NEXT BIG THING ....

Thesis Proposal Progress Report

Monday – April 18

See the ISR course web page for …

Expectations
IMRAD

Why talk IMRAD in ISR? ...

because it’s incredibly fascinating??

NOT!!
Why IMRAD in ISR??

* Take-home final is an IMRAD MS
* YCP lab reports (IMRAD)
* Senior thesis (IMRAD)
* Reading primary lit (IMRAD)
BIOLOGY
YORK COLLEGE OF PENNSYLVANIA

LAB REPORT FORMAT

Laboratory and field-oriented courses in the Department of Biology at York College often entail exercises and experiments that require formal lab reports. Our department has developed a standard lab report format that you will use throughout the curriculum. It is based on the IMRAD format used in virtually all primary research articles in the biological literature. The acronym IMRAD refers to the following sections: Introduction, Methods, Results, and Discussion.

COMPLETE ORDER OF SECTIONS: Title page, Abstract, Introduction, Methods, Results, Discussion, Literature Cited, tables, and figures. Ask your instructor at the beginning of the semester if they deviate from the guidelines in this document. Also ask about their expectations for cited literature (primary journal articles, review articles, books, websites, etc.)

Each section of the lab report plays an important and unique role. The following provides guidelines about the information in each section.

TITLE PAGE (separate sheet of paper): Name of experiment or exercise, your name, name of lab partners, name of class, date experiment done, date report submitted.

ABSTRACT (separate sheet of paper): This is a single, tightly-written paragraph that briefly summarizes the major elements of the lab report. A minimum of one sentence each should be devoted to your introduction, objectives, methods, results, and conclusion. Avoid citing literature, figures, or tables. Your job will be easier if you write the abstract after the rest of the report is complete.

INTRODUCTION: This section supplies background information and may also provide a theoretical basis and historical context for the work that you have done. Do not directly address your specific study in the opening paragraph. Instead, begin on a more general note. A good introduction indicates why the work was undertaken and why it is interesting and will therefore involve citing literature. At the end of this section you should explicitly state your hypotheses or objectives.

METHODS (also called MATERIALS AND METHODS): In this section you will describe the procedures that enabled you to collect your data. A simple listing of “materials” is inappropriate. Ideally, you should include the details that would permit someone to repeat your work based on their reading of this section. Consider describing your different methods in separate paragraphs. For most labs, the methods will come from a lab manual/handout. The degree to which your manual/handout may be used for citing methodology is up to your instructor. Avoid insignificant details such as the name of the company that made your pipette or the day of the week on which your lab occurred. Provide any formulas or equations that you used for making important calculations. Lastly, describe your statistical procedures and identify your statistics software. The predominant verb tense in this section is past tense. The METHODS section is often the most straightforward to write and is therefore a good place to begin your report.

RESULTS: This is the core of the report in which you present your findings, usually in the form of numerical data. Sometimes raw data may be presented, but it is more common and useful to provide data that have been condensed to some degree. If you are presenting calculated means, don’t forget to include some measure of data variability (e.g. standard deviations). Tables may be needed to organize large groups of numbers. Figures (= graphs) can be particularly useful to display trends in data. It is not enough, however, to simply refer readers to tables and figures. Results must be verbally expressed in the Results section. All of your data are not equally important. Draw the reader’s attention to particularly noteworthy data or the presence of meaningful trends. If possible, support this with statistical analyses, keeping in mind that statistical significance may conflict with your sense of biological significance. The
text of the Results section should summarize the data, but stop short of interpreting their meaning or drawing major conclusions about their importance. Certain biology courses may require a differently-structured Results section — see your instructor about appropriate modifications.

**DISCUSSION:** Interpret your data and evaluate the meaning of your results. Avoid making your discussion just a re-statement of results. Toward that end, do not re-cite your tables, figures, and statistical outcomes (e.g., p-values). Instead, address whether your hypothesis, as stated in the Introduction, was supported by the data. If possible, connect your findings with the results from published studies by using literature citations. Do your results contradict, reaffirm, or extend previously published findings? How do your results fit into the big picture? Don't be afraid to discuss "negative" data (e.g., lack of relationships among variables). In some cases, negative outcomes are more interesting and important than positive and predictable findings. If your data seem anomalous or unreasonable, provide reasons that might help explain this. Resist the temptation to discuss every aspect of your data and do not provide every conceivable explanation for the obtained results. Speculation should be limited and clearly identified as your own speculation. The last paragraph of this section should be a strong statement of the take-home message.

**LITERATURE CITED:** All citations that appear in the body of your lab report must be listed in this section. We will use the author-year format to arrange the citations. List the papers in alphabetical order based on the first author's last name. Unfortunately, there are many ways of formatting citations. As a matter of convenience and consistency, we will arbitrarily adopt the following formats:

**Research Articles**


Citing Literature in the Body of the Report

You are expected to cite appropriate literature in the Introduction, Methods, and Discussion sections of your lab report. Citing an article, however, implies that you possess the article or have access to it and that you have read it. Citing an article based only on a reading of the article's abstract, for example, is not acceptable.

Not surprisingly, there are a few rules about how to cite correctly. Instead of using direct quotes with quotation marks, science writers paraphrase passages and then cite the source using an author-year format. Citations most commonly appear at the end of a sentence inside parentheses as illustrated in the following three examples:

- Growth rates are positively correlated with rainfall (Jones 1993).
- Growth rates are positively correlated with rainfall (Jones 1993, Roy and Smith 1988).
- Growth rates are positively correlated with rainfall (Jones 1993, Roy and Smith 1988, Williams et al. 1937).

Note that "et al." was used for the last citation. This automatically informs you that Williams had two or more collaborators on the paper.
more coauthors. All authors' names should appear in the complete citation in the Literature Cited section of your report. The above format is preferred although some writers will explicitly insert the cited author's name(s) into a sentence:

Jones (1993) found that growth rates are positively correlated with rainfall.

A positive correlation between growth rates and rainfall was found by Jones (1993).

Is it acceptable to cite an article that you haven't seen but is cited in an article that you have read? In general, the answer is "no". The above rule also applies here: If you cite an article you should have read it. If, for some reason, the original article of interest (e.g. Winston 1893) is unobtainable, then you may cite it by writing (Winston 1893 in Rodgers 2003). This tells your reader that you are relating something from Winston even though you were unable to read the original publication from 1893. It also indicates that you learned about Winston by reading the Rodgers article.

Visual Aids: Tables and Figures

The Results section of a lab report often presents data in the form of tables and figures. Your first consideration is deciding if visual aids are truly necessary. If you choose to include them, follow these guidelines.

Tables

1) A table heading is a terse indication of table contents. It is a SINGLE sentence or sentence fragment and may, for example, lack a verb.

2) Restrict your use of horizontal lines and never use vertical lines.

3) Use superscripts and footnotes to provide additional information about the contents of the table.

4) Each table should be on its own piece of paper.

EXAMPLE:

Table 1. Carapace widths of three spider species in counties of north Georgia.

<table>
<thead>
<tr>
<th>County</th>
<th>Araneus diadematus</th>
<th>Neoscona hentzii</th>
<th>Neoscona arabesca</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width(^a) (cm)</td>
<td>Width (cm)</td>
<td>Width (cm)</td>
</tr>
<tr>
<td></td>
<td>n(^b)</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>SEM(^c)</td>
<td>SEM</td>
<td>SEM</td>
</tr>
<tr>
<td>Clarke</td>
<td>2.3 19 0.5</td>
<td>2.7 22 0.9</td>
<td>2.1 18 0.3</td>
</tr>
<tr>
<td>Ocone</td>
<td>2.2 31 0.6</td>
<td>2.9 34 0.7</td>
<td>1.9 29 0.2</td>
</tr>
<tr>
<td>Fulton</td>
<td>2.5 29 0.7</td>
<td>3.0 38 0.9</td>
<td>1.9 40 0.1</td>
</tr>
</tbody>
</table>

\(^a\)mean
\(^b\)sample size
\(^c\)standard error of the mean
Introduction

* most readable section (why ??)

* prose is “light” and accessible

Intros should have a great 1\textsuperscript{st} sentence …

Grab attention from the get-go!!
"Organisms receive a wide range of sensory stimuli from their environment."

"The often **vivid coloration** of coral reef fish has long puzzled biologists and led to championing of hypotheses ranging from camouflage under natural conditions (Longley 1917; Townsend 1929), aposomatism (Neudecker 1989) and warning coloration (Cott 1940; Wickler 1967) to poster coloured advertisement (Lorenz 1962; Brockman 1973)."
What are the 3 functions of an INTRO?

1) Supply background info to help reader
   Accomplished via CITING LIT …

2) Why is this research interesting … and worthwhile?

Introductions begin with general information about the topic.
Accurate and rapid identification of methicillin-resistant *Staphylococcus aureus* (MRSA) in clinical specimens is essential for timely decisions on isolation procedures and effective antimicrobial chemotherapy.

Numerous approaches that improve turnaround time for the identification of MRSA have been described. Fluorescence tests, PCR assays, or penicillin-binding protein 2a (PBP2a) antibody agglutination tests have been described elsewhere. Yet, these require subculture on solid media, and many are unable to determine species and methicillin susceptibility at the same time. A simultaneous test of methicillin resistance and species confirmation by a *mecA femB* duplex PCR has been proposed elsewhere. The *mecA* gene encodes the extra PBP2a, which is unique to methicillin-resistant staphylococci. The *femB* gene codes for an enzyme important in cross-linking peptidoglycan in various different *Staphylococcus* spp. The specificity of the *femB* PCR primers used for DNA amplification of the species *S. aureus* has been demonstrated previously.

This study describes the performance of this technique in a clinical setting of moderate MRSA endemicity where large numbers of screens need to be processed on a daily basis. Moreover, the robustness of the test was investigated by determining the number of false-positive readings due to coamplification of *femB* and *mecA* from methicillin-susceptible *S. aureus* (MSSA) and methicillin-resistant coagulase-negative staphylococci (R-CNS) coexisting at the sample site (C. M. Vandenbroucke-Grauls and J. G. Kusters, Letter, J. Clin. Microbiol. 34:1599, 1996).
Introduction

Variation in the size of clutch laid by individuals within the same population is a common phenomenon in many species of birds (Klomop 1970). Generally, those females naturally rearing the larger clutches tend to be more successful than those with smaller ones in terms of the number of offspring that survive to breed (recruits). In addition, the size of clutch laid by individual females in successive years is often highly repeatable, whilst the heritability estimate $h^2$ for clutch size in many birds can be relatively large. For example, in the great tit (*Parus major*), it is estimated to be around 40–50% (Perrins & Jones 1974; van Noordwijk, van Balen & Scharloo 1981). Therefore, an apparent paradox presents itself: why, within the same population, do some individuals lay small clutches and others larger ones? For example, Boyce & Perrins (1987) have shown for great tits nesting in Wytham Woods, near Oxford, that average recruitment increases with increasing brood size such that three times as many offspring are recruited from clutches of 12 eggs as from clutches of six. Hence, why are not all of the individuals within this population attempting to rear larger broods? Two, not necessarily mutually exclusive, hypotheses have been put forward to explain the observed variation in clutch size between individuals within years. The Individual Optimization Hypothesis (IOH) was proposed by Perrins & Moss (1975), whereby
Historically, blacks in the United States have had a higher incidence of invasive pneumococcal disease than whites, with the widest disparities occurring among children in the first 2 years of life and among adults 18 to 64 years old.\textsuperscript{1-3} Introduction of a new protein-polysaccharide pneumococcal conjugate vaccine (Prevnar; Wyeth Lederle Vaccines, Madison, NJ) for young children has led to dramatic declines in invasive disease among children younger than 2 years, as well as declines in incidence among adults and elderly individuals.\textsuperscript{4} The impact of vaccination on racial disparities in incidence of pneumococcal disease has not been examined.

In October 2000, the Advisory Committee on Immunization Practices (ACIP) recommended vaccination for all children younger than 2 years and for children aged 2 to 4 years with certain chronic illnesses.\textsuperscript{5} For newborns, the ACIP recommended 3 doses given at 2, 4, and 6 months of age with a fourth dose given between the ages of 12 and 15 months. Fewer doses were recommended for children who began the series later. For unvaccinated children aged 2 to 4 years with certain chronic conditions, the ACIP recommended 2 doses given 2 months apart. Among healthy unvaccinated children aged 2 to 4 years, the ACIP recommended a single dose of vaccine, with priority given to children of Alaska Native, American Indian, or African American descent.\textsuperscript{5} The pneumococcal conjugate vaccine is one of a few vaccines for which certain minority populations have been targeted for priority vaccination and was the first to specifically list children of African American descent as a high-risk group.

Eliminating racial disparities in disease incidence is a main objective set forth in Healthy People 2010.\textsuperscript{6} The goal of eliminating disparities requires meeting Healthy People 2010 targets for pneumococcal disease in all racial and ethnic minority populations. The Healthy People 2010 targets for invasive pneumococcal disease are to reduce incidence to 46 cases per 100 000 children younger than 5 years and to 42 per 100 000 adults aged 65 years or older.\textsuperscript{6} We measured progress toward these goals using data from the US Centers for Disease Control and Prevention (CDC) Active Bacterial Core surveillance (ABCs) system. This analysis examined the impact of childhood vaccination on disease incidence and pneumococcal serotype.

This study
3) INTROs should end with a ...... ??

Statement of Objectives or Hypotheses
In this study, the hypothesis that competitive ability remains reasonably constant over time is tested. The change in the rank of absolute feeding rate and change in susceptibility to interference competition between years within the same population of wild European blackbirds is also measured. If competitive ability remains constant throughout a blackbird’s life then it is predicted that there will be little change in individual rank of absolute feeding rate and/or change in susceptibility to interference between years.

Methods
Individual differences are often sufficiently large as to make it difficult to quantify a behaviour and to distinguish its underlying components (Gotceitas and Colgan, 1988; Mather and Anderson, 1993; Wilson et al., 1993). However, individual variation may constitute an important aspect of behavioural selection (Clark and Ehlinger, 1987; Gotceitas and Colgan, 1988; Colgan et al., 1991). For example, it might ensure fitness of a population when resources are limited (Magurran, 1986a; Gotceitas and Colgan, 1988). Nevertheless, analyses of behavioural performance often focus on general phenomena of entire populations, and idiosyncratic aspects are noted secondarily. Moreover, studies on individuality often concern higher order behaviours, such as, in the case of teleost fish, foraging, fear avoidance, aggression, predator inspection, mating strategies, parental care and sociability (Gervai and Csányi, 1986; Magurran, 1986a,b; Clark and Ehlinger, 1987; Huntingford and Giles, 1987; Gotceitas and Colgan, 1988; Francis, 1990; Murphy and Pitcher, 1991; Colgan et al., 1991; Wilson et al., 1993; Budáev, 1997; Coleman and Wilson, 1998; Budáev and Zhuikov, 1998; Budáev et al., 1999a,b). While these behaviours all involve motor activity, they are often quantified on the basis of socio-biological descriptors, such as inspection rates, or proximity to other fish. However, less attention has been paid to the possibility of individual differences in the underlying basic patterns of motor activity.

Swimming is actually composed of highly organized spatial and temporal patterns even in a relatively homogeneous environment (Kleerekoper et al., 1974; Steele, 1983). Some of these patterns are complex and cannot be characterized with the tools of classical kinematics, as they may exhibit nonlinear properties, such as persistence (the tendency to repeat a given sequence), redundancy (the relationship between the uncertainty of a signal and its length) and scale invariance (a tendency for a signal to have the same structure when observed on different temporal or spatial scales) (Faure et al., 2003). Indeed, nonlinear measures have been used to characterize locomotion and the behavioural repertoires in various species, including invertebrates (Dicke and Burrough, 1988; Cole, 1995), fish (Coughlin et al., 1992; Alados and Weber, 1999; Brewer et al., 2001), birds (Viswanathan et al., 1996; Ferriere et al., 1999) and mammals (Paulus et al., 1990; Marghitu et al., 1996; Alados et al., 1996; Alados and Huffman, 2000).

The present study was designed to (1) apply five nonlinear measures and one linear measure as descriptors of goldfish swimming trajectories in order to quantify this locomotor behaviour and (2) to develop a discriminant analysis that would
Some sly and crafty writers do something surprising at the very end of the INTRO ... 

They briefly state their results!!

Why do this??
In this study we addressed two questions: (1) Is activation of sucrose-sensitive neurons in the chorda tympani nerve sufficient to increase preference? (2) Do all preferred sucrose-like stimuli activate sucrose-sensitive S fibers in the chorda tympani? **Our findings suggest that preferential ingestion of simple or complex stimuli by hamsters can be controlled by sweetness and that activation of S fibers in the chorda tympani nerve may be sufficient but not necessary for preference for sweet stimuli.**
Methods

2 simple (but profound) goals:

* make it clear how you did what you did

* provide sufficient detail for replication
Methods

Ten 250 mL beakers
Perkin Elmer UV spectrophotometer
Beckman refrigerated centrifuge
Fifty 100 gram mice
250 g NaCl
Two hundred 10 mL test tubes
-90° C freezer
Fisher circulating water bath
Eppendorf pipettes

NO LISTS OF “MATERIALS”
Number 1 Challenge in writing Methods:

going the right amount of detail
EXAMPLE:

On January 5 I purchased four paper cups, 400.00 g of potting soil, and 12 radish seeds. I carefully labeled the cups A, B, C, and D and then planted three seeds per cup. A plastic spoon obtained from a local hardware store was used to cover each seed with 4 cm of soil.
Methods: getting the right amount of detail

Same paragraph ... revised

Four **200 mL** cups contained **100 mL** of potting soil (**60% peat/40%vermiculite**) and were used to germinate "**early boy**" radish seeds (**Park Seed Co.**). Each cup contained three seeds covered by 4 cm of soil.
Methods: getting the right amount of detail

The beauty of “Standard Methods”

“ … Surface water samples were collected near the center of each lake in August 1990. Alkalinity, pH, calcium, magnesium, total hardness, conductance, turbidity, secchi transparency, color, tannic acid, chlorophyll a, total phosphorus, and total nitrogen were measured. All analyses and holding times were in accordance with standard methods in USEPA (1983) and APHA et al. (1985).”
Do Copper Jacketed Bullets Auto-Sterilize When Fired?

Department of Biological Sciences
York College of Pennsylvania

Gary Petruzzelli
1) Barrel Cleaned

Barrel Cultured

2) Bullet Treated

Cleaned

Bullet Cultured

3) Fired

Bullet Cultured

Tract Cultured

2) Bullet Treated

Off Shelf

Bullet Cultured

3) Fired

Bullet Cultured

Tract Cultured

Inoculated

3) Fired

Bullet Cultured

Barrel Cultured

Tract Cultured
Methods … some properties

- Writing is sparse/precise … no fat
- Verb tense: PAST
- Lit citations important
- Subsections useful/appreciated
Materials and methods

POPULATION MONITORING

Goshawk population dynamics was monitored between 1975 and 1999 in a 250-km$^2$ investigation area in Germany (52°10′ N and 8°25′ E). It consists of two 125 km$^2$ grid squares, 3715 (Bissendorf) and 3816 (Spenge). Meller Berge, the main habitat, is a low mountain region reaching a maximum height of ≈ 300 m above sea-level. Ridges are covered by Norway Spruce Picea abies, Beech Fagus sylvatica and Oak Quercus robur and Q. petrea forests at lower altitudes. The second main habitat type is cultivated landscape to the north and south of the main ridge, mainly composed of Beech and Oak forests.

Each year, all forest patches within the study area were visited in late winter to look for signs of goshawk. All nest-sites were marked on large-scale maps and each active nest-site was visited at least three (mostly
Subsections

Fisheries management—Long Lake has been stocked with rainbow trout by the MDNR since 1961. Rainbow trout require streams with current washed gravel to spawn. Such streams are not available to the trout in Long Lake, so trout abundance depends on the number stocked, natural mortality and fishing mortality. Acoustic estimates of trout abundance indicate that fewer than 10% of the stocked trout remain in the lake after 12 months (Hembree 2002). In 1998, the MDNR switched from autumn to spring stocking of trout in Long Lake. So, on the first sampling date in 1998 (22 April), the lake had not been stocked with trout for 17 months (since November of 1996), and the acoustic estimate of trout density was very low (2.4 ha⁻¹). On 23 April 1998, 14,500 yearling rainbow trout were stocked (density = 218 ha⁻¹). Thereafter, the density of trout decreased linearly from 191 ha⁻¹ on 25 May to 30 ha⁻¹ on 24 October (Hembree 2002).
Results

DATA and analyses are the results

Results are the CORE

Intro & Methods

Discussion
What do RESULTS do … and not do??

They do not discuss
- why you did the work (INTRO)
- how the work was done (METHODS)
- what the data mean (DISCUSSION)

They do
- present the data
- emphasize major observations
- highlight key trends
RESULTS: This is the core of the report in which you present your findings, usually in the form of numerical data. Sometimes raw data may be presented, but it is more common and useful to provide data that have been condensed to some degree. If you are presenting calculated means, don't forget to include some measure of data variability (e.g. standard deviations). Tables may be needed to organize large groups of numbers. Figures (= graphs) can be particularly useful to display trends in data. **It is not enough, however, to simply refer readers to tables and figures.** Results must be verbally expressed in the Results section. All of your data are not equally important. Draw the reader's attention to particularly noteworthy data or the presence of meaningful trends. If possible, support this with statistical analyses, keeping in mind that statistical significance may conflict with your sense of biological significance. The text of the Results section should summarize the data, but stop short of interpreting their meaning or drawing major conclusions about their importance. Certain biology courses may require a differently-structured Results section -- see your instructor about appropriate modifications.
more on Results

Data are not RAW

Expectation:

* Descriptive stats (means, SEM, r, etc.)

* Inferential stats (t-test, chi-square, etc.)

* Tables & Figures
RESULTS

Demographic characteristics and route of HIV acquisition for the 302834 adult PWAs are shown in TABLE 1. Nearly half were between 30 and 39 years old at AIDS onset and most were younger than 50 years. Whites were the largest group among men (47.8%), whereas blacks predominated among women (57.2%). Homosexual men (including homosexual intravenous drug users) constituted 62.8% of the men, and an additional 26.4% were non-homosexual intravenous drug users. Only 3.1% of the men were HIV-infected through heterosexual contact. Among women, 49.6% were infected through
MANIPULATION OF GREAT TIT BROODS AND MEAN NESTLING MASS

Figure 2 illustrates the significant negative trend between mean nestling mass and extent of final manipulation ($F_{1,1371} = 36.61, P < 0.0001$; mean nestling mass = $18.72 \pm 0.038 \text{ g} - 0.0874 \pm 0.0144 \text{ g} \times \text{final manipulation}$). Mean nestling mass varied significantly between years ($F_{9,1361} = 12.41, P < 0.0001$), but even after controlling for year effects, there remained a significant decline in mean nestling mass with both increasing clutch size ($F_{1,1361} = 27.24, P < 0.0001$) and simultaneously with increasing final manipulation ($F_{1,1361} = 62.50, P < 0.0001$). The addition of higher order terms of these two variables (clutch size and final manipulation) did not significantly influence mean nestling mass ($F_{1,1360} = 0.87$ and $1.09$ for the squares of these terms, respectively). There was, however, a significant interaction between year (entered as a factor) and clutch size ($F_{9,1352} = 2.71, P < 0.01$), indicating that the effect of clutch size on mean nestling mass varied between years, although no such interaction between year and final manipulation could be detected ($F_{9,1352} = 0.87$, NS). Examination of the para-
Results

The manipulation of clutch sizes had the desired effect of causing birds to lay lighter clutches (paired t-test comparing each female’s mean performance on the two treatments: $t_{17} = 4.41, P < 0.001$), containing fewer eggs (Wilcoxon matched pairs test: $Z = 3.01, P = 0.001$), when on the small clutch treatment compared with the large clutch treatment (Fig. 1a). Females lost the same amount of body mass during egg laying, whether on the large or small clutch treatment (Wilcoxon matched pairs test: $Z = 0.59, n = 18$ females, $P = 0.557$; Fig. 1b). However, they lost substantially more pectoral muscle condition when induced to lay large clutches than when induced to lay small clutches (Wilcoxon matched pairs test: $Z = 2.55, n = 18, P = 0.011$; Fig. 1b).
DISCUSSION

Results are explored and interpreted

Put your “spin” on your data

Begin strongly…….
Discussion

There are some limitations to this study. The feeding task presented to the blackbirds was artificial and probably relatively simple compared with natural conditions. Although this allowed the conclusion to be drawn that relative competitive ability under the same conditions does not change over time, this does not mean that individuals cannot change their relative competitive ability by changing their patch conditions (see Cresswell *et al.* 2001). If a change in feeding conditions, such as second-year birds inheriting better feeding areas with different prey types, is correlated with age, then relative competitive ability will apparently change with time. Many apparent age-dependent changes in foraging ability may therefore be a result of age-dependent changes in access to patches of differing conditions rather than an actual improvement in foraging ability.
Discussion

Our results indicate that bison behaved as time minimizers. They showed strong preference for patches of intermediate biomass greater than that expected for energy maximizers. It should be noted, however, that there are two time scales implied by the nature of the constraints incorporated into the model presented here: the availability constraint utilizes the functional response, a measure of instantaneous intake, whereas the digestive constraint embodies forage intake measured over several days. The importance of temporal scale in optimization studies has been emphasized previously (Templeton & Lawlor 1981; Gass & Roberts 1992), and it is generally agreed that averages of net energy accumulation should be calculated over an extended period (Stephens & Krebs 1986). Thus, we have identified bison as time minimizers on the longest temporal scale, while they implicitly behave as energy
RECOMMENDATIONS FOR THE DISCUSSION

1) Avoid redundantly re-stating Results
   • avoid re-citing figures and tables
   • avoid re-stating statistics (p-values)

2) D-I-S-C-U-S-S … interpret your data
   … create a “big” picture
   … make generalizations

3) Connect your findings to the LITERATURE (via citations) … Do your data support or contradict earlier viewpoints??

4) End with an explicit conclusion paragraph
   … provide an obvious TAKEHOME MESSAGE
Discussion

Our results show that increased egg production entails a within-clutch cost in terms of decreased escape flight performance, and that this appears to be mediated through flight muscle loss. Previous studies on the effects of reproduction on locomotor performance in various taxa (Shine 1980; Berglund & Rosenqvist 1986; Schwarzkopf & Shine 1992; Lee et al. 1996) have concentrated on the costs of carrying eggs; the implication of these studies has been that the major cost lies in the increased body mass of the gravid female (Roff 1992). In contrast, the reduction in escape ability measured here occurred after all the eggs in a clutch had been laid, and was independent of changes in body mass (as the mass lost during laying was the same in both treatments), and must therefore be due to physiological changes associated with the production rather than the carriage of eggs.
DISCUSSION

Female pupal weights and fecundities did not differ among larvae reared on foliage from xeric sites and mesic sites. *This does not support the hypothesis that* trees growing under the stressful growing conditions of xeric ridgetops ....
by changes in species composition than by phenotypic plasticity.

In conclusion, we have established that an inverse relationship between protist cell size and temperature, resulting mainly from a plastic phenotypic response, is widespread. We have quantified this relationship, and found that it does not differ among diverse taxa, habitats or modes of nutrition. The relationship has the potential to improve predictions in some aquatic-ecosystem simulation models. The data are consistent with two hypotheses that are capable, in principle, of explaining the TSR in ectotherms in general. The extents to which resource limitation and 'compound interest' affect the temperature-size relationship in protists will determine when our broad 2.5% prediction should be applied, and when and how it should be modified. It is, therefore, ecologically important that these hypotheses are tested.

The authors thank H. Bustamante for her care in the initial collation and screening of many of the datasets. The work was partly funded by Small Ecological Project grant no. 1937 from the British Ecological Society.
ABSTRACT

Appears first … written last … WHY??

Abstract qualities:
- IMRAD sentence rule
- single paragraph
- tightly written
- mostly past tense
- no references to literature
- figures & tables
Antler rubs made by male white-tailed deer (*Odocoileus virginianus*) were observed during the 1996 rut at a wood lot in agricultural land in York County, Pennsylvania. A population assessment indicated that 17 tree species were available as potential rubbing trees. Ten tree species were actually rubbed at the research site. Chokecherry \((Z = 3.33, P < 0.05, n = 22)\) and red maple \((Z = 2.70, P < 0.05, n = 23)\) were the tree species rubbed at a frequency significantly greater than expected based on their availability. Among the rubbed trees there was no correlation between frequency of being rubbed and mean base diameter of the trees \((r = 0.078 \text{ (ns)})\) indicating that tree size did not determine tree preference. There was also no relationship between frequency of being rubbed and the length of the rub or the general appearance of the rub. The preferences for chokecherry and red maple were clear, but the underlying reasons for them remain unknown.
Verb Tense Guidelines
(with exceptions)

<table>
<thead>
<tr>
<th>Past Tense</th>
<th>Mixed Tense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>Introduction</td>
</tr>
<tr>
<td>Methods</td>
<td>Discussion</td>
</tr>
<tr>
<td>Results</td>
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THE
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