DERIVING OBJECTIVE EXPLANATIONS FROM BIOLOGICAL INTERACTIONS USING COMPUTER BASED IMAGE ANALYSIS TECHNIQUES.

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Computer based image analysis is the means by which we would like to measure and prove by the use of mathematics the things that can be clearly seen by the eye and in a fashion determined by the brain. There are some crucial in between embellishments and assumptions, but basically the mind is well capable of looking at things and forming a perspective and opinion from which a body can make progress, and describe the world. In many respects the minds interpretation and evaluation is more than adequate if not perfect for the job. As scientist however, a theory only works for the conditions or time it remains valid, an obvious statement perhaps, but the validation requires reproducible repetition and to contest a theory, rigorous reproducible proof should be required. Opinions and observations are useful in discussion, but actually fall well short of providing the necessary proof which scientists can take to their own labs and reproduce.

CCD cameras, scanners and frame grabbers have provided the means to enable computers to see what we see; the ultimate system to date in reproducibility and objectivity has vision. Even the most cynical pay homage and then take for granted the analytical and processing powers of the humble PC. The pedantic torture system can with the correct approach yield analytical and statistical fact.

In truth computers only do what they are asked to do, and if the question is poorly founded and presented a computer won't miraculously turn it into good science. The ultimate analytical tool does not ask questions or beg for assumptions. From this standpoint image analysis has both the power to produce meaningful incisive data but also the power to produce numerical

nonsense, the difference between both at first glance is often unperceivable. No scientist would ever conduct an experiment without including controls, but how many have tested their image analysis system with controls? How many regularly include controls or calibration runs?

The processing software for image analysis is now at such a high level of technical sophistication, where, if a specimen can be seen and presented in a visual format to the PC it can be analysed and measured in almost anyway the scientist wishes. The question that arises here is what is being measured and what does it mean? How much of this is a real measure and how much is the scientist's own digitized observations? Automated, hands free image analysis is the gold standard; the reality with image analysis is that it is always the final step and often an after thought and used as a means to derive data from samples, which may ordinarily not have provided numerical data.

Very few experiments are designed from the onset with image analysis as the final determination in mind. As such the model and subsequent analysis often lacks repeats and controls and usually involves manual intervention. This latter point is fundamentally numerating personal observations. This could in itself be acceptable if a number of people (>4) were used for the evaluation of specimens.

Truly objective evaluation is difficult to achieve and changes for each model and analysis. It should involve the determination of large sample sizes with many repeats and massive data sets and subsequent statistics. If it doesn't the errors involved are not offset by the reproducibility.