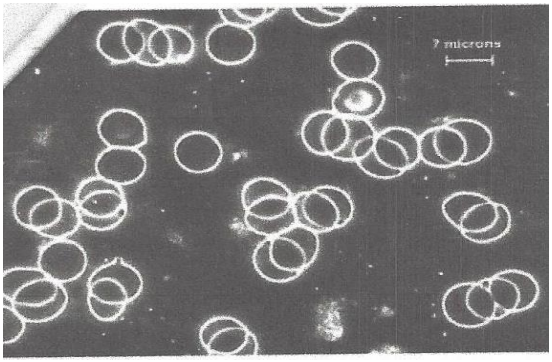


Red Blood Cell (RBS) Abnormalities

A picture is worth a thousand words…the following pictures are excerpted from an exploratory study conducted by **Beverly Rubik, Ph.D., *President and Founder of the Institute for Frontier Science*, entitled: "Does Short-term Exposure to Cell Phone Radiation Affect the Blood?"** Ten healthy individuals, adults with no chronic disorders or conditions, were selected to assess if changes occurred in their blood following exposure to a smart phone. The researchers used live blood analysis to assess changes, where a small droplet was drawn from the finger and placed under a dark-field microscope attached to a digital video camera system. Three blood samples were taken for each individual under three exposure conditions.

The study results showed substantial changes in the blood for nine out of ten subjects. The types of changes the researchers noted were frequently those observed in ill persons. Further, since the blood drawn from the finger would be from a highly exposed area for a handheld device, the researchers also drew blood from the toe and the same blood changes were observed, suggesting that the **effects are systemic**.

Baseline Condition: Healthy blood showing round, separate Red Blood Cells. Prior to taking the baseline subject refrained from using cell phone for four hours.



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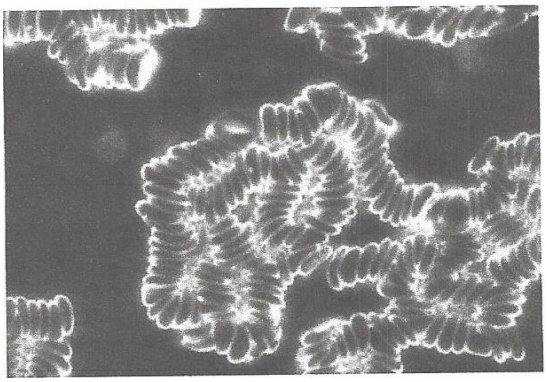
Carrying Condition: The smart phone was in receiving mode worn by the subject in a backpack for 45 minutes. RBC's are no longer round but sticking together.



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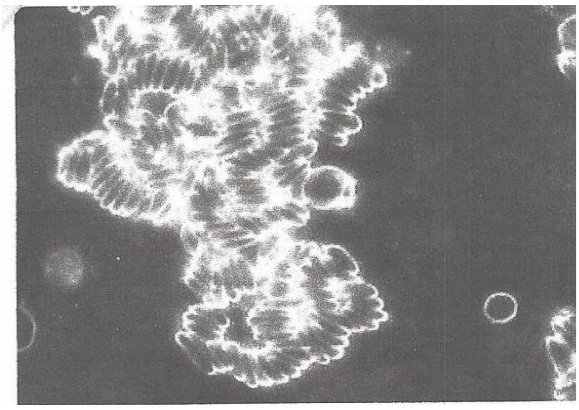
Active Use Condition: The subject continually used the cell phone communications function for 45 minutes by making phone calls or accessing the Internet. RBC's are misshapen and clumping together.



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The researchers referenced that these RBC changes may be related to functional changes in cell membrane permeability – like the one we will review next on the blood-brain barrier permeability.

Permeation of Blood-Brain Barrier

Salford et al. (2012), referenced in BioInitiative 2012 Report Section 10, assessed mobile device radiation effects on the blood-brain barrier (BBB). Using a low intensity exposure and limiting the exposure to a short period of time, their study showed harm to the BBB.

> "A single 2-hr. exposure to cell phone radiation can result in increased leakage of the BBB, and 50 days after exposure, neuronal damage can be seen, and at the later time point also albumin leakage is demonstrated. The levels of RFR needed to affect the BBB have been shown to be as low as 0.001W/kg…"

The radiation level used in this study is well below the FCC's allowable limits for mobile device radiation absorption into the brain – the current FCC limit is 1.6W/kg (Watts per kilogram) and this study showed harm at just 0.001W/kg, magnitudes below FCC limits.

Why do we need to be concerned about the blood-brain barrier?
The blood-brain barrier acts like a net to keep viruses, bacteria and other harmful microorganisms from getting through to the brain. Harmful microorganisms can cause serious and potentially life threatening neurological effects. Further, even elements that are not dangerous to other parts of the body may cause harm if they reach the brain. The proper operation of the BBB is critical to staying healthy; mentally and physically.

Mobile Device – Specific Absorption Rate (SAR)

SAR is the measurement used by the U.S. in setting mobile device exposure limits. The following chart compares SAR, measured in Watts per kilogram (W/kg), with bio-effects levels found in peer-reviewed studies. *Refer to your cell phone instructions to find its SAR rating.*

MOBILE DEVICE LEVELS AND HEALTH EFFECTS

Mobile Devices *Levels can vary widely*	**SAR**	**Health and Biological Effects***
U.S. Guideline	1.6 W/kg	
Cordless, Cell or Smart Phones *Many operate around this level.* *Device settings can affect exposure levels.*	1.0 W/kg and lower	Sleep patterns change, Altered human mental performance, Headache and Fatigue, Fourfold increase in Eye Cancer, Sperm motility and viability reduced
	0.14 W/kg and lower	Increased DNA damage and reduced DNA repair, Cardiovascular system hypotension, Lymphoma cancer rate doubled, Structural changes in testes
Baby Monitors .01 to .08 W/kg *(per Swiss Federal Office of Public Health)*	.09 W/kg and lower	Impaired DNA repair, Hyperactivity, Brain cell damage, Sperm damage, Lower melatonin levels, Leakage of Blood-Brain Barrier, Mitochondria affected

**Effects per peer-reviewed studies from the 2012 BioInitiative Report, RF Charts by C. Sage MA, Sage Associates, used with permission from C. Sage*. Go to: www.BioInitiative.org/rf-color-charts/ for detailed study results.