Professional organizations such as the Acoustical Society of America are considering the standards for technical definitions for Human Bioacoustics. This paper suggests specific language for such definitions arising from the considerations presented herein.

Computerized biometric frequency modeling used to detect and compile mathematically designed disease, staging and diagnostic biomarkers

Sharry Edwards, M.Ed.: Director, Sound Health Research Institute [a registered 501(c)(3)] (www.soundhealthresearch.org). Albany, Ohio, USA; Capital University of Integrative Medicine, Washington, D.C. Department of Natural Medicine (SharryEdwards@gmail.com).

BioAcoustic Biology is an emerging science capable of providing biometric information through a mathematically based evaluation of anomalous vocal acoustics. Published reports indicate that vocal analysis has been used to determine levels of hormones and biological reactions during drug trials. Stephen Williams, Pfizer's executive Director of Clinical Technology, states that Pfizer has been able to detect otherwise invisible efficacy reaction biomarkers using voice spectral analysis.

Defining disease and staging biometrics is still novel but "diagnostic biomarker" is not yet a defined biomarker category (Boguslavsky, 2004). In fact most biometric information is being used only in clinical trial selection and evaluation with the exception of the exploration being done at the Sound Health Research Institute in Ohio. Their investigative work, spread over the last three decades, includes evaluations of biochemical cascades, structural configurations, nutritional assessments, heart and eye disease templates and genetic make-up, plus toxicity and pathogenic exposure information. The Institute, in addition to the Acoustical Society of America, has taken a leading role in defining this field.

Vocal pattern assessment incorporates mathematical analysis of anomalous vocal acoustics, coupled with the evaluation of amplitude decay among low-order harmonics. The results are being used to model the frequencies and architecture of coherent acoustic parameters contained within the human voice. This emerging system of articulation of sample analysis is being uniquely investigated for its potential to develop reliable frequency-based protocols that can define innate, mathematically derived templates of human biology and definitive disease with health biomarkers.

Embracing the idea that the voice is a biometric representation of health and wellness, through the recurrent laryngeal and direct vagus nerve associations with the brain, Vocal Assessment has the potential to provide significant bioinformation.

BioAcoustic Biology research has established and is testing predictive biometric templates for nutritional needs, heart and eye health through biomarkers gained from acoustic vocal samples. Additional research includes anti-aging potential, Alzheimer's biomarkers, Fibromyalgia, autism and stroke recovery.

The brain communicates using the language of frequency that can be expressed mathematically. The brain receives and assigns signals to ranges and areas of the brain for interpretation and possible reactions. Events experienced by the body reach the brain as biofrequencies that are then sorted, routed and assigned an interpretation designation. The brain uses a network of frequencies to communicate internally. When we speak, the vibrations of the vocal cords create resonances throughout the body. These resonant frequencies entrain the brain and nervous system.

Like music, the voice is a measurable arrangement of sounds. The voice as spoken language is a complex, often mathematically

discordant, cacophony of sounds. Each word contains individual sound units called phonemes. Vocal analysis mathematically examines the chaos, the dissonance, of these phonemes. Language barriers do not play a part in this type of evaluation. Any sound, including moaning, crying, laughing or nonsense syllables may be used to reveal biometric information.

The foundational principle on which BioAcoustic Biology has been established is the concept that the voice is a comprehensive representation of the body that can be mapped through uniquely devised algorithms to provide a glimpse into the individual biological, chemical, and structural make-up of the body.

Through distinguishing mathematical calculations, termed in the field of Human BioAcoustics, as "Mathways" (as in Pathways when referring to chemical cascades of reference), BioAcoustic Biology-related studies have shown considerable promise in allowing science to observe the interconnected systems of the body; not merely as closed systems working independently, but as actual frequency-based structural as well as biochemical interactions of the body.

As an example, a recent evaluation of a pregnant volunteer showed that hormones responsible for labor and delivery could be monitored by studying the changes in vocal acoustics during pre-labor and the labor initiating process. The Frequency Equivalent (FE) of a labor inducing medication, Pitocin, is indicated in Chart 1 using a frequency domain vocal print; and reported in terms of time intervals in Chart 2.

Most labor and delivery hormones can be monitored in the same way. This technique would allow a quick assessment to discriminate between false and actual labor thereby saving considerable resources for insurance companies, medical personnel and clinical resources.

Like chemistry, which draws conclusions using elements and compounds, BioAcoustic Biology uses sound to explain our frequency-based biological systems. Vocal Profiling, Human BioAcoustics and BioAcoustic Sound Presentation are clinical aspects under the master heading of "Sonistry," which is being defined as the study and application of sound and sound frequencies as a universal measurement of biologically related events.

The opportunity to create precedent-setting protocols has the potential to significantly expand understanding of the human body as a collection of predictable math-based compilations.

The need for advanced biometric diagnostic templates is apparent in light of Secretary Michael Leavitt's (Health & Human Services) commitment to "transform the healthcare system." Among his plans is the initiative that wellness and prevention should be sought as rigorously as treatment, and that health care should be available and affordable.

Routine vocal assessment could be used to monitor medications, the overall health of a person with limited mobility, suspected toxin or pathogenic exposures, and the status of persons in remote locations. Sites such as airports, airplanes, land-based transit systems, buildings or other geographically sensitive locations could be monitored. Since the vocal samples are digital in format, they can be sent and received via satellite or the internet to a central location with no loss of integrity.

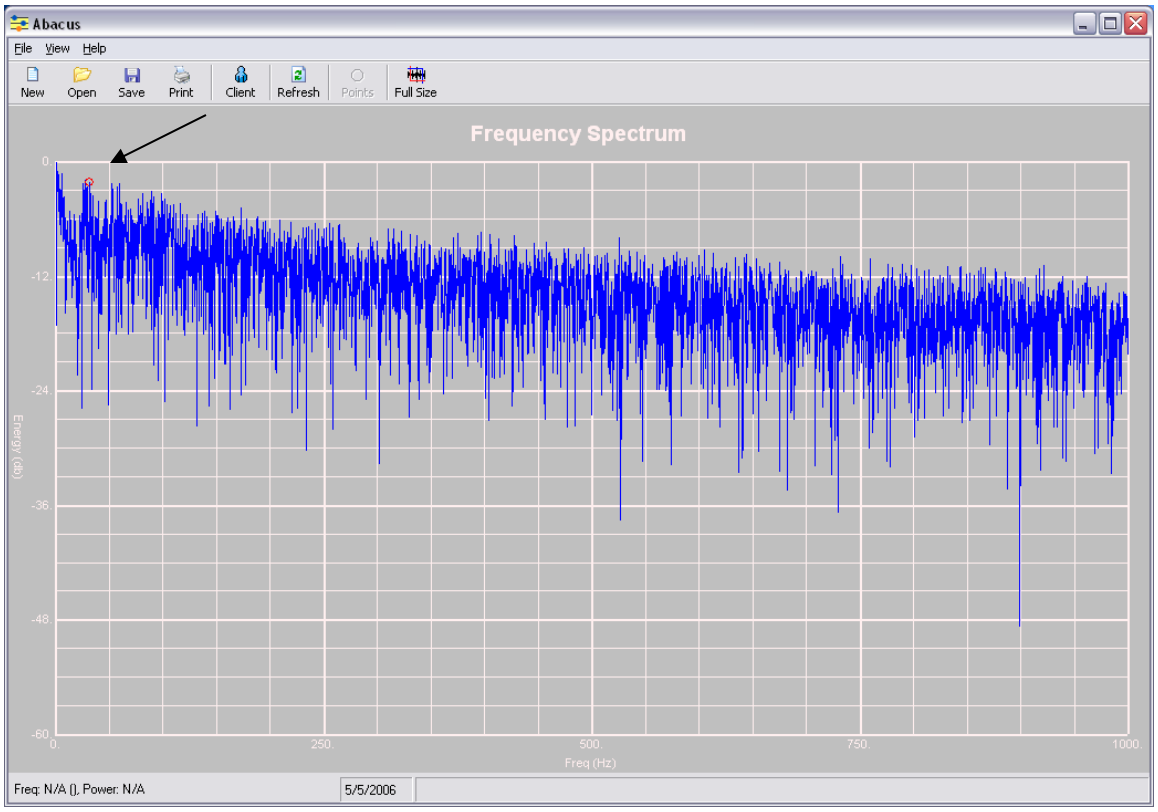

Chart-1 Frequency Domain Vocal Sample - The circle indicated by the arrow represents the Frequency Equivalent (FE) of Pitocin. In the example monitoring Pitocin during induced labor, the FE of Pitocin began to ascend beyond the coherence range of the vocal architecture as the dosage increased.

Frequency Equivalent (FE) Monitoring of Pitocin* using FFT of Vocal Acoustics

Date	Time	Pitocin FE Q	Dosage
5/1/2006	5:22am	-9.50	none
5/1/2006	8:40am	-7.65	1mU
5/1/2006	9:15am	-8.46	2mU
5/1/2006	9:30am	-4.98	3mU
5/1/2006	10:06am	-1.97	labor contractions initiated

*Pitocin = synthetic form of natural labor inducing hormone, Oxytocin
0 = highest FE representation -60 = lowest FE representation
the higher the presentation FE, the more likely the substance is active

Chart-2 – Time table key of Pitocin FE vocal acoustic evaluations for an induced labor due to previous C-section; labor was induced nine days prior to the due date.

Charts 3 and 4 represent Frequency Equivalent (FE) levels of Pitocin and a CONTROL comparison.

It was expected that the Frequency Equivalent (FE-Q) of the drug would increase as the dosage increased. Such was the case.

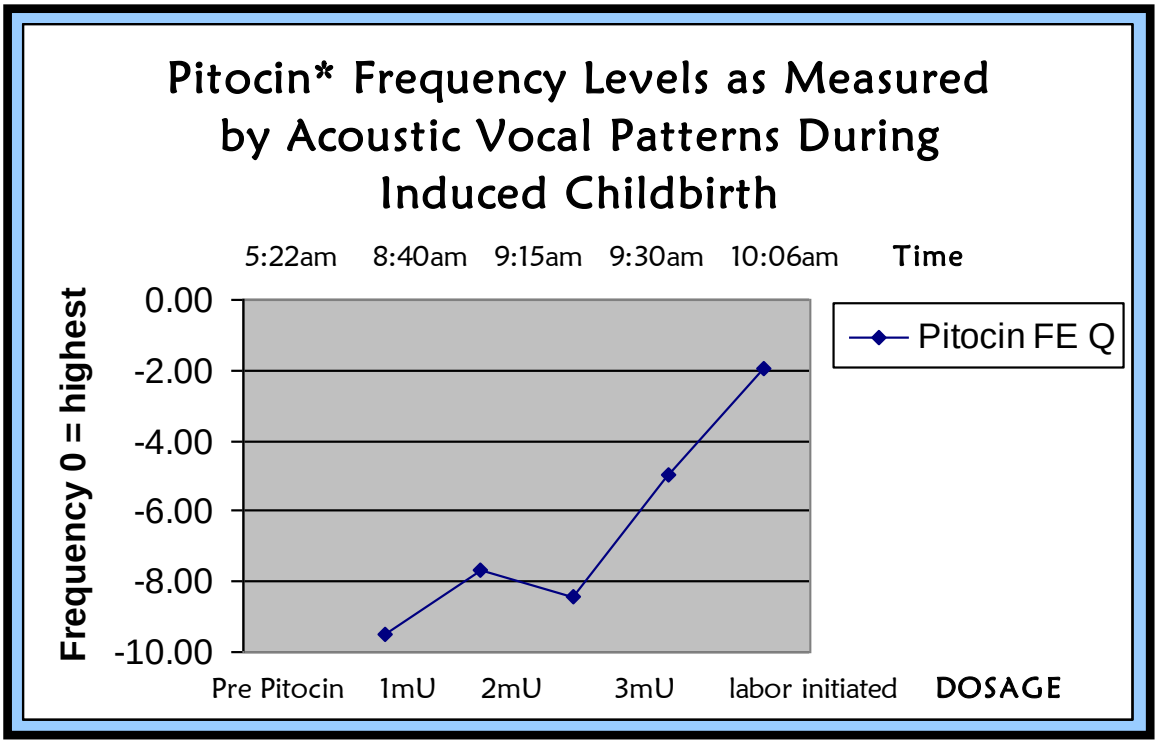

Chart-3 - During childbirth the labor inducing drug, Pitocin, was monitored as the dosage was increased. It was expected that the Frequency Equivalent (FE-Q) of the drug would increase as the dosage increased. Such was the case. 0 = highest frequency

Time	Pitocin FE(Q)	Dosage
10:06 am	-1.97	no increase
LABOR INITIATED		
9:30 am	-4.98	3 mU
9:15 am	-5.09	2 mU
8:40 am	-7.65	1 mU
5:22 am	-9.50	none

During the observation sequence additional hormone FEs were sampled and could have been used to predict the emergency (3:30 am) C-section that was the result of this induced labor.

As early as 10:30 am, the vocal print indicated that the body was producing biochemicals known to act as blocking agents to the onset of labor contractions.

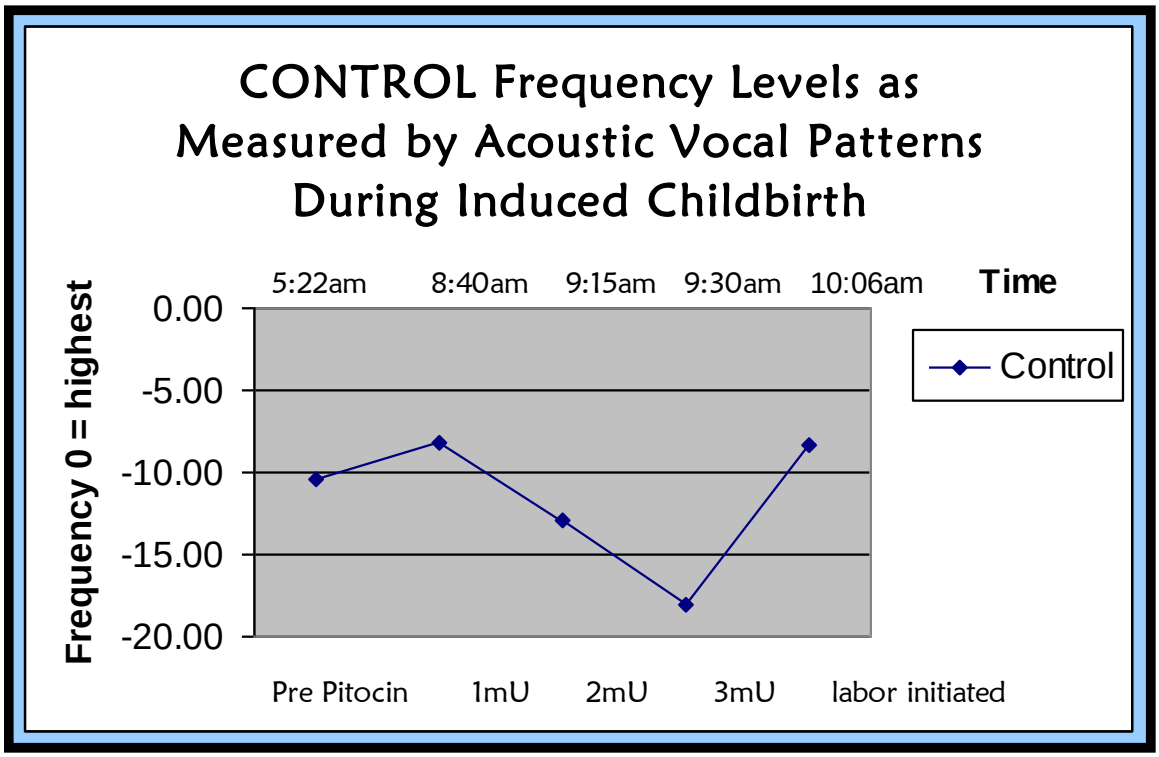

Chart-4 - During childbirth/labor, a CONTROL frequency was used for comparison with the labor inducing drug, Pitocin.

As expected the CONTROL showed erratic frequency fluctuations.

Time	Control
5:22 am	-10.39
8:44 am	-8.26
9:15 am	-12.87
9:30 am	-18.08
10:06 am	-8.39

Vocal Profiling is an innovative methodology that has the potential to answer the demand for efficient, non-invasive and mobile methods of monitoring health status.

A review of blood analysis laboratories indicated that it can take as long as two weeks to return an evaluation of nutritional status. On-line Vocal Profiling would make the assessment nearly instantaneously.

The system, once funded and in place, could provide the ability to evaluate health in a timely and cost-effective manner, making it possible that inequities in our present health system could be abated.

The theoretical basis of such use of sound has progressed to the stage that preliminary technical definitions can be advanced[9].

The therapeutic potential of using the evaluation of anomalous vocal acoustics for the identification of pre-diagnostic biometrics could enhance or render inert disease-based biomarkers depending on the desired outcome. The results promise to add significant confirmation to the idea that our bodies constitute a predictable system of mathematical computations.

Vocal algorithms give us an unprecedented window into individual BioAcoustic Biology. To further advance the field of Human BioAcoustics, based on the clinical and research experiences of the Institute, the author proposes the following draft definition for consideration by the Acoustical Society of America: “Human BioAcoustic vocal pattern assessment incorporates the mathematical analysis of anomalous vocal acoustics, coupled with the evaluation of amplitude decay among low-order harmonics. The results may be used to preliminarily model the frequencies and architecture of coherent acoustic bioinformation contained within the human voice. This emerging system of Vocal Profiling has the potential to develop reliable frequency-based protocols that can define intrinsic, mathematically derived templates of human biology and definitive disease and health biomarkers.”

References

1 Boguslavsky, J. “Biomarkers as Checkpoints.” Drug Discovery & Development. Sept. (2004).

2 Butterworth, Brian. What Counts: How Every Brain is hardwired for Math. Free Press (Simon & Schuster Inc.). 1999.

3 Chiu CC, Chang HH, Yang CH. “Objective auscultation for traditional Chinese medical diagnosis using novel acoustic parameters.” Comput Methods Programs Biomed. Jun;62(2) (2000): 99-107.

4 Davis, Dorinne. “Davis addendum to the Tomatis Effect” Journal of BioAcoustic Biology. 2006.

5 Harel, B, Cannizzaro, D; Cohen, H; Reilly, N; Snyder, P. Voice Acoustics Laboratory, Clinical Technology, Pfizer Global Research and Development. “Acoustic characteristics of Parkinsonian speech: a potential biomarker of early disease progression and treatment. Journal of Neurolinguistics 17 (2004) 439-453.

6 Leavitt, Michael. Secretary Leavitt’s 500-Day Plan, Health & Human Services web site: http://www.hhs.gov/500DayPlan/500dayplan.html

7 Moore, C, S Shalet, K Manickam, T Williard, H Maheshwari, and G Baumann. "Voice abnormality in adults with congenital and adult-acquired growth hormone deficiency." J Clin Endocrinol Metab 90(7 (2005): 4128-4132.

8 Rotman, David: “The Impact of Emerging Technologies: Can Pfizer Deliver.” Technology Review February, (2004).

9 Edwards, Sharry: Definitive Theory of Human BioAcoustic Vocal Profiling & Sound Presentation, Journal of Bioacoustic Biology, Volume #5, Issue #11 - October, 2005 rev 1.3 Online Journal: