A Review of the Diagnostic Scope of Biomarker Techniques, Genetic Screening and Virtual Scanning

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Abstract: The purpose of this article is to compare and evaluate the advantages and benefits of the cognitive screening technique Virtual Scanning with contemporary diagnostic and screening techniques, in particular genetic screening and biomarkers.

In the last 50 years biomarker techniques and more recently genetic screening have been developed to characterise the onset, progression and regression of pathologies. Nevertheless the scientific picture is not yet complete. It does not yet include an understanding of relationship between genotype and phenotype; the regulatory function of the autonomic nervous system; or the rate or level of the expressed protein, protein conformation, the rate at which proteins react, and the reaction conditions such as pH, levels of minerals and cofactors, and temperature. By contrast, Virtual Scanning is based upon the light absorbing and emitting properties of proteins and how this bioluminescence influences colour perception. It provides a measure of the level of expressed protein and the rate at which such expressed protein subsequently reacts with its reactive substrate.

The article highlights the limitations of genetic screening and biomarkers and the perceived advantages which Virtual Scanning may have for routine mass screening *e.g.* of diabetes, cardiovascular disease, cancers, depression, migraine, etc.

Keywords: Autonomic nervous system, biomarker, cognitive colour perception, genetic screening, genotype, mathematical model, phenotype, physiological systems, virtual scanning.

VIRTUAL SCANNING

Virtual Scanning is a cognitive technique developed by Dr Igor Gennadyevich Grakov [1, 2] from research findings made during his work re the biomedical application of lasers at the University of Novosibirsk during the period 1980-1986¹; the further development of the technology in MIMEX Inc during the period 1986-1999; and finally its introduction into the Russian Health Services in the period 1999/2001.

Although a cognitive technique, the fundamental phenomenon upon which this technology is based is that proteins are visually active and that the light which is absorbed and emitted by proteins and enzymes as they react with their reactive substrates [3] influences colour perception. See Fig (1). The phenomenon of colour perception shifts is widely reported and is associated with diabetes [4], dyslexia [5], migraine [6], cancers, etc.

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¹Grakov IG. Strannik Diagnostic and Treatment System: a Virtual Scanner for the Health Service. *Minutes of Meeting No. 11 of the Praesidium of the Siberian of the Academy of Medical Sciences of the USSR (AMN)* held in Novosibirsk 4 December 1985.

[Reaction conditions]

Light + Proteins + substrates > Protein* + metabolites + Light

Fig. (1). The influence of pathologies upon the light absorption and emission of light by proteins

Proteins require to be raised to their activated state in order to react. In many cases light provides this energy of activation. (ii) The reaction conditions including pH, levels of minerals and cofactors, and temperature; influence the conformation of proteins and the rate at which the reaction proceeds. (iii) Upon completion the reaction releases light. The colour is a unique biomarker for the reaction. The intensity of the light released is proportional to the rate at which the reaction proceeds. This absorption and emission of light influence colour perception.

The technique is based upon an understanding of the relationship between visual perception and the autonomic nervous system. It incorporates an understanding of the nature and structure of the physiological systems *i.e.* it is a bio-mathematical model of the physiological systems. The data generated by Virtual Scanning highlight the following:

- Many diseases are polygenic and hence are difficult to characterise through gene profiling. Each person's genetic profile differs. The genes responsible for disease, and hence the expression of proteins, can alter between those with different racial characteristics. This is a significant limitation of gene profiling.

- Many diseases are multi-systemic [4,6] *i.e.* the etiology of disease(s) often involves a combination of different pathologies.
- Each pathology involves a combination of genotype and phenotype. Virtual Scanning is a cognitive approach more typical of optogenetics, proteomics or metabolomics. It assesses the light which is absorbed and emitted by proteins as they react and which influences our perception of colours. This provides a measure of genotype (*i.e.* the absorption of light by expressed proteins) and phenotype (*i.e.* the rate at which such expressed proteins subsequently react).

GENETIC SCREENING

Genetic screening identifies which genes are active and how they interact to produce proteins however it may be difficult to characterise exactly which genes are responsible for each condition because (i) many diseases are polygenic *i.e.* the spectrum of genes varies according to racial and/or genetic subtype and (ii) the genetic profile alters in response to the influence of stressors.

By contrast Virtual Scanning is able to identify the extent of protein expression and the rate at which such expressed proteins react – for each medical indication. It is a parallel technique to genetic screening which may have significant advantages. There are no other known technologies which have the ability to quantify the extent of genotype and phenotype for each disease. This is hugely significant. Most drugs are based upon genetic research and are only about 50% effective because most diseases are triggered by a combination of genotype and phenotype *i.e.* genetic screening effectively overlooks about 50% of the disease process [7].

Genetic screening measures a predisposition to disease whilst Virtual Scanning measures an actual disposition *e.g.* a patient may have a determined genetic predisposition to angina pectoris but will not show the symptoms of angina unless and until the heart is challenged *i.e.* the phenotype exceeds the heart's functional/genetic capacity. This demonstrates the need to improve the understanding and significance of phenotype.

BIOMARKER-TYPE TECHNIQUES

Histopathology testing including biomarker-type techniques is the current standard methodology. The accuracy of such tests can vary from 25% (PSA test) to an estimated 90%.

In general, biomarker-type techniques compare the determined level of a component with a statistical range - typically 4-8mmol per litre blood glucose in the case of diabetes – however this has a number of inherent limitations:

- The body is a multi-systemic entity in which multiple biological systems continuously influence the body's stability *i.e.* the levels of blood components rise and fall throughout the day.
- Many medical conditions have multi-systemic, and multi pathological etiology [4, 6].

- Most diagnostic techniques measure the symptomatic onset of a pathology.
- Every biomarker test has detection limits. There is a need to determine the earliest emergence of diseases in order to reduce future costs of treatment.
- Diagnostic tests must take into account the influence of genotype and phenotype.
- Biomarker tests are subject to biochemical side-effects which can cause false positives or false negatives.

In addition most biomarkers focus upon genetic indicators *e.g.* a protein; and ignore the influence of phenotype. As both genotype and phenotype is a feature of the disease process both must be measured. For example in type 1 diabetes the condition is linked to the availability of insulin whilst in type 2 diabetes the condition is linked to the ability of insulin to react and/or perform its cellular function. The indirect marker HbA1c (glycated haemoglobin) illustrates the concept *i.e.* measure the level of protein (haemoglobin) and the level of glycation.

ADVANTAGES OF VIRTUAL SCANNING

In principle, Virtual Scanning can be used to track changes to genotype and phenotype before and after the use of a therapeutic intervention.

Virtual Scanning determines protein reactivity *i.e.* the rate at which proteins react with their reactive substrates. This effectively distinguishes between the total level of proteins expressed and which are measured in biomarker-type tests, and the level of coiled/uncoiled or reactive/unreactive proteins. This is significant because many proteins do not coil correctly or are uncoiled, and is particularly significant re the diagnosis of Diabetes, Alzheimer's disease, Cystic Fibrosis, etc

Genetic screening does not incorporate an understanding of how the body functions. It deals only with the genetic cause or consequences of disease. Grakov's research incorporates a revised understanding of the structure and significance of the physiological systems [8, 9] which can be used to predict the future development of pathologies.

Genetic screening largely ignores all epigenetic factors, determinants and/or influences which are introduced by/from the environment *i.e.* it does not take into account whether the gene profile is the consequence or the cause of the condition. Both can be true. As Virtual Scanning deals only with the proteins expressed and their subsequent reaction this is unlikely to be an issue of concern for this technology.

Virtual Scanning provides an image of organ topography and cell morphology (see Fig. (2)) *e.g.* as (i) increased arterial blood flow and/or inflammatory response, (ii) increased venous outflow or ischemia, (iii) cell hyperfunction, (iv) cell hypofunction, (v) abnormalities of cell division, (vi) cell growth and (vii) cell death. This takes Virtual Scanning into the realm of imaging technologies *i.e.* where an abnormality can be identified and its approximate location. By contrast, most scanning techniques can identify the location of an abnormality *e.g.* a cyst or tumour, but are often unable to differentiate between a benign or malignant abnormality.

0 - Norm **31**- hypofunction **11**- inflammatory process **33**- hyperfunction **22**- increased venal
outflow (ischaemia) **41**- abnormalities
of cell division **55**- old cells/cell death**Fig. (2).** Cell Morphology Images

In addition the genetic profile may alter according to circumstances *e.g.* a viral infection, to remedial therapies, to exercise, etc. If so genetic screening should be repeated at regular intervals to track genetic predisposition. This requirement dramatically illustrates the need to have a less costly screening technology.

As a routine tool the cost of Genetic screening has been reduced to abt £1,000 per patient and is expected to decline further to less than USD500 per patient. Virtual Scanning results are available within 15 minutes whilst it takes typically 1 or more weeks to process the results of genetic screening/testing. Virtual Scanning test cost is typically in the range USD50-150 per patient (and provides typically 300

medical indications *i.e.* circa 10 medical indications in each of over 30 organs; and an image of cell morphology across different topographical locations in each organ).

Virtual Scanning is a screening technology which can identify the earliest emergence of a pathology from its pre-symptomatic origins *i.e.* each medical condition is associated with the emission of biophotons. The eye responds to as little as 70 biophotons per second to a maximum of typically 10^9 biophotons per second. Low levels of biophoton emission (bioluminescence) *i.e.* below the visual threshold, do not influence colour perception. Greater levels of biophoton emission influence colour perception and can be used to monitor the progress of pathologies from their earliest pre-

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n.b. the term ‘compensatory’ refers to decreased level of protein expressed; the term ‘pathology’ refers to decreased level of the rate at which the protein reacts with their substrates.

Fig. (3). Example Test Report.

symptomatic indications to their symptomatic prevalence *i.e.* as acute and/or chronic forms of disease.

Genetic screening is now a recognised technique. Such technique fullfills the industry expectations for high-technological solutions for complex medical problems. By contrast, although cognitive techniques are now being marketed *e.g.* for the diagnosis of Alzheimer’s disease, Parkinsonism, etc; cognitive technologies such as Virtual Scanning

are considered to be radical and disruptive and hence may not adhere to the medical industry’s expectations. Nevertheless certain medical specialisms will recognise the value of such technology *e.g.* optometrists, neurologists, general practitioners, psychologists, wholistic practitioners, Alzheimer’s researchers, dyslexia researchers, etc; whilst those in the biomedical sciences may be reluctant to adopt such technologies.

Diseases have contextual limitations *i.e.* genetic screening provides data irrespective of a person's age, gender and weight. Virtual Scanning provides weighted data which provides a more useful assessment of the disease process. This is especially useful in the elderly *e.g.* in the case of diabetes. Whilst their protein levels decline, the consequence of the aging process, the brain continues to regulate the body's stability.

Genetic screening is able to assess which genetic issues are significant in disease processes. Nevertheless this technique has significant limitations. It is of value mainly in genetic diseases such as Haemophilia, Gaucher's disease and other indications where lack of a protein or enzyme is the genetically inherited cause of the disease. It has less value in the indications which are caused by a lifetime of inadequate exercise, poor diet, consumption of toxins, and stress.

By contrast, results from a Virtual Scanning test (see Fig (3)) has been shown to contribute to a better understanding of migraine [6], developmental dyslexia [5], sleep apnoea [10], diabetes [4, 11-13] and, perhaps also, of regressive autism, depression and other medical conditions.

This knowledge of how sensory input influences the function of the autonomic nervous system, and of the physiological systems, provides a theoretical basis for most CAM techniques [8, 14].

IN SUMMARY

Virtual Scanning was first approved by the Russian Health Services in the period 1999/2001. It has been evaluated by researchers and clinicians who consider this to be a technology which is able to improve the diagnosis and treatment of disease². Nevertheless the evaluations conducted to date have not yet been in the form of a randomised clinical trial.

It is a world-leading technology for a number of reasons (i) its understanding of how sensory perception influences and is influenced by the autonomic nervous system; (ii) the understanding of the significance of the physiological systems; (iii) it is the first cognitive technology of its type; (iv) it is non-invasive and rapid; (v) it incorporates the ability to quantify both genotype and phenotype; and (vi) provides a theoretical framework for all diagnostic and therapeutic techniques in CAM and orthodox biomedicine.

From the fundamental commercial and theoretical perspectives outlined in this summary Virtual Scanning may offer the possibility to diagnose earlier, more comprehensively, better, more safely, more rapidly and at significantly less cost than most other diagnostic modalities.

²Vysochin Yu V, Lukoyanov VV, Yaichnikov IK, Tkachuk MI, Chyev VA, Yemelyanenko VV, 2001. Methodology and Technology of Invigoration of Different Population Orders. In: Consolidated 5 year Research Plan of Physical Training, Sports and

Tourism State Committee of the Russian Federation. 2000. English translation available at: <http://www.montaguehealthcare.co.uk/files/Vysochin/Vysochin.pdf>

CONFLICT OF INTEREST

Graham Ewing is a Director of Montague Healthcare, a company which is solely devoted to the commercialisation of Virtual Scanning technology. Dr Igor Gennadyevich Grakov is the developer of this technology.

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ABBREVIATION

CAM = Complementary and alternative medicine.

REFERENCES

- [1] Ewing, G.W.; Ewing, E.N.; Hankey, A. Virtual Scanning - Medical Assessment and Treatment. *J. Altern. Complement. Med.*, **2007**, *13*(2), 271-286.
- [2] Hankey, A.; Ewing, E.N. New Light on Chromotherapy: Grakov's 'Virtual Scanning' System of Medical Assessment and Treatment. *eCAM*, **2007**, *4*(2), 139-144.
- [3] Ewing, G.W.; Parvez, S.H.; Grakov, I.G. Further Observations on Visual Perception: the influence of pathologies upon the absorption of light and emission of bioluminescence. *Open Sys. Biol. J.*, **2011**, *4*, 1-7.
- [4] Ewing, G.W.; Ewing, E.N. NeuroRegulation of the Physiological Systems by the Autonomic Nervous System – their relationship to Insulin Resistance and Metabolic Syndrome. *Biogenic Amines*, **2008**, *22*(4-5), 208-239.
- [5] Ewing, G.W.; Ewing, E.N.; Parvez, S.H. Developmental Dyslexia: the link with the Autonomic Nervous System and the Physiological Systems. *Biogenic Amines*, **2009**, *23*(3), 115-190.
- [6] Ewing, G.W.; Ewing, E.N.; Parvez, S.H. The Multi-systemic Origins of Migraine. *Biogenic Amines*, **2009**, *23*(1), 1-52.
- [7] Spear, B.B.; Heath-Chiozzi, M.; Huff, J. Clinical Applications of Pharmacogenetics. *Trends Mol. Med.*, **2001**, *7*(5), 201-204.
- [8] Ewing, G.W. A Theoretical Framework for Photosensitivity: Evidence of Systemic Regulation. *J. Comput. Sci. Syst. Biol.*, **2009**, *2*(6), 287-297.
- [9] Ewing, G.W.; Parvez, S.H. The Dynamic Relationship between Cognition, the Physiological Systems, and Cellular and Molecular Biochemistry: a Systems-based Perspective on the Processes of Pathology. *Act. Nerv. Super. Rediviva*, **2010**, *52*(1), 29-36.
- [10] Ewing, G.W.; Nwose, E.U.; Ewing, E.N. Obstructive Sleep Apnea Management with Interactive Computer Technology and Nutrition: Two Case Reports. *J. Altern. Complement. Med.*, **2009**, *15*(12), 1379-1381.
- [11] Ewing, G.W.; Parvez, S.H. The Multi-systemic Nature of Diabetes Mellitus: genotype or phenotype? *N. Am. J. Med. Sci.*, **2010**, *2*(10), 444-456.
- [12] Ewing, G.W. The Regulation of pH is a Physiological System. Increased Acidity alters Protein Conformation and Cell Morphology and is a Significant Factor in the onset of Diabetes and other common pathologies. *Open Syst. Biol. J.*, **2012**, *5*, 1-12.
- [13] Ewing, G.W.; Parvez, S.H. Mathematical Modeling the Systemic Regulation of Blood Glucose: 'a top-down' Systems Biology Approach. *Neuro Endocrinol. Lett.*, **2011**, *32*(4), 371-379.
- [14] Ewing, G.W. Does an improved understanding of the nature and structure of the Physiological Systems lead to a better understanding of the therapeutic scope of Complementary & Conventional Medicine? *J. Comput. Sci. Syst. Biol.*, **2009**, *2*(3), 174-179.