Dalhousie University, Faculty of Dentistry

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Deadline October 5th 1990

Deadlines

Note that the deadline for the the Academy of Operative Dentistry Fellowship Programme directed towards the support of a dental student and a junior faculty member in a specific research project is the **17th of September 1990.** Applications are to be submitted to the Research Development Office for internal review. A further deadline to note is the **5th of October 1990** which is the deadline for receipt of Abstracts for the IADR to be in Washington. The plan is to send a package from the Research Development Office to Washington on the 2nd of October at 12:00 pm. Please provide copies of your abstracts to the Research Development Office on a disk for publication in the next edition of Dental Research News.

Prosthodontic Novice Research award

The Prosthodontics Research Group of the IADR/AADR are holding a novice investigator competition ($1,000 prize, supported by Oral-B Laboratories). To be eligible for the competition the entrant must not have been author or co-author of more than two papers in published refereed journals. The competition will be based upon abstracts submitted jointly to the IADR Acapulco meeting and to the Prosthodontics IADR Group. Abstracts must be accepted for oral presentation at the Acapulco meeting in order to qualify. A full length manuscript must also accompany the abstract forwarded to Dr. Jane Brewer SUNY at Buffalo. Note: the deadline for both IADR and Prosthodontic competition is October 5th 1990.

"Relative to an Identified Distribution".

A large proportion of research conducted by our Dental Faculty members presents a problem in terms of selecting the appropriate statistical package for analyzing the data. For example the analysis of histological slides or SEM images, the ranking of leakage scores from an *in vitro* study of endodontic procedures, or the ranking of degree of replication from an *in vitro* comparative study of impression materials. This type of research often results in the researcher producing a distribution of ordered categories which adopt a simple grading system, from zero through to some higher value for the most pronounced of the specific features or components which we are looking for. Such a grading system is clearly subjective and probably not very reliable. However, this ranking seems preferable to a simple yes, no type of analysis. We could go ahead and calculate means and standard deviations for the numbers which we have selected for our various categories, we could then apply t tests or analysis of variance to these assigned numbers. However, concocting numerical values such as this has a very serious drawback and gives the illusion of much greater accuracy than that which really exists. Although we may easily be able to rank the various features, the difference between say rank number 2 and number 3 may be very large, compared to the difference between say the 3rd and 4th ranking. The measurements we wish to analyze may consist of a number of ordered categories of clinical improvement, or a number of observations in a rank order classifying dental restorations in terms of quality. In such an eventuality the researcher may be very reluctant to allocate a numerical scale, but would much prefer to use a method which would take account of the rank order of the observations. It is much more sensible to work with the natural ordering which exists within our observations. One such statistical method which makes use of this natural ordering is called RIDIT ANALYSIS. The term Ridit is derived from the initials of **"Relative to an Identified Distribution".** Ridit analysis only requires that the discrete categories should represent simple intervals which have an underlying but unobservable continuous distribution. The analysis does not assume that the data follows any distribution (ie normal distribution). For this reason it

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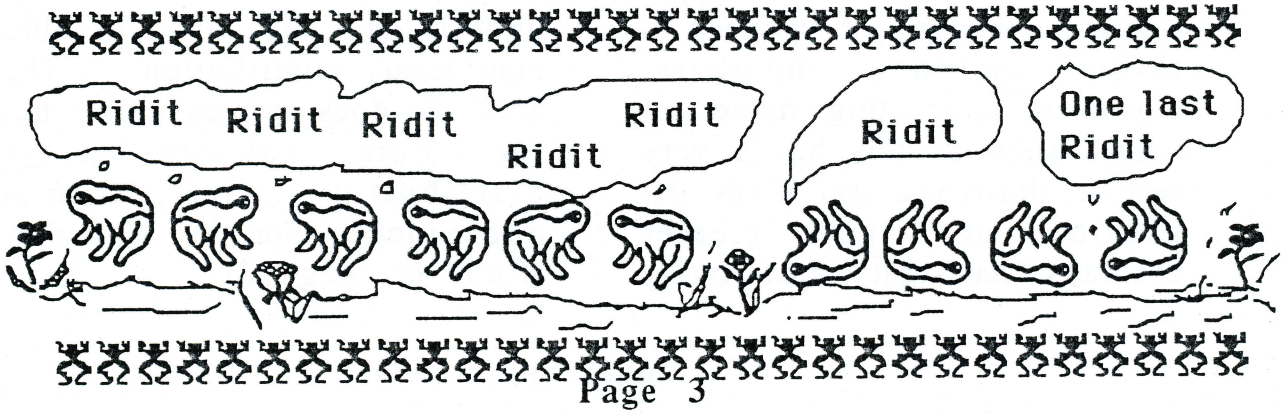
(RIDIT Cont from page 2) seams logical for the type of data outlined above that we should use a distribution-free method, or as it is most often called a nonparametric statistical method. Ridit analysis is a nonparametric statistical method. For Ridit Analysis no assumption is made about normality or any other form for the distribution of our data.

Ridit analysis begins with the selection of a population to serve as a standard or reference group. For the reference group, we estimate the proportion of all individuals with a value on the underlying continuum falling at or below the midpoint of each interval, that is, each interval's *Ridit*. The mean Ridit for a group is the probability that a randomly selected individual from it has a value indicating greater severity or seriousness than a randomly selected individual from the standard group. The final values are the *ridits* associated with the various categories. The Ridit for a category, is the proportion of all subjects from the reference group falling in the lower ranking categories plus half the proportion falling in the given category. If, in the model of an underlying continuum, we assume that the distribution is uniform in each interval, then a category's Ridit is the proportion of all subjects from the reference group with an underlying value at or below the midpoint of the corresponding interval. If you feel that you could use Ridit analysis to evaluate the data in your research project you should contact the Research Development Office. We have recently produced customized Ridit analysis programes for the Macintosh using Microsoft Excel. Once you have your customized disc all you have to do is punch in your raw data and the Mac does the rest.

Supposing that you conducted a research experiment on ten frogs and four of them croaked, how would you perform a statistical analysis?



Central Question

Many dental clinical research projects involve the development of a questionnaire. However, the development of a good research questionnaire is quite difficult and can be very complex. You should ask yourself what is the central question, or hypothesis which you wish to investigate?

Often research proposals using questionnaires aim to seek answers to a large number of diverse problems, each of which might be the subject of very extensive and involved investigations. Try to keep it simple. It is most important that you consider the population to which you intend to direct your study, to what extent do you intend to generalize your findings? It is rarely possible to examine the whole of any population. We usually have to settle for a sample and then infer from the sample back to the population. We should randomly select a sample from the true or real population and in a true experimental design we would need to randomly divide this into two groups. The sample size has to be adequate in order to justify inferential conclusions.

Have you considered how you can assure a good response to your questionnaire? Do you have any evidence that the instruments you intend to use are valid and reliable? In the case of distribution of the questionnaire by mail have you considered the delay for mail to reach some segments of society? In the case of personal distribution of the questionnaires have you considered the need to assure reliability among observers? Have you considered the importance of the timing of your questionnaire? Just prior to or just after a holiday season may not be appropriate. How long will it take to complete the questionnaire, what effect will the length of time for completion have on the results? Consideration of all of the above factors should be given by the researcher in the preparation of the questionnaire. Your research proposal may be approved as written, or the proposal may be approved with some minor revisions. Approval of the proposal may be deferred pending major revisions, or approval may be denied.

If the decision of the Research Development Committee is either of the latter two, much of your effort will have been wasted. Meticulous preparation is the best way to reap success. As a faculty member involved in research you must be willing to spend the time and effort necessary to examine the related literature.

Ultrasound

In our Biomaterials Research Laboratory we are using ultra sound to measure the mechanical properties of materials which we are synthesizing. The modulus of elasticity can be determined none destructively for samples of our materials. Ultra sound was once only associated with the low-tech dog whistle, now ultrasound is also used in modern medical technology in devices used to break up kidney stones or in diognostic methods to image the body. Using sound waves pitched beyond the range of human hearing, but more intense than the roar of a jet engine. University of Illinois professor Kenneth Suslick a chemist, is hurtling metal particles in solution together at speeds of 1,000 miles per hour. The collisions produce temperatures of thousands of degrees, melting and fusing the particles.

These high frequency waves, make chemical reactions go very much faster. Ultrasound can strip metals of their unreactive coatings, freeing the pure, elemental metal inside to promote chemical reactions. Researchers say, because of this ability to enhance the reactivity of metals used for catalysis, ultrasound has the potential to find a new niche as a money-saver in industrial processes.

Professor Suslick has said that "Using ultrasound, we can enhance the reactivity of metal powders in some reactions almost a million-fold," "We should be able to replace expensive metal catalysts with metals that are normally less reactive, but also less expensive. For example it may be possible to find a way to replace platinum in catalytic converters, which are used to break-down harmful components in automobile exhaust. Shockwaves are created in a liquid when ultra-sound is applied, very much like a microscopic submarine depth charge. It is these shockwaves which can drive solid particles together. Kenneth Suslick and Stephen Doktycz published results of their sonochemistry experi-ments, in the Journal Science in March 1990. They used a scanning electron microscope to photograph particles of different metals after collisions. The photographs show spherical particles fused together by a thin neck, in a dumbbell shape. Knowledge of particle sizes, melting points, heat capacities and neck volumes enabled calculateion of energies, temperatures and velocities of the colliding particles.

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Ultrasound (Cont. from p. 5)

To-date the researchers have succeeded in melting and fusing zinc, chromium, nickel, tin, iron and to a lesser extent molybdenum particles. In contrast, tungsten, which has a very high melting point, did not fuse together in their experiments. the particles were roughly 10μm in diameter. It was concluded that temperatures achieved at the point of collision were between about 2,600°C close to the melting point of molybdenum, and 3,400°C, the melting point of tungsten. The speeds at which particles collided were estimated at over 24,000 feet/sec.

From the Known to the Unknown

"I have imposed upon myself, as a law, never to advance but from what is known to what is unknown; never to form any conclusion which is not an immediate consequence necessarily flowing from observations and experiment; and always to arrange the facts, and the conclusions which are drawn from them, in such an order as shall render it most easy for beginners in the study of chemistry thoroughly to understand them."

Lavoisier

PhD Success for Jim Johnson

Jim Johnson was successful in defending his PhD thesis in the subject area of biomaterials. The thesis which deals with orthopeadic research involving bone cement and the stress distribution within the femoral hip implant has taken Jim three years to compleat. Jim will recieve his PhD degree through the Technical University of Nova Scotia.

The Art of Knowing

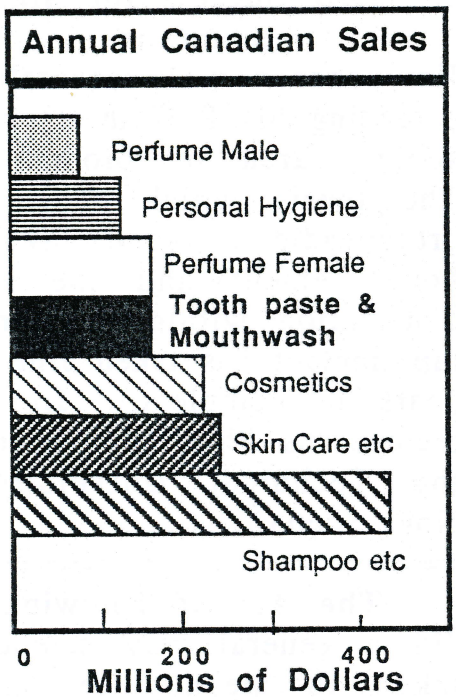
"In a general way science is taken to mean 'The Art of Knowing'. It is almost the same thing as research, which means the accumulation of knowledge by systematic observation, deliberate experiment and rational theory."

John Ziman

14) In order to conduct a thorough literature review you need to have included all potential reviewers.

15) Discs only crash when you have not backed up the only copy of your data.

It Makes You Smile



The breakdown of annual national sales of popular cosmetics from the Canadian Cosmetic, Toiletry and Fragrance Association shown above indicate that the Canadian Public spends some 63% more on hair care products (shampoo etc.) than on oral-hygiene products such as tooth paste and mouth wash. In addition they spend some 33% more on skin care products and 27% more on face, lip and eye cosmetics than on oral-hygiene products. Canadian females use the same dollar value of $160 million in perfume and fragrances as the entire population spends on oral-hygiene products.

Ceramics at Cutting Edge

Ceramics are said to be the materials of the future. Our own research into the sol-gel development of new glass materials and the use of wet chemical methods to produce a whole range of biomedical glass, ceramics and cements has an exciting future. Ceramic research is one of the hottest areas for development of new materials. It is interesting to note that ceramics are now being applied to one of the oldest industries. A British company "Agricultural Ceramics, Suffolk," has developed a line of farm tillage tools made of highly wear-resistant ceramic. All ceramic components are laced with a special additive so that they will absorb the shock of hitting a rock, and spring back without cracking or breaking. It'll outwear hardened steel four to nine times, yet only costs slightly more," according to Mark Donsworth, the sales manager for Agricultural Ceramics. Donsworth predicts that within three to five years most major farm equipment manufacturers will offer ceramic soil-wearing components as standard equipment on chisels, plows, cultivators, drills and planters. The British firm reportedly was the first to market ceramic farm implements.

Dalhousie Ranked at Fifth Place for Reseach

1) McMaster
2) UBC
3) Queen's
4) U.Weston Ontario
5) Dalhousie
6) Alberta
7) Manitoba
8) Sherbrook
9) Montreal
10) Ottawa
11) Memorial
12) Calgary
13) Saskatchewan
14) Laval

According to a report in the Daily News of the 2nd August Dalhousie University was ranked fifth in a U.S. study of research strengths of Canadian universities, published by the Philadelphia -based Science Watch. The analysis involved 16 Canadian universities which have medical schools. Science Watch used a computer database of articles to track trends and performance in basic research. They counted the number of papers written by members of each university and published in 3,200 leading scientific journals. To calculate the significance of the research, the group counted the number of times the papers were later cited as references in the same journals. The analysis covered the period from 1873 to 1988, but also looked at trends in the more recent period of 1981-1988. It is interesting when looking at the ranking list of 14 institutions published in the Daily News that no mention was made of the ranking for the University of Toronto? The report is undobtedly good news for Dalhousie Researchers, it confirms what many of us already new that Dalhousie University is one of the leading research institutions. The data can clearly be used in arguments to try to convince the Provicial Government to accept that that Dalhousie is unique in the Province of Nova Scotia in terms of it's funding requirements. The high standing of Dalhousie in the international research community must be a telling argument for additional funding.

PURE and APPLIED SCIENCE

"Pure and applied science are currents in the same stream; they lead into and test one another. The value of discoveries is established in the lab and in the field by both their theoretical and practical fruitfulness."

Edward Spooner,
Professor of Geology, U of T.

Biodegradable composite used in surgery

A project has begun at Staffordshire Polytechnic, Stoke-on-Trent, to develop a biodegradable composite material for orthopedic and maxillofacial surgery.

The degradation profile of the composite may be controlled by the solubility rate of the solubility rate of the phosphate-based filler, producing a range of composites.

Raw materials have been characterized so that composites may be compared with those used in other work. This has been shown to be particularly important when considering the surface properties of the glass filler.

Optimization of mechanical properties has been performed with regard to filler particle size and percentage addition.

Tensile testing has been used to determine the composite's mechanical properties. An analysis of the fracture surface has shown a different fracture pattern to that of other composite materials such as glass-reinforced polyesters and hydroxyapatite-reinforced polyethylene.

An additional project under way has two goals: to develop hydroxyapatite ceramic coatings on stainless steel or titanium alloy prosthetic devices to encourage the growth of bone directly onto the implant, and hydroxyapatite ceramic materials of high density with a controlled porosity for use in reconstructive orthopedic surgery.