an Alzheimer's patient's brain some protein molecules behave in the same way. These molecules start to gather forming first long thin assemblies – fibrils, which then expand, grow into plaques and disturb the brain's functions.

Software Development - Health Sciences

Russian specialists from *Neurobotics* Company (Zelenograd) have developed a system that helps people work on a computer without making any physical motions. The development is based on the accepted fact that our physical movements, perceptions or in general cogitative activities involve activating a set of neurons. These neurons interact by means of electric pulses. These currents, accordingly, create an electromagnetic field that can be detected and measured. As a result, we can obtain an electroencephalogram (EEG) whose analysis is a well-known method for brain activity diagnosis.

Of course, the Moscow scientists approach does not solve the problem of mind reading. Their approach solves simpler and more practical problems. A completely immobilized and even speech deprived patient has by this technology an opportunity, by means of a computer, to communicate: to indicate his/her desires, to type texts, to control the cursor movement on the monitor and —in the longer term, also to operate other external devices beyond the computer.

Software Development - Security

Employees of Russian company *Artek Ventures* have developed that substantially enhances computer security by preventing unauthorized access. The device is a small and intelligent 3D camera. By scanning the space of less than one meter in front of the monitor, this video camera, via a USB port, transmits information to the computer. The latter, by means of the software developed by authors, quickly analyses the information. Three-dimensional and two-dimensional images of the authorized operators are used. The technology identifies the user and switches on the computer. Further, as soon as a stranger (unauthorized operator) comes near to the monitor, the 3D camera program will immediately close all windows and will not be possible to peep over the user's shoulder.

The identification is based on recognizing of two images of the user. The first is an ordinary two-dimensional color photograph. And, the second is a high resolution stereoscopic picture of the user's face, made up of forty thousand points, the position of each of them defined with an accuracy of 0.6 mm. Then, by using the personal identification technology *Dynamic 3D* ™, high-qualitative 2D and 3D models are created and all the scanned fragments are automatically synchronized to make a uniform textural 3D model. As a result, it is possible to obtain integral stereoscopic pictures of people of different height and constitution - and quickly recognize and identify them. The actual identification procedure is based on a comparison of these images with those stored in the computer database. Therefore, to enter into the system, the user just needs to take his/her place at the work station and to look at the monitor. The system is much more convenient and reliable than entering a password, which, could be stolen or forgotten.

Software Development - Entertainment

Engineers from the Urals have developed a unique technology - *Phenomenon EVA*, for the movie industry. The technology enables making any existing film voluminous (not stereo, not 3D, but voluminous). Further, the technology allows the spectator to decide whether to watch the video in voluminous or flat format. The viewer simply pushes a button, irrespective of where he is – at home or at the cinema.
In addition, the development makes the theater set look "realistic". Any image will have volume, and can be the backdrop of live actors playing online.

The technology for recoding any digital image into a voluminous format is a 2x2 cm chip with a built-in program. The program allows real-time decomposition of the monoimage into a stereopair. Thereafter, with each element of the pair, 7 geometrical transformations are made. As a result the spectator sees a voluminous picture.

There are several significant differences between current three-

dimensional movies and the new technology. First, conversion to the voluminous mode is made after the movie has already been shot. Secondly, if a 3D movie is viewed in a stereo movie theater it is necessary for movie watchers to keep their head in a certain position to see the stereo effect. The new anaglyph glasses make it possible to view a movie at any angle and in any position. Moreover, they do not fatigue the eye. The engineers are currently working on an advancement to their technology that would allow watching movies in voluminous format without special glasses.

Biotechnology - Biosensors

A.N. Belozersky Research Institute for Physical and Chemical Biology, Moscow State University has designed biosensors to monitor environmental pollutants (herbicides, heavy metal ions). The biosensors are based on photosynthetic pigment–protein complexes as receptor elements. Electron paramagnetic resonance and luminescence analysis can be used for monitoring changes in the photosynthetic apparatus state at early stages of exposure to pollutants. The scientists demonstrated that isolated thylakoids of higher plants could be used as receptor elements of biosensors for rapidly identifying enhanced concentration of heavy metal ions in soil substrate.

Biotechnology – Water Purification

Employees of D.I. Mendeleyev Russian Chemical Technology University are developing a method for water purification by eliminating crude oil and oil hydrocarbons emulsified in it, floating on its surface, or even lying on the bottom of a body of water. The method is based on immobilizing microbes specializing in destruction of oil and petroleum derivatives on an ordinary sorbent. As a result, there is a chance to not only collect these notorious and the extremely widespread contaminants, but also to convert them into water and carbon dioxide. Additionally, it is possible to repeatedly use the sorbents. Microbes that are immobilized on a solid emulsion substrate do not change their activity for up to a year and can be reused as many as seven times. Between their "work" cycles the microbes need some “rest”. They should be washed and given some additional easily digested food. If there is no "work" to be done, the sorbent can be simply stored in a refrigerator.

The sorbent is easy to isolate from the aqueous phase. The microorganisms within it are stable and safe in the sense that they will not be «washed away» into the environment. Moreover, it does not need cleaning as it cleans itself. By using the alternative of a nonwoven material, it is possible to prevent evaporation of light fractions, for example, benzene.