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MESSAGE FROM NEIL B. GODICK

A new study by an international public health research team published in the British medical journal *The Lancet* documents the impact of alcohol abuse on Russia. The study shows that drinking caused 52% of the deaths among Russians aged 15 to 54 since the Soviet Union's collapse.

Elsewhere in the world the estimate is that less than 4 percent of deaths are caused by alcohol abuse.

It is estimated that the increase in alcohol consumption since 1987, the year when then-Soviet leader Mikhail Gorbachev's restrictions on alcohol sales collapsed, cost the lives of 3 million Russians.

Russians currently consume almost twice the global average, the equivalent of 6.2 liters of pure ethanol alcohol per year, the global report found.

The link between life expectancy and alcohol in Russia has long been the subject of study. Mortality rates fell sharply in Russia from late 1985 to 1987, when then-Soviet leader Mikhail Gorbachev imposed strict limits on alcohol sales. During the period of political and social revolution that followed, death rates soared to levels unprecedented in modern industrialized nations.

Russians generally blame alcohol deaths on the consumption of adulterated or industrial alcohol. A previous study carried out by British and Russian researchers and published in *The Lancet* in 2007 estimated that drinking alcohol not meant for consumption like cologne and antiseptics was responsible for nearly half of all deaths among working-age Russian men. A recent government crackdown on the sale of alcohol not intended for human consumption appears to have significantly cut those deaths, experts say.

In spite of this, there is relatively little recognition in Russia that excessive drinking of alcohol in any form, including beer and wine, can lead to serious health problems.

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.

Health care - Unique laser medical device

Russian physicists and physicians partnered to develop a unique medical device, the laser complex *Lazurit.* The device combines two lasers within the same housing –

- A laser scalpel and
- A laser lithotriptor.

On interaction of a laser pulse with a solid, a laser spark is formed on the surface. Expanding plasma in the spark results in forming a bubble in a liquid. Once the bubble achieves its maximum size, it begins to collapse under the atmospheric pressure action. It is the shock wave (the sound produced by the bubble's collapse in the liquid) that destroys calculi. This laser can break large calculi reaching them via natural urogenital paths without surgical intervention.

The lithotriptor emits pulses (as short as 1 microsecond) simultaneously at two wavelengths — 0.54 and 1.08 µm. These wavelengths were selected so to be minimally absorbed by the body's soft tissues. This minimal sorption means that the laser allows for surgeon errors. If the pulse were to hit a mucous membrane instead of calculi, the tissues will not be damaged.

The second laser is a powerful Nd-YAG laser operating at 1.064 mcm with an output power up to 120 W. It is used as both a scalpel and a coagulator. This property makes it possible to use the laser to perform surgery on blood-filled organs – kidneys, spleen.

The laser combination allows for

- One laser within its housing can operate on a renal carcinoma and simultaneously seal vessels, while
- The other can crush stones in kidneys and urinary bladder without making any incision

Rapid TB Diagnosis

A joint effort by **Russian physicists and physicians** has produced a unique device that provides for:

- Screening large groups of patients for TB.
- Express-analysis of those patients screened

With this device, in 25 minutes 10 patients can be screened for TB. The device has passed all necessary tests for use in Russia and for proving its claims for rapid and accurate TB testing and analysis.

Conventional TB diagnostic methods have disadvantages.

- Fluorography can detect only fairly advanced instances and only in the lungs.

- The most reliable detection method is microbiological. This method takes too long and not all TB cultures can be grown. Using this method it is not possible to confirm TB in a patient who does not release bacteria.
- New TB detection methods, used to detect specific TB fragments (mycobacterium), use PCR (polymerase chain reaction). These methods are fast but require expensive equipment, highly skilled personnel, and very expensive consumables.

The new Russian diagnostic method eliminates these disadvantages. The Russian technology's physics are quite simple. A 632.8 nm laser beam passes through pre-prepared blood plasma (produced by centrifugation) and excites a fluorescence — response radiation of the molecules excited by the laser. This spectrum's response radiation is measured by the sensor.

The developers selected a specific wavelength for their device. They selected the one wavelength that causes fluorescence to the derivatives (special agents – porphyrins) formed as the TB mycobacterium's living activity products.

As a result, in just 25 minutes after taking the patient's blood, the doctor obtains a graph. The graph shows the dependence of fluorescence intensity as a function of emitted wavelength. This graph, upon evaluation, provides the diagnosis. If needed, the diagnosis is then confirmed using a traditional method. The new Russian device's reliability, verified by other methods is 93.7%.

The throughput using a single device is up to 400 analyses over an 8 hour period. Using the device it is also possible to control the efficacy of drug therapy. The device enables adjusting drug resistance to TB in two or three weeks.

Chemistry - Ceramic filtration elements for fine gas purification

Bakor, a private company, has successfully developed and tested its production technology for filtration elements with an inorganic nanodispersion fiber fibrous membrane. The technology increases dust entrapment.

The processes that use the Bakor filters are similar to those using conventional filtration materials (tissues, bags). However there is a key difference: with the Bakor filter there is no need for a support system. These filter elements have a rigid structure and are mounted on a built-in flange.

The existing bodies of bag filters can be equipped with Bakor elements.

Operating characteristics of the ceramic filters:

Application temperature	up to 1000°C
Degree of dust entrapment, Filter class according to GOST standard R51251-99	F7-F9 (fine filter)
Low resistance	from 120 to 200 Pa
High heat resistance, (1000°C-water)	over 30 thermocycles
Strength of σ compression	from 35 to 50 MPa

Key advantages:

Resource savings

- High temperature of purified gases – up to 1000°C, (no additional expenditure is required for cooling)
- Eliminating the slurry eliminates the need for costly land plots
- Using purified gases as an additional heat source
- The possibility of recycling valuable products

Pure environment

- 5-10 times reduction in emissions into the air
- Assured purification of gases to meet the norms
- Underground water heavy metal contamination reduction.

Efficient operation

- 2-3 fold reduction in operating costs for gas purification
- The technology enables producing various modifications of filtration elements that fit specific operating conditions - specific kinds of dust.

Microbiology - Microbes to efficiently convert refuse to alcohol

Moscow microbiologists have developed new microbes that recycle vegetable and plant mass waste accompanying agriculture and the biofuel production process. The recycling converts the waste to alcohol. The researchers studied microorganisms capable of processing cellulose. They then selected the single microbe, which reacts the quickest and in the most efficient manner. The microorganisms studied were to meet one condition: they must be thermophile, i.e. successfully grow and multiply at high temperatures.

Extremely thermophilic (for which 70ºC and higher are optimal temperatures for growth) and hyperthermophilic (80ºC and higher) bacteria were the focus. These bacteria consume cellulose and yield ethanol. It is the 70ºC temperature or higher that provides for the best vegetable waste biotechnological treatment process.

The research team headed by Dr. Bonch-Osmolovskaya obtained six anaerobic microorganisms strains from Kamchatka hot springs. These strains grow on microcrystalline cellulose and carboxymethyl cellulose at 70—85ºC. The researchers compared the bacteria's cellulolythic activity and fermentation products release by them in

processing the nutrient medium. In this way they selected the most suitable microorganism. Now the researchers are determining the complete genomic sequence for the bacterium. Their goal is to identify conditions that will promote greater ethanol yield.

Skin transplant technology

Specialists from the Institute of Cytology, RAS (St. Petersburg) have developed a new technology for growing cells necessary for skin grafting treatment for burns, trophic ulcers, etc.

Current methods for growing the needed cells cost $15 and more for 1 sq. cm. Using their *know-how*, the scientists have developed a less expensive method to produce the needed cells. Cells produced using the Institute of Cytology's method cost 3—4 times lower than existing methods.

The Institute of Cytology, RAS began developing their method for skin cell substitution therapy (skin grafting) over 15 years ago. Three years ago a Russian Federation Health Ministry permit was obtained for their use in clinical practice. Skin cells grown at the Institute are used in throughout Russia, and some Former Soviet Union countries.

Health care - Cobweb thread

Cobweb thread is five times stronger than steel and 1.5 times more elastic than nylon**.** The key mystery of cobweb is its unusual strength. Of course, cobweb thread can easily be broken by brushing against it with your hand. This is because it is very thin. To break steel wire of the same diameter would take an effort that is five times less. Another cobweb thread property is its elasticity, Cobweb threads can be stretched by 15% and still revert to their original shape. Not a single artificial polymer can boast these properties.

GNTs GosNII-Genetika has been working for about 15 years on developing a material that would reproduce the cobweb's properties. They have developed a cobweb in laboratory conditions that holds good promise for application especially in medicine.

The researchers' interest mostly focused on the cobweb cord. The cord is composed of two proteins: a stronger spidroin 1 and a more elastic spidroin 2. These proteins are not easy to obtain using usual genetic engineering. In terms of size, these proteins are one of the largest in nature. Moreover, their structure has not been fully decoded.

The scientists have developed an original methodology for isolating and purifying recombinant proteins. One kg of wet cells of yeast yield about 100 mg of pure protein, which is then freeze-dried and used for experiments.

Thread weaving in laboratory conditions is difficult. The weaving process takes two days. One cycle produces 100 mg of artificial cobweb.

The material developed at Genetika has wide application in medicine. Their artificial threads can stretch almost in the same way as natural ones. The threads are superior to tendons and bones in terms of strength.

Another application for the cobweb is in targeted drug delivery. Their protein can be used to produce both thread and films. Cobwebs can be used to make nanocontainers: porous balls that can contain drugs. In this form they can be used to make healing coatings for wounds and burns that would not be rejected by the body while stimulating the patients' epithelium regeneration. Experiments on the cell culture confirmed that films made from cobweb recombinant protein are nontoxic.