TABLE 2

I. ICOSAHEDRAL SYMMETRY

A. <u>DNA Viruses</u>

VIRUS (# capsomeres)	DIAMETERS (nm)	APICAL LENGTH 58% ave d (nm)	UNIT (nm) DISTANCE	FREQUENCY (Hz)
Parvovirus	21			7.143×10^{10}
(32)	23			6.522×10^{10}
(Adeno-Assoc.Virus)	22			6.818×10^{10}
		12.76		1.176×10^{10}
			6.63	2.26×10^{11}
Polyomavirus	40			3.75×10^{10}
(JC Virus, BK Virus,	50			3.00×10^{10}
Simian Virus 40,	45			3.33×10^{10}
Bovine, Baboon)		26.1		5.75×10^{10}
(72)			13? skewed	
Papillomavirus	45			3.33×10^{10}
(72)	55			2.72×10^{10}
	50			3.00×10^{10}
	29			5.17×10^{10}
			? skewed	
Herpesvirus	95			1.57×10^{10}
(162)	105			1.42×10^{10}
(Oral, genital,	100			1.50×10^{10}
chickenpox, zoster,		58		2.58×10^{10}
I, II, III)			25	6.00×10^{10}
			9	1.66×10^{10}
Bovine herpes virus	95			1.57×10^{10}
(162)	105			1.42×10^{10}
	100			1.50×10^{10}
		58		2.58×10^{10}
			25	6.00×10^{10}
			9	1.66×10^{11}
Herpesvirus IV virus	95			1.57×10^{10}
(162)	105			1.42×10^{10}
(Epstein Barr)	100			1.50×10^{10}
		58		2.58×10^{11}
			25	6.00×10^{10}
			9	1.66×10^{11}
Herpesvirus V virus	95			1.57×10^{10}
(162)	105			1.42×10^{10}
(Cytomegalo)	100			1.50×10^{10}
		58		2.58×10^{10}
			25	6.00×10^{10}
			9	1.66×10^{11}
		50 nm core		3.00×10^{10}
Adenovirus	70			2.14×10^{10}
(252)	75			2.00×10^{10}
	72.5			2.07×10^{10}

		42.05		3.57×10^{10}
			8.41	1.78×10^{11}
Vaccinia	200			7.5×10^{9}
	250			6.0×10^{9}
Variola	200			7.5×10^{9}
(Smallpox)	250			6.0×10^{9}
Cowpox Virus	200			7.5×10^{9}
	250			6.0×10^{9}
Molluscum	200			7.5×10^{9}
Contagiosum	250			6.0×10^{9}
ORFVirus	150			1.0×10^{10}
	250			6.0×10^{9}
Paravaccinia	150			1.0×10^{10}
	250			6.0×10^{9}
Hepatitis B	40			3.75×10^{10}
Virus	45	(Dane Particle)		3.33×10^{10}
	42.5			3.53×10^{10}
		28 nm core (Spheres and bacillary forms noninfective)		5.36×10^{10}

B. RNA VIRUSES

VIRUS (# capsomers)	DIAMETERS (nm)	TRIANGLE LENGTH (nm)	UNIT DISTANCE (nm)	FREQUENCY (Hz)
Calicivirus	31			4.84×10^{10}
32	35			4.28×10^{10}
	33			4.54×10^{10}
		19.14		7.84×10^{10}
			9.96	1.51×10^{11}
Picornavirus	25			6.00×10^{10}
32	30			5.00×10^{10}
	27.5			5.45×10^{10}
		15.95		9.40×10^{10}
			8.29	1.81×10^{11}
Reovirus	70			2.14×10^{10}
(92)	75			2.00×10^{10}
	72.5			2.07×10^{10}
		42.05		3.57×10^{10}
			14.02	1.07×10^{10}
HIV	85			1.76×10^{10}
	150			1.00×10^{10}
	100			1.76×10^{10}
		Surface spikes 12 nm		1.25×10^{10}
		18 nm		8.33×10^{10}
		Cone width 1/4 of diameter		

II. HELICAL SYMMETRY

RNA Viruses

VIRUS (# capsomers)	DIAMETERS (nm)	TRIANGLE LENGTH (nm) DISTANCE	UNIT FREQUENCY (nm)	(Hz)
Influenza	80			1.88×10^{10}
HumanA,B	120			1.25×10^{10}
& C, Avian		Peplomers 10 nm (A&B)		1.5×10^{10}
		Peplomers 8 nm (C)		1.88×10^{11}
		A - 6 nm wide helix core		6.66×10^{11}
		C- 9nmwide helix core		1.66×10^{11}
Parainfluenza	90			1.66×10^{10}
(Mumps,Croup)	300			5.00×10^{9}
		Helix 15 nm		1.00×10^{11}
		Helix 19 nm		7.89×10^{10}
		7.5 rimby		2.00×10^{11}
		3 nm		5.00×10^{11}
		Central canal 5 nm		3.00×10^{11}
Paramyxovirus	90			1.66×10^{10}
(NewcastleDs,	300			5.00×10^{9}
Avian, Simian,		Helix 15 nm		1.00×10^{11}
Measles)		Helix 19 nm		7.89×10^{10}
		Central canal 5nm		3.00×10^{11}
Respiratory	120			1.25×10^{10}
Syncytial Virus				
		Helix 15 nm		1.00×10^{11}
		Helix 19 nm		7.89×10^{10}
		Central canal 5 nm		3.00×10^{11}
Marburg virus	80nm wide helix			1.88×10^{10}
& Ebola Virus	50 nm internal canal			3.00×10^{10}
	20nm central canal			7.50×10^{10}

25 Once the qualitative viral resonant acoustic signature has been determined, quantitative results may be determined by comparing the resonant acoustic signature amplitudes from samples of known concentrations of a specific virus. Samples with higher viral loads (concentrations) will have higher resonant acoustic signature amplitudes. A ratio of primary resonant frequency amplitude to viral concentration is thus derived, allowing for
30 assessment of viral load in samples of unknown concentration.

In another embodiment, resonant acoustic signatures from the test disc/slice may be

generated either by first clamping a control disc/slice into the transducer chamber and storing the resonant acoustic signature in a microprocessor for subsequent processing with the test disc/slice signature, or by clamping a control into a second transducer chamber and sweeping through the wide band of frequencies simultaneously with the test disc/slice virus sweep.
5 Also, the test disc/slice may be clamped between the transducer and a reflective surface, and the acoustic wave generated and received by the same transducer, thus analyzing reflected rather than transmitted acoustic waves. Furthermore, one or more transducers analyzing reflected or transmitted acoustic energy may by immersed into a fluid or medium containing the virus.

10 In another embodiment one or more transducers analyzing reflected or transmitted acoustic energy constitute the walls of a vessel into which a fluid or medium containing virus is placed.

The present invention also allows the effects of the resonant frequencies to be determined *in vitro* as shown by the apparatus in Figure 13. Using standard virology culture
15 methods, known to those skilled in the art, the viral culture may be placed in a reusable/autoclavable test cylinder. The bottom surface of the test cylinder is the transducer, constructed for the appropriate frequencies, such as a thin film zinc oxide on a sapphire substrate . The host medium thus placed in the test cylinder spreads over the bottom of the cylinder in a monolayer and in direct contact with the transducer. Acoustic energy of the
20 desired resonant frequency is then delivered through the culture fluid and host medium to the viruses, and the effects on growth and function are assessed using standard virology methods. By varying the acoustic wave characteristics, such as amplitude, mode (continuous vs. pulsed), shape (sinusoidal vs. square), intensity etc., the ideal frequency and waveform required to obtain specific effects can be determined.

25 For example, in testing the augmenting and/or disrupting effects of resonant acoustic frequencies on HIV, uninfected T-lymphocyte host cells are first assessed in the test cylinder with the resonant acoustic intervention (resonant frequencies in varying waveform patterns for varying periods of time at varying intensities) using the trypan blue dye exclusion test, which excludes anomalous viral results by assessing the effects of the acoustic intervention
30 on the host cells alone. Step 2 involves placing a calculated number of HIV infected T--lymphocytes in the test cylinder. The host cells form a monolayer on the transducer/floor of

the test cylinder, where the acoustic intervention is delivered. The results are then assessed using standard *in vitro* methods such as the Coulter HIV- 1 p24 antigen kit, HIV cultures, HIV- 1 DNA by PCR, viral load measurement, quantitative measurements, time to positivity, and growth suppression.

5 The methods of the present invention also provide means to disrupt viruses *in vivo* and extracorporeally in animals as shown in Figure 14. For example, in humans infected with HIV, an extracorporeal blood circulation system is established using techniques known to those skilled in the art. The extracorporeal blood is passed over a series of reusable/autoclavable sterilized transducers that deliver acoustic energy at primary or 10 harmonic resonant frequencies. The acoustic transducer series acts in effect as an acoustic filter, disrupting viruses in the blood stream. Efficacy of treatment is assessed using viral load studies, as known to one skilled in the art, both prior to and after the extracorporeal treatments.

In another embodiment, the above described acoustic filter is also fitted with a 15 receiving transducer mode for analysis of the blood sample. With initial passes of blood containing large numbers of intact virus, the resonant amplitude will be high. After prolonged exposure of the blood to the disrupting resonant frequencies, the resonant amplitude will decline as the numbers of intact viruses decline, thus giving viral load readings and a method to determine when cessation of the extracorporeal treatment is indicated.

20 In another embodiment, a sheet of piezoelectric material is fashioned into an envelope or mesh-type transducer, through which the extracorporeal blood is passed. In another embodiment, a tube of piezoelectric material is fashioned into a coil transducer, through which the extracorporeal blood is passed. In another embodiment, the extracorporeal blood is separated into red and white blood cell portions, and only the while blood cell portion is 25 passed through the acoustic filter, thus reducing the time required for treatment and reducing mechanical damage to the red blood cell portion.

In another embodiment, banked blood is passed through an acoustic filter at any one of multiple points in the blood product collection and administration process (i.e., collection from the donor, separation into components, or administration to the recipient).

30 In another embodiment, nanosystem technology (see *Nanosytems*, by Eric Drechsler; publications of CJ Kim, Berkley University; publications of Ralph Merck, Xerox Co., Palo